APPENDIX B

Biological Resources

Supporting Documentation

- **2023 Biological Assesment**
- **USFWS Response & Conference Opinion**
- **SCARNG McCrady Training Center INRMP**
- **Fort Jackson INRMP**
- **USFWS Monarch Butterfly Conference Opinon**
- **USFWS Informal Response for Monarch Butterfly**

Biological Assessment for the Proposed Construction and Operation of the Multipurpose Machine Gun (MPMG) Range

Version 2: 18Aug2023
FWS-2023-0069117 (previously 2012-I-0063)
Fort Jackson, Richland County, South Carolina

Introduction

The South Carolina Army National Guard (SCARNG) holds a license to approximately 15,000 acres on the southeast portion of US Army Fort Jackson, Richland County, SC (Figure 1). This licensed area, The McCrady Training Center (MTC), is the primary training facility for the SCARNG.

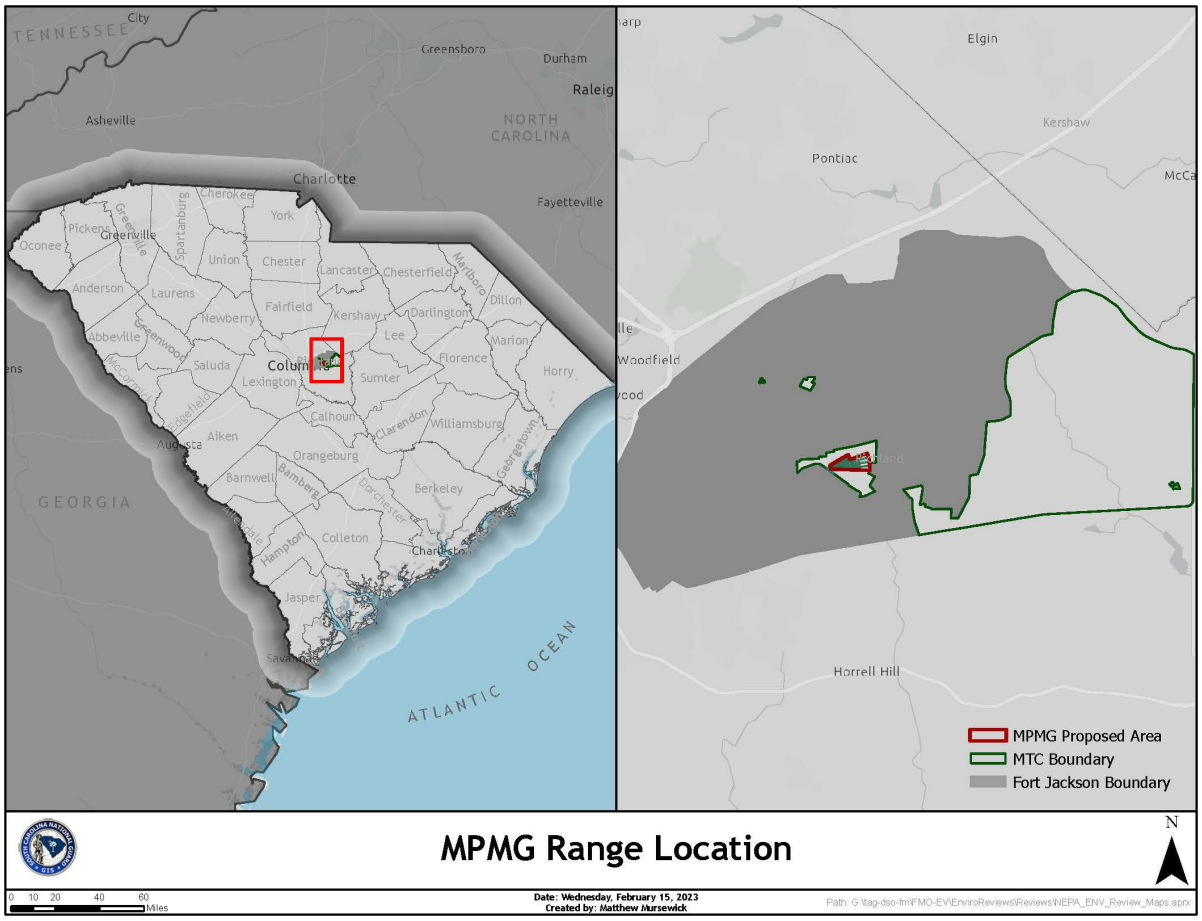


Figure 1: Multi-Purpose Machine Gun Range (MPMG) proposed location at McCrady Training Center (MTC) on Fort Jackson in Richland County, SC.

The SCARNG is planning to construct a live fire range, standard-design MPMG with automated target systems (ATS) on MTC (Figure 2). This project is critical to the state of SC due to the non-availability of a facility to train on Crew-served weapons. Currently, on Inactive Duty Training weekends personnel must travel to active-duty locations at least 4 hours (each way) at Fort (Ft.) Stewart, GA, or Ft. Bragg, NC. The use of 8 or more hours for traveling for each training session reduces valuable training time on Inactive Duty Training weekends that could be used for meeting other training requirements, if a closer training location were available. There are no other MPMG ranges within a 2-hour travel distance (limit specified in NGB/FORSCOM Reg 350-2) that meet qualification requirements. This project is required to provide SCARNG with adequate, doctrinally correct throughput capability for the M60 Machine Gun (MG), M240B MG, M249 Squad Automatic Weapon, MK19 40mm MG, and M24 Sniper Rifle.

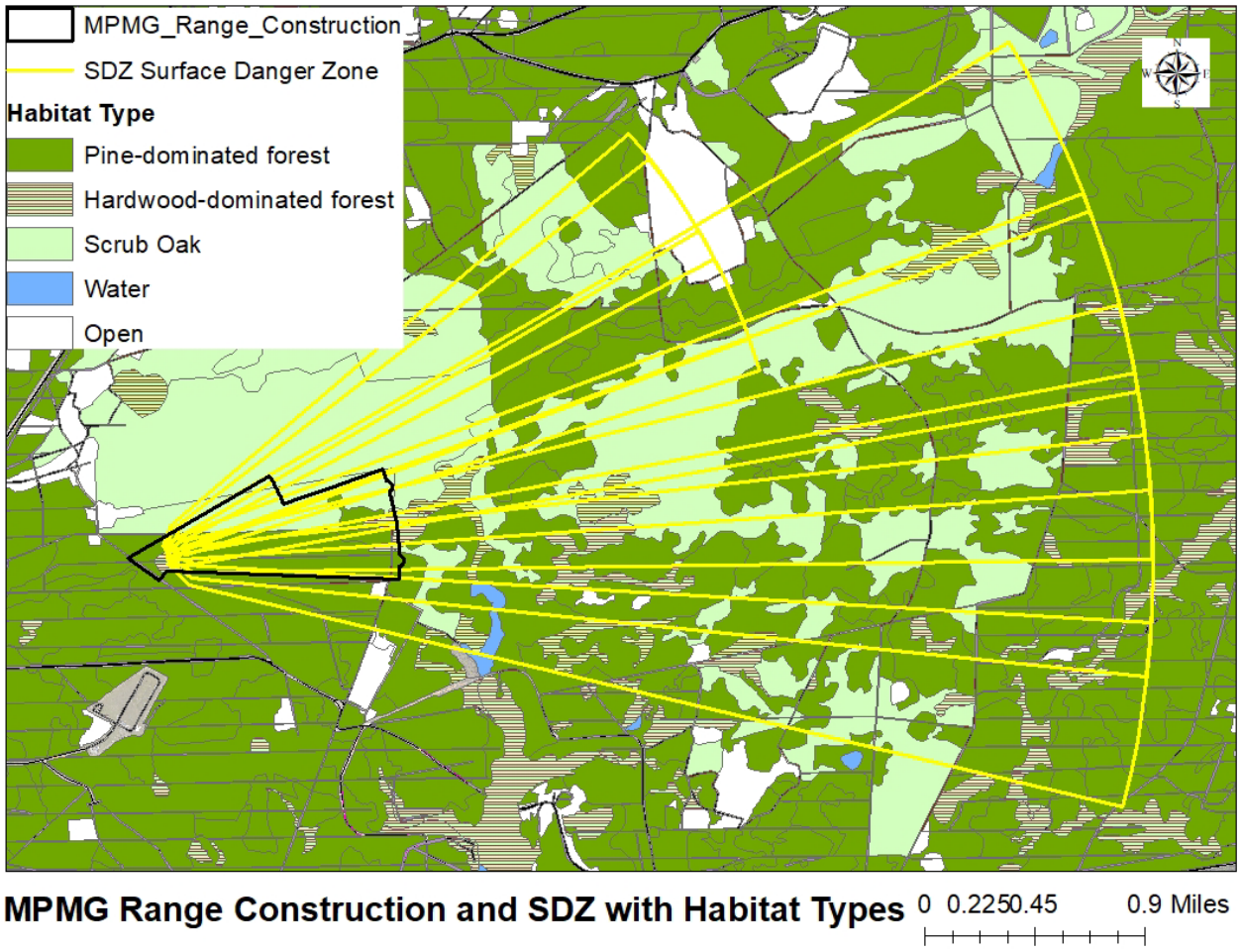


Figure 2: MPMG Range Construction Limit with Surface Danger Zones and general habitat types.

There are two distinct actions involved in this assessment for the proposed MPMG range. The first action assessed is for the construction of the MPMG range. The second action assessed is for the operation of the MPMG range.

The purpose of this document is to provide information on the presence or absence of federally listed threatened/endangered animal and plant species and their habitat in the proposed area as well as at-risk species. It also assesses the anticipated impact to these species from the proposed actions.

National Environmental Policy Act (NEPA) documentation addressing the proposed construction and the operation of the MPMG range is currently being prepared in accordance with 32 CFR 651. Initial scoping letters were sent to the U.S. Fish and Wildlife Service (USFWS) in 2012 concerning this project. USFWS reference number FWS-2012-I-0063.

Site Description

The project site is located within the MTC's licensed area of Fort Jackson. The proposed MPMG range will be located, within the impact area, on an existing active range complex that is managed by Fort Jackson (Figure 3).

The Impact Area is an existing area where weapons, bombs, explosive munition, etc. have been and can be fired or detonated. Fort Jackson has had field artillery operations since World War I. See the MPMG Target Box Imagery Map and the maps showing the historical ranges (Appendix 3, Folder #3).

Fort Jackson occupies 51,313 acres in the Sandhill region of South Carolina. It is situated between the northern and western piedmont region and the southern and eastern coastal region. The predominant soil types are well drained sand/loam combinations. The dominant vegetation of the proposed site consists of pine and mixed pine/hardwoods. Typical land uses on Fort Jackson include military vehicle and Soldier maneuvers, bivouacking, helicopter landing zones, firing points, live-fire ranges and associated safety zones, impact areas, forestry and other natural resources management, hunting and fishing, and cantonment.

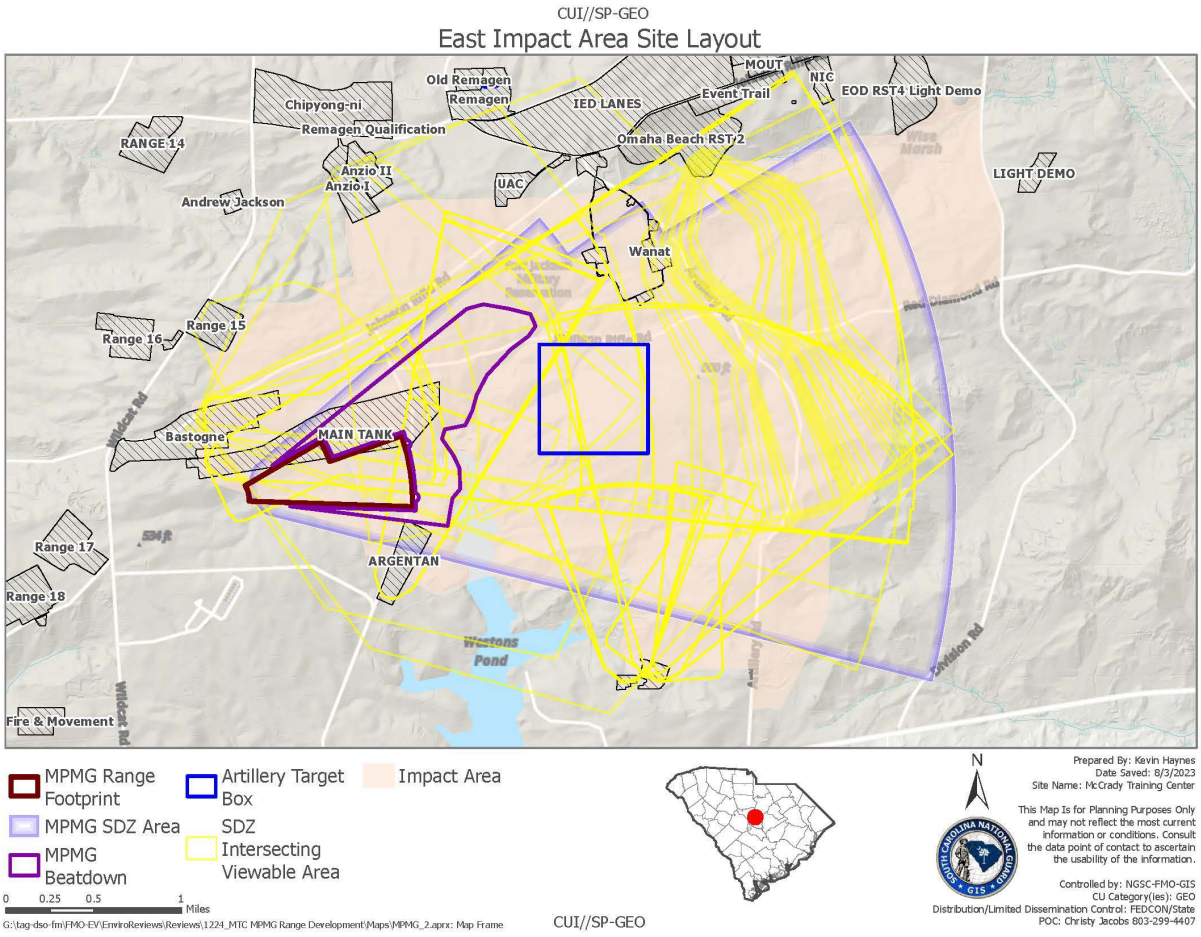


Figure 3: Fort Jackson East Impact Area Site Layout

Project Description

The proposed MPMG Range is based on the latest design guidance from the *U.S. Army Corps of Engineers Range Design Guide- Multipurpose Machine Gun (MPMG) and Army Training Circular (TC) 25-8.* The project is currently at the 30% design phase and the final details may change slightly; however, it is not anticipated that the project will expand beyond the footprint described in this document.

The existing Main Tank Range overlaps the northern edge of the MPMG footprint; based on this overlap, Main Tank Range will not be able to fire at the same time as MPMG. Both Main Tank Range & MPMG Range both fire 0.50 cal. If MPMG is active, then Main Tank will be closed. Once the construction of MPMG is complete, Main Tank Range will only be used for firing a few times a year. Therefore, no increase in use of 0.50 cal ammunition is anticipated.

The proposed project will consist of the Range Operations and Control Area (ROCA; Figure 4) and a 6-lane MPMG range (Figure 5). Two lanes will be standard 800-meter (0.497 mile) lanes equipped with eight (8) Stationary Infantry Targets (SITs). Four lanes will be standard 1,500-meter (0.932 mile) target lanes and include SITs, and Stationary Armory Targets (SATs). The installation of the SATs utilizes a treated railroad tie retaining wall on three sides and a protective earthen berm. The SITs have concrete emplacement with a geotextile/gravel drainage layer, a treated railroad tie front wall protection, and a protective earthen berm. No moving targets

are proposed for the MPMG. UXO clearance would take place in the maximum construction limits and would use ground penetrating radar and metal detecting to identify UXO. Any inert UXO would be removed and moved off-site and if, by chance, any live UXO was encountered it would be blown in place. UXO clearance is done by the Department of Army and not contracted by SCARNG. Therefore, the timing of UXO clearance is unknown at this time.

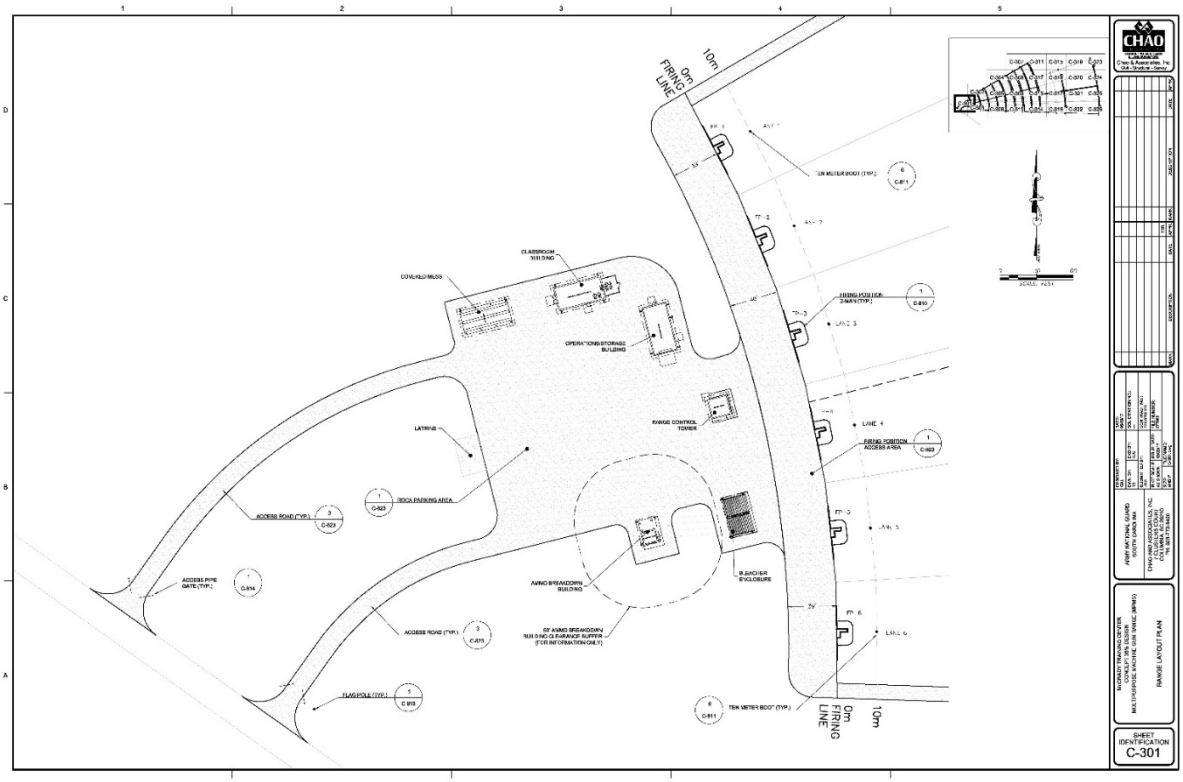


Figure 4: Engineer drawings of MPMG Range Operations and Control Area (ROCA) overview figure.

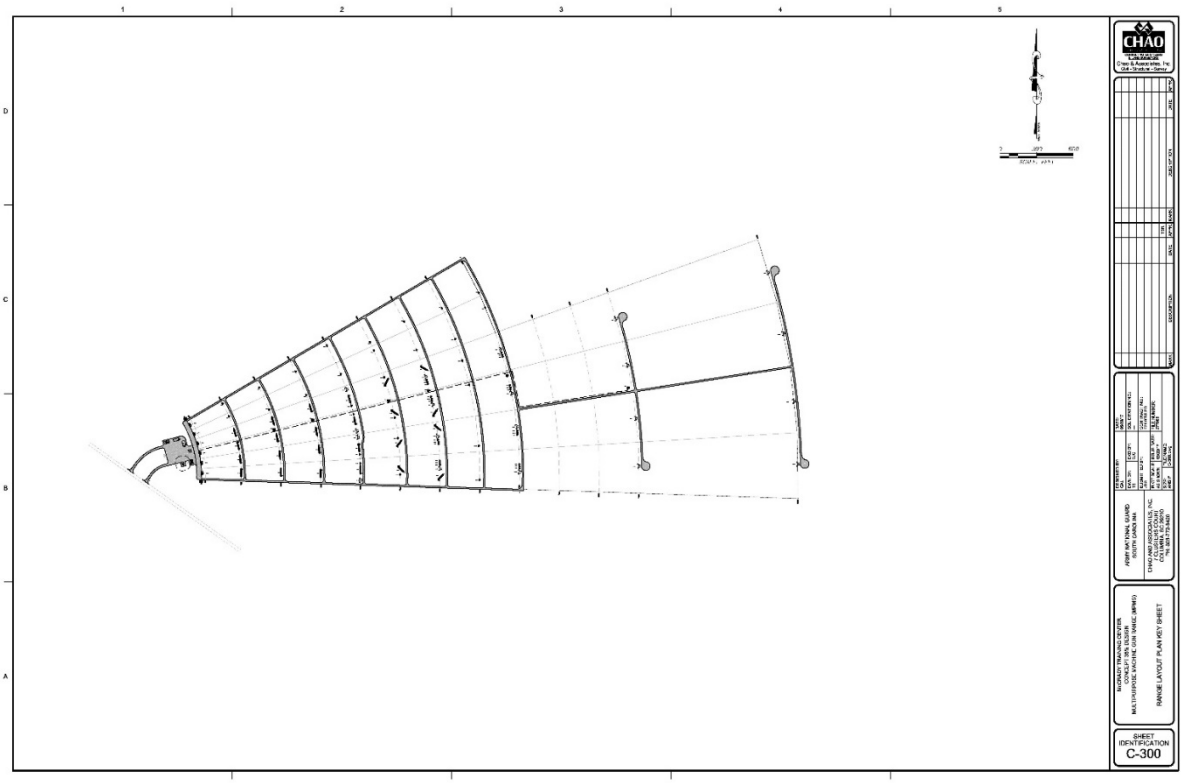


Figure 5: MPMG Range footprint, 30% design engineer drawings.

Primary facilities within the ROCA include:

- Range Operations Center -control tower
- General Instruction building
- Operations/ Storage Building
- Ammunition Breakdown Building
- Concrete Pads for contracted Portable Latrine facilities
- Bleacher Enclosure
- Covered Mess Shelter
- Vehicle Parking Area

The facilities will be designed to meet Industry Standards as well as all local, State, and Federal building codes and as per 40 USC 4154. Construction will include all utility services, information systems, roads, walkways, storm drainage and site improvements. All electrical will connect to the existing Fort Jackson primary electrical line on Wildcat Road via installation of a new overhead utility line and right-of-way and will run onto the ROCA portion of the range for the support facilities and downrange to support the ATS operation (Figure 6). The current design will have 13 power poles and the right-of-way will be a length of 3,563 feet.

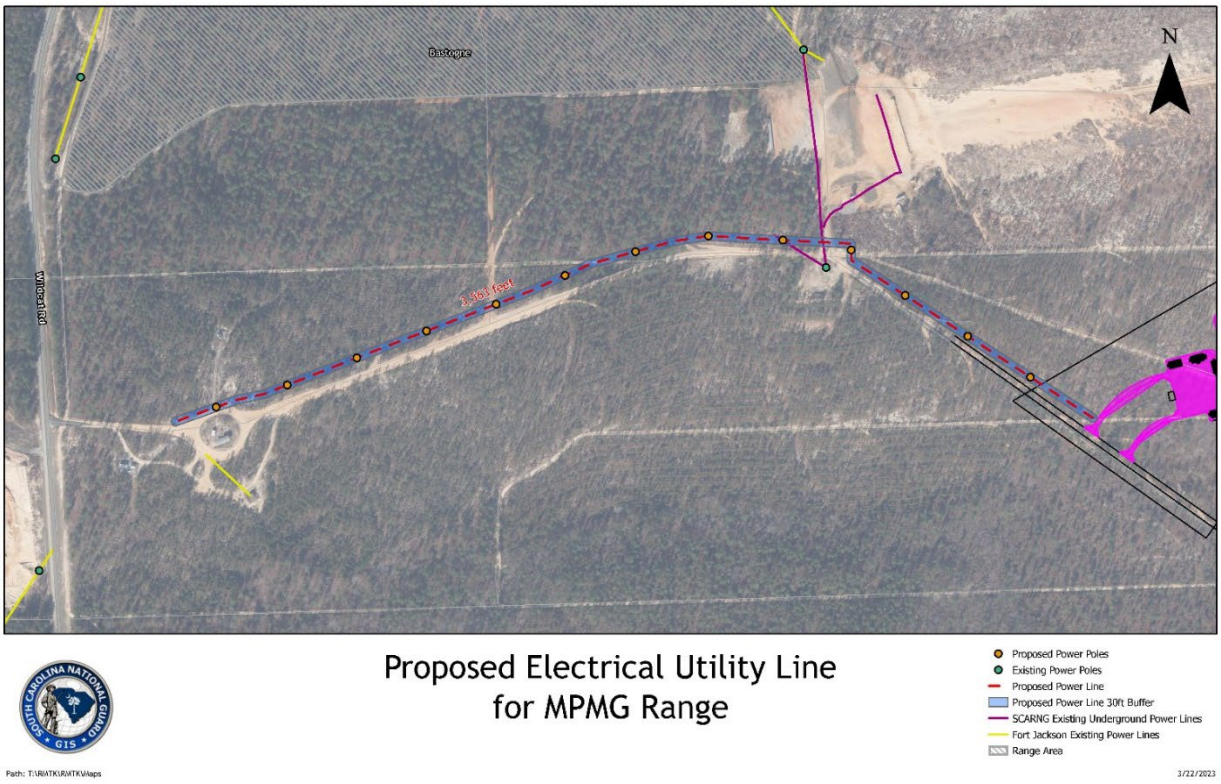


Figure 6: MPMG proposed electrical utility line.

Storm drainage will predominately continue along its current drainage patterns. Existing drainage is from west to east across the entire range. To maintain existing flow patterns and prevent ponding throughout the site, several proposed culvert locations are shown on the 30% grading plans. Based on the current design phase, culvert size has not been determined; however, SCARNG will follow all current guidance on future culvert maintenance. The ROCA is proposed within a topographic "saddle" so additional culverts will be provided to route stormwater around the ROCA. To meet stormwater, sediment, and erosion control requirements, a stormwater basin will likely be required within the range footprint, adjacent to the ROCA. This will be confirmed and designed after the 30% design. This stormwater basin will aid in stormwater routing around the ROCA and will also provide fill material for downrange targets that need to be elevated.

The first action to be analyzed is the range and ROCA footprint with their maximum construction limits. Based on the 30% design, the proposed maximum construction limit for the area is 208 acres (Figure 7). Construction will require clear-cutting, grubbing, grading, and the construction of targets and infrastructure within an existing range impact area (East Impact Area, EIA). The maximum construction limit for the range is currently composed of the following habitat types: 101.49 acres of Longleaf pine plantation, 72.88 acres of Scrub Oak (currently impacted by other ranges), 18.12 acres of Longleaf pine forest, 6.46 acres of Mixed Pine/Hardwood, 5.01 acres of open roads and firebreaks, 4.04 acres of Hickory-Longleaf forest (Figure 7). The electrical right-of-way will clear an additional 2.5 acres of pine forest (Figure 6).

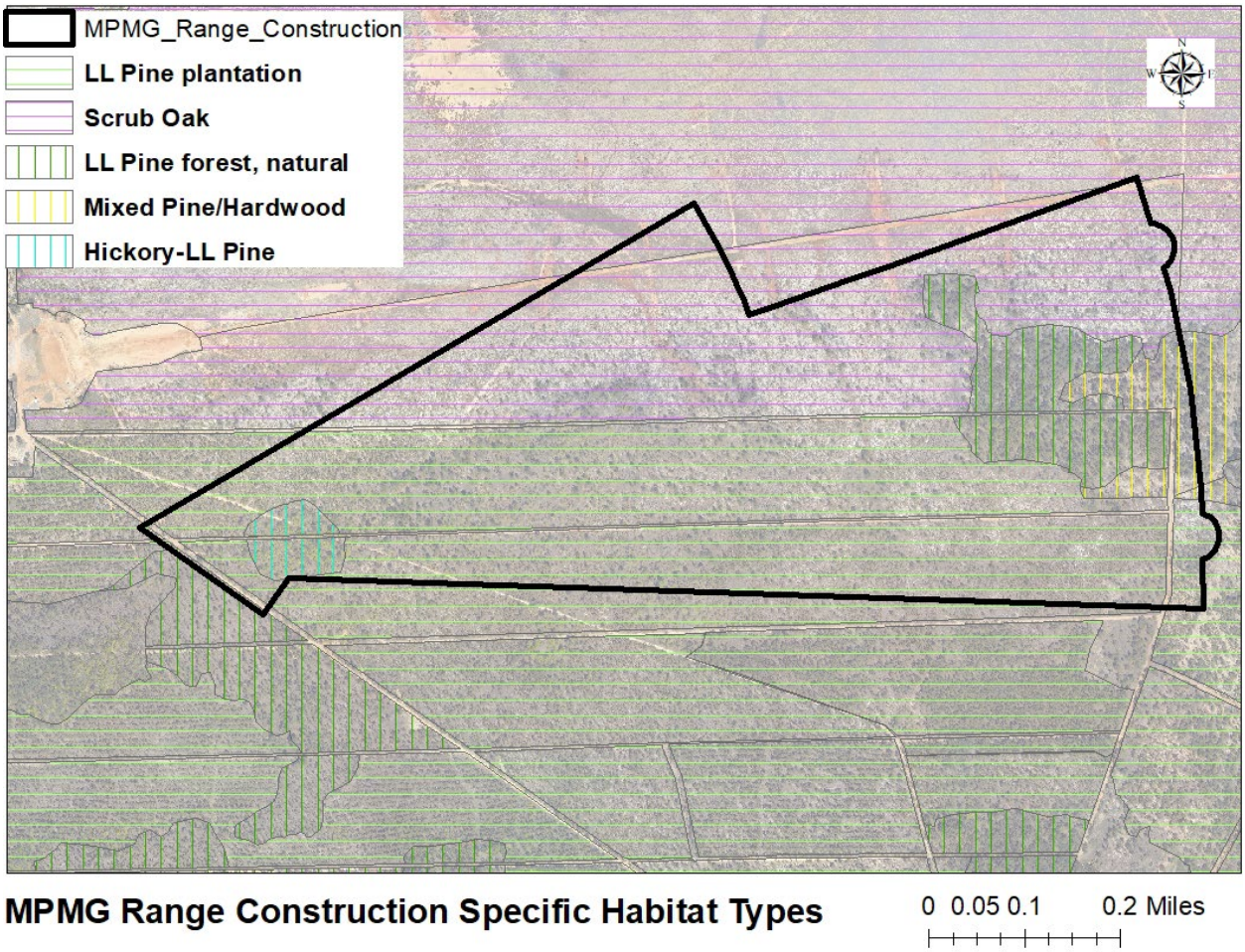


Figure 7: Specific habitat types within the maximum construction limit of MPMG Range.

The second action to be analyzed is the operation of the MPMG range. One area of effect is the 4,796-acre surface danger zone (SDZ) which is a buffer zone that accounts for projectiles, fragments, debris, and components resulting from the firing of weapon systems during the operations phase of the range (Figure 2). The SDZ falls within the East Impact Area, which is a designated area in which weapons are generally fired into, producing ordinance impacts or detonations. To predict the down-range impact to trees within the SDZ, resulting from live-fire operations conducted on the range, our analyses resulted in a 587-acre 'beaten area' (Figure 8). The Beaten Area was designed to predict the area where a majority of any tree damage or mortality would take place. The area outside the Beaten Area in the SDZ is expected to remain a forested habitat with negligible damage to trees and no predicted additional mortality.

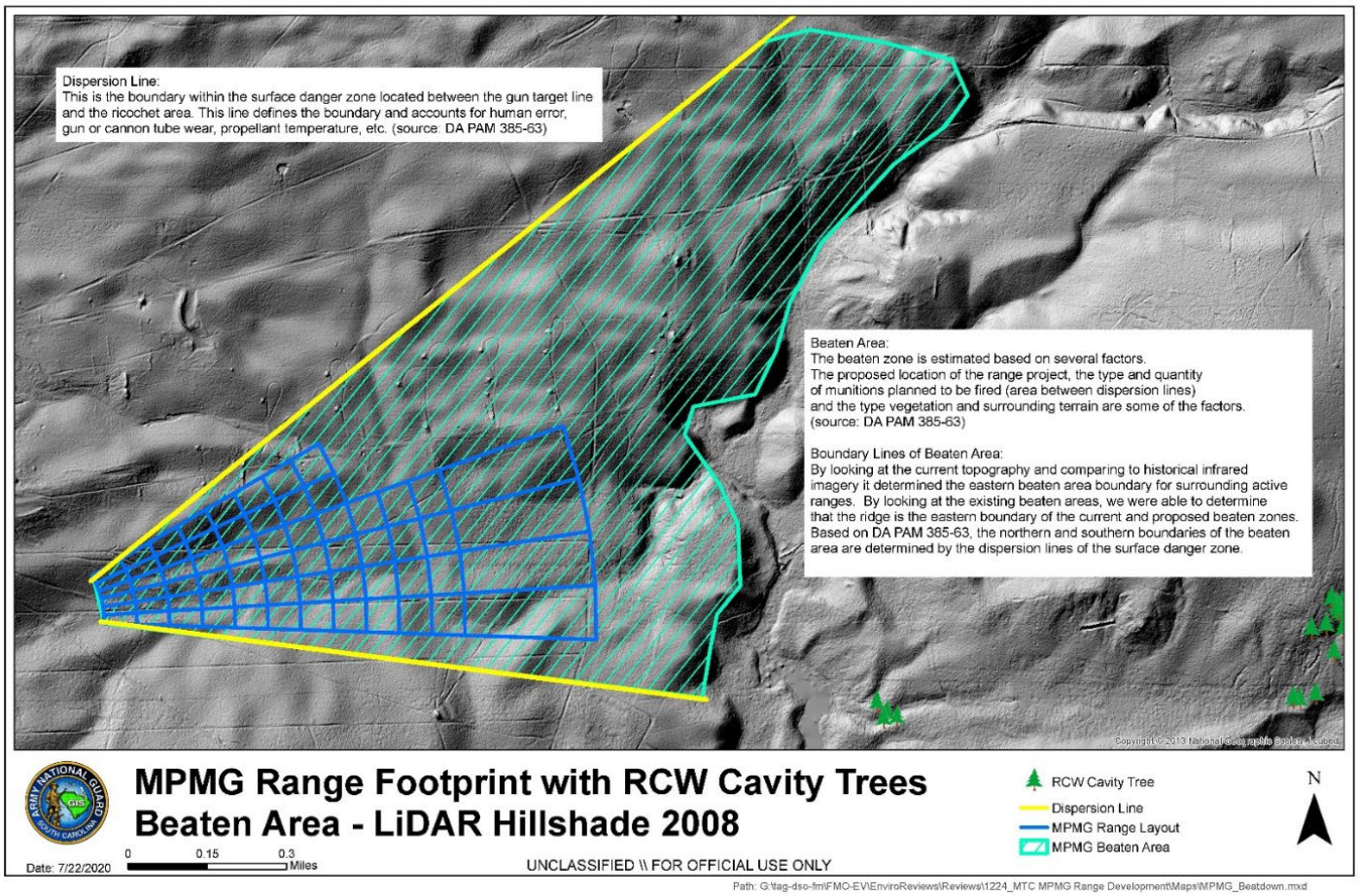


Figure 8: MPMG Beaten Area with hillshade.

The beaten area was estimated in the following way. Over time trees downrange of firing points in the SDZ will incur some degree of damage or mortality from fired munitions hitting or shearing trees, either directly or from ricochet. To quantify potential tree mortality, the area expected to experience the most damage is defined as the beaten area.

1. We considered the range location, the type of munitions to be fired, the type of vegetation, and the surrounding terrain.
2. By looking at the current topography and comparing it to historical infrared imagery we determined the eastern beaten area boundary for surrounding active ranges (Appendix 3, Folder 3).
3. By looking at the existing beaten areas, the viewshed, and LiDAR Hillshade images, we were able to determine that a ridge located ~1.3 miles (2 km) from the firing line is the easternmost boundary of the current beaten area and the estimated beaten area for the MPMG Range (Figure 8).
4. Based on DA PAM 385-63 the Beaten Area Viewable Area Dispersion Line for the northern and southern boundaries of the beaten area are determined by the dispersion lines of the surface danger zone (Figure 2, 8). The DA PAM is guidance on defining different aspects of the Surface Danger Zone (SDZ) and Dispersion area (see Appendix 3 'MPMG Range Terms.docx'); these terms are discussed throughout the DA PAM document. The terms are vital to understanding the methodology used to predict the beaten area. The Beaten Zone Memo (Appendix 3, Folder 3) also explains the methodology used to predict the beaten area.

Based on USFWS guidance, we divided the Beaten Area into two parts. The area to the north that overlaps with the existing Main Tank Range represents a baseline habitat (323.69 acres) because this area is already impacted by firing from existing ranges and tree damage is present (Figure 9). The proposed MPMG is a new action but may not change the baseline habitat appreciably. New impacts are anticipated within the footprint (208 acres) and in the predicted beaten area (64.21 acres; Figure 9).

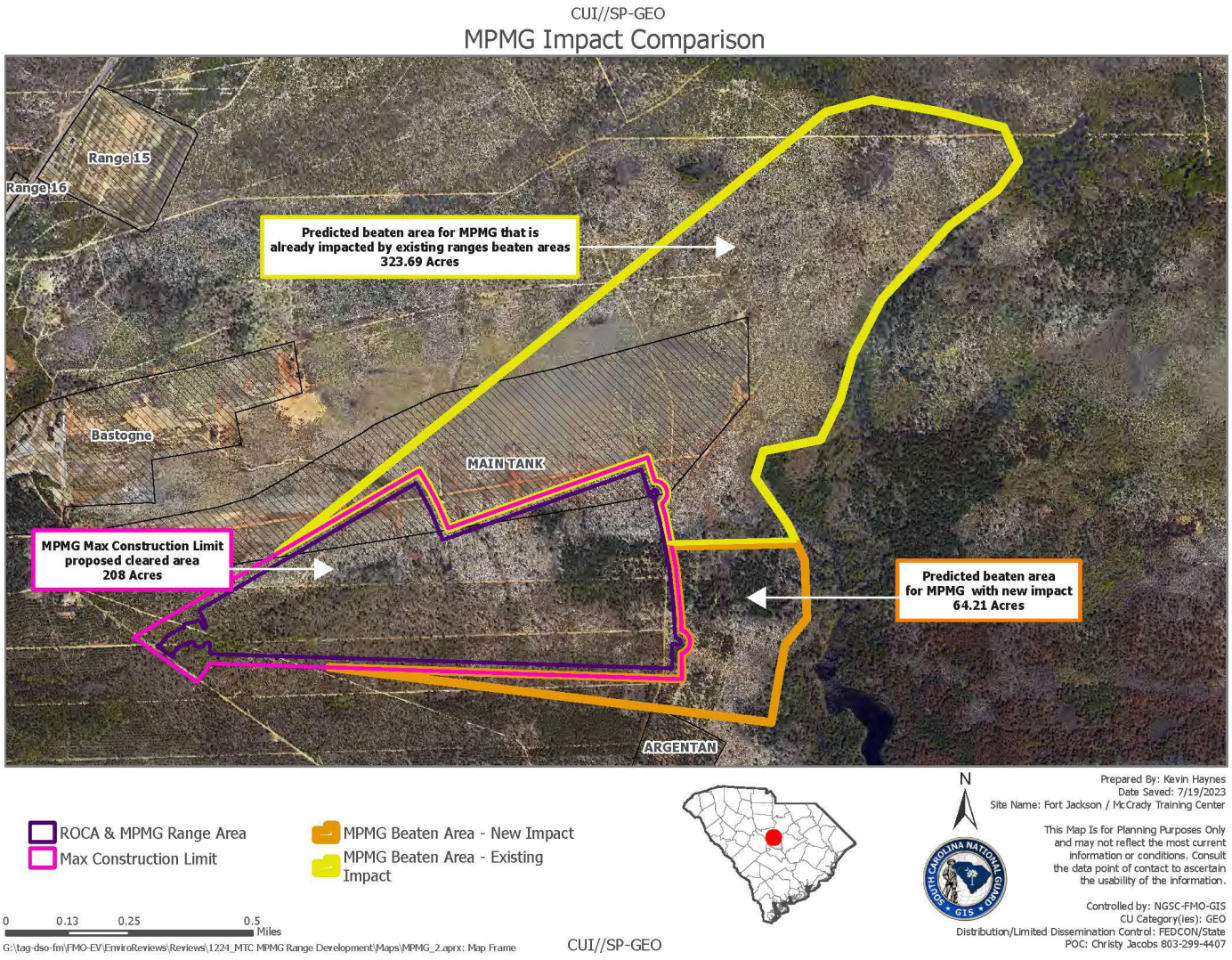


Figure 9: MPMG Beaten Area divided into the northern section currently impacted by other ranges, and the southern section which will receive new impacts from MPMG operation.

The Beaten Area will potentially damage 387.91 additional acres OUTSIDE of the maximum construction limit for the range (Figure 9). These acres are composed of the following habitat types: 310.24 acres of Scrub Oak, 21.78 acres of Longleaf pine plantation, 19.91 acres of pine/scrub oak, 22.10 acres of Mixed Hardwood, and13.88 acres of pine forest. The proportion of habitat types in the north and south sections of the Beaten Area is shown in Figure 10.

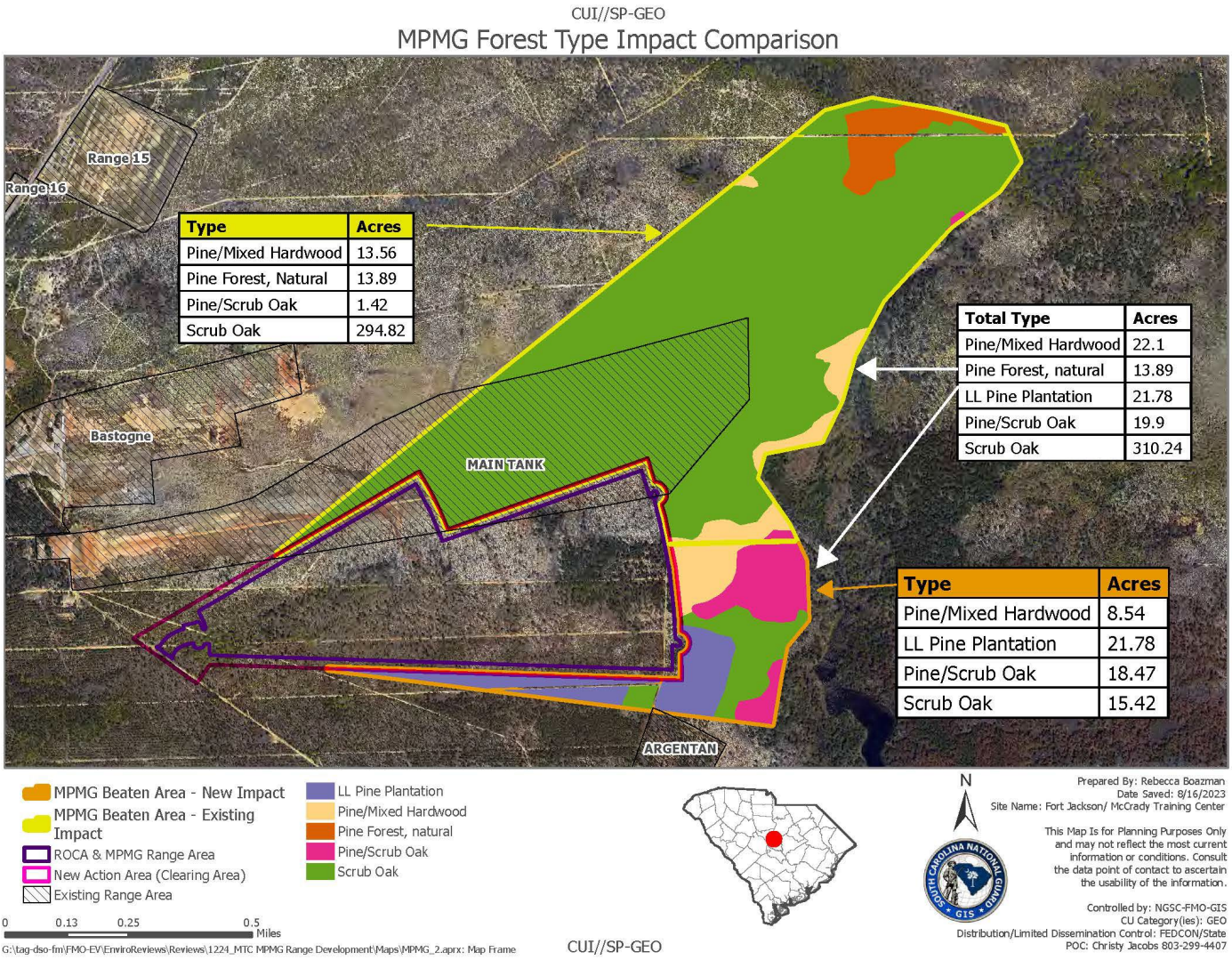


Figure 10: MPMG Beaten Area with specific habitat types.

The MPMG range will be active approximately 85 to a maximum of 100 days per year, based on the anticipated demands of military units with the requirement to qualify on the MPMG. Range qualification days will mostly occur on drill weekends and annual training periods with approximately 3 consecutive active qualification days for each event. The weapons planned for this range (Table 1) use primarily lead-based ammunition and no high explosive munitions will be used. There will be no increase in ammunition fired because both Main Tank and MPMG ranges use 0.50 cal and cannot be active at the same time. Since they cannot fire at the same time there will be no increase in noise overlap, as there would with both firing at once, but there may be more noise events. On average, the MPMG range will only be used during daylight hours.

Table 1: MPMG range details on size, dimensions, weapons, targets, ROCA, and other infrastructure.

Range Area (acres)	SDZ Area (acres)	Maximum Construction Limit (acres)	Range Dimensions	Weapons Utilized	Targets	Range Operations Control Area (ROCA) Components	Access Road	Parking Area	Electricity/ Telecom
170 (166 range & 4 ROCA)	4,796	208	6 lanes Lanes 1 and 2 are 800 meters (0.497 mi) long Lanes 3-6 are 1,500 meters (0.932 mi) long Range width is 860 meters (0.534 mi).	M60 Machine Gun (MG) M240B MG M249 SAW MK19 40mm MG M24 Sniper Rifle No frangible bullets will be used	5 Stationary Armor Targets (SATs) at 400, 600, 800, 1,100, and 15,000 meters (0.25, 0.37, 0.5, 0.68, 9.32 mi) in Lanes 3-6. 20 Stationary Infantry Targets (SITs) will be arrayed at 100-meter intervals to 800 meters (0.062mi intervals to 0.497 mi) in Lanes 1-6.	Range Operations Center - control tower General Instruction building Operations/Storage Building Ammunition Breakdown Building Concrete Pads for contracted Portable Latrine facilities* Bleacher Enclosure Covered Mess Shelter Vehicle Parking Area	580 linear feet of 16-foot-wide access road (0.21 acre)	2,000 square yards (0.41acre)	Electrical will connect to the existing primary line on Wildcat Road. It is approximately 3,563 feet from the connection to the proposed MPMG.

* Port-o-lets used at the proposed project will be maintained under existing agreements for such work on Fort Jackson.

Consultation Methodology

The SC Army National Guard Environmental Resource Center's Conservation Office reviewed the list of all federally listed threatened/endangered (T&E) animal and plant species known to have occurred in Richland County, South Carolina (Appendix 1). Referencing the USFWS online tool 'Information for Planning and Consultation' (iPAC) and the USFWS lists we determined the following T&E faunal species are found in Richland County: the Shortnose Sturgeon as endangered, Red-cockaded Woodpecker as endangered, the American Wood Stork as threatened, and the Bald Eagle as protected under the Bald Eagle Protection Act (1940) and Golden Eagle Protection Act (1962). The T&E floral species listed in Richland County include: the Smooth Coneflower as threatened, Rough-leaved loosestrife as endangered and Canby's Dropwort as endangered. The Tricolored bat has been proposed as endangered by USFWS at this time and is expected to be listed soon. All other species discussed within this Biological Assessment (BA) are listed as at-risk species. While at-risk species are not afforded any legal protection under the Endangered Species Act, they are included in this document as a precaution in case of future listing. Each species is discussed in the *Analysis of Effects* section of this BA regarding their presence and the presence of suitable habitat on the proposed site. Appendix 1 of this document provides further information regarding species' federal and state listing status (if applicable), their habitat, and primary threats to species' population.

A literature search was performed for the seven (7) federally listed T&E and twelve (12) at-risk species to determine habitat requirements and to find descriptions of the species that would facilitate species identification during the field surveys. Important sources of reference information included the following: natural resource agency data and published reports, natural resource field guides, previous Army Fort Jackson/SCARNG BAs, various flora and fauna literature, forest inventory data, GIS Data, and GIS analysis.

On multiple dates in the spring of 2020, Mr. Chris Stone, Mr. Layne Anderson, and Mr. Bryan Hall of the SCARNG Environmental Resources Center conducted field surveys of the site. On multiple dates during the December 2022 through January 2023 period, Ms. Michelle Wilcox, Mr. Thomas Clawson and other staff of the Fort Jackson Wildlife Branch conducted field surveys of the site. We observed the existing habitat and searched for signs indicating the possible presence of each listed plant and animal species. The proposed site was surveyed to the best of our ability outside of the UXO areas. The proposed project area habitat was analyzed against the species list provided. The findings from the field surveys and project analysis are included below.

Consultation History

An initial scoping letter requesting comments from the USFWS on a project involving multiple new ranges (Range Development Plan), including MPMG, was sent on 21 November 2011. The Interagency/Intergovernmental Coordination for Environmental Planning (IICEP) letter briefly described the proposed action and detailed the Environmental Assessment (EA) for this project. The USFWS responded in letter reference FWS-2012-I-0063. Due to a lack of funding, and postponement of the project, the EA was never completed. Informal consultation was reinitiated on March 30, 2020 for the construction of just this proposed MPMG range.

A draft Biological Assessment was sent to the Charleston Field Office on 24 April 2023. A request for additional information was emailed to Fort Jackson on 24 May 2023. The additional information was returned to USFWS on 22 June 2023 and an in-person meeting was held between USFWS, Fort Jackson and SC Army National Guard

staff to discuss the project on 27 June 2023. An on-line meeting was held on 26 July 2023 to discuss Tricolored bats (TCBs), this meeting included USFWS, Ft Jackson and SC Army National Guard. This updated Biological Assessment includes all requested additional information.

Analysis of Effects

Chamberlain's dwarf salamander (*Eurycea chamberlaini*)

Chamberlain's dwarf salamander was documented on MTC during survey efforts conducted by the South Carolina Department of Natural Resources (SCDNR 2019, 2020, 2021, 2022). This salamander has since been documented by surveys performed elsewhere on Fort Jackson outside of the MTC. This species inhabits wetland areas which are not present on the proposed range footprint's maximum construction limit (Figure 7). The proposed range footprint is situated in stands of pine, hardwood, or mixed pine/hardwood. No streams pass through the proposed range footprint and the closest stream is approximately 0.24 miles from Eastern boundary of range footprint's maximum construction limit. The range footprint does not provide suitable habitat for this species. There are wetland habitats in the Beaten Area portion of the project that may support this species. The effects on this area may include the potential injury/mortality of canopy trees. Opening the canopy in wetland areas can be beneficial to many species because it mimics occasional canopy-killing hot fires that would burn through wetlands historically.

It is anticipated that there would be no effect on this species as a result of the proposed range construction and operation.

Bald Eagle (*Haliaeetus leucocephalus*)

No Bald eagle nests were observed during the field survey of the proposed range footprint, and the range footprint does not contain open-water habitat to support the preferred foraging of this species. The Beaten Area encompasses some potential nesting sites on the west border of Weston Lake. There have been occasional sightings of Bald Eagles over Weston Lake but there has been no evidence of a nesting territory. The Beaten Area was surveyed from cleared roads during Dec 2022- Jan 2023 and no eagles or nests were seen.

The closest known active Bald eagle nest is along Dupre Pond located on Ft. Jackson approximately 5.6 miles from the proposed range footprint. This nest (SC DNR #N743) has been monitored annually by the Ft. Jackson wildlife office. Bald eagles have occasionally been observed temporarily roosting in large trees or flying over water bodies in other locations on the installation.

Due to the insignificant chance of Bald Eagles being struck with munitions while flying or perched in the Beaten Area near Weston Lake, it is anticipated that this project 'may affect but is not likely to adversely affect' this species.

American wood stork (*Mycteria americana*)

The American Wood Stork has only been observed on Ft. Jackson on three occasions. There is no evidence of nesting activity on Fort Jackson. However, they have not been observed in or near the proposed range footprint since it does not provide wetland habitat for this species. The proposed range footprint is situated in stands of pine, hardwood, or mixed pine/hardwood. No streams pass through the proposed range footprint and the closest wood stork observation was at Weston Lake dam, which is over 1.25 miles from the boundary of the range footprint. Damage to trees in the Beaten Area is not predicted to affect the wetlands or their ability to support forage for Wood Storks.

It is anticipated that there would be no effect on this species as a result of the proposed range construction and operation.

Broad River spiny crayfish (*Cambarus spicatus*)

The Broad River spiny crayfish is restricted to the Broad River Basin in Fairfield, Greenville, Richland (north of Ft Jackson) and Spartanburg Counties. Fort Jackson is situated in the Saluda and Catawba River Basins, not the Broad River Basin. A rare fauna survey (Gaddy and Gaddy 2020) also found no evidence of this species in any streams located on MTC.

It is anticipated that there would be no effect on this species as a result of the proposed range construction and operation.

Shortnose sturgeon (*Acipenser brevirostrum*)

The Shortnose sturgeon has never been documented on Fort Jackson. In 1997, Fort Jackson prepared a BA of Fort Jackson's potential effects on the Shortnose sturgeon pursuant to Section 7 of the Endangered Species Act of 1993. The U.S. Department of Commerce reviewed this document and by letter dated January 13, 1997, concurred with the BA's determination that populations of endangered or threatened species under their purview would not be adversely affected by actions occurring on Fort Jackson. This concurrence was because Shortnose sturgeons are extremely unlikely to occur on, or in the immediate vicinity of Ft. Jackson.

The proposed range footprint is situated in stands of pine, hardwood, or mixed pine/hardwood. No streams pass through the proposed range footprint and the closest stream is approximately 0.24 miles away from Eastern boundary of range footprint maximum construction limit. However, this stream flows south into Weston Lake which is a dammed impoundment. After exiting the post, it passes through privately owned dammed ponds, eventually emptying into the Congaree River. The downstream dams that form ponds between Weston Lake and the Congaree River severely impedes the passage of any anadromous fish further upstream.

It is anticipated that there would be no effect on this species as a result of the proposed range construction and operation.

Robust redhorse (*Moxostoma robustrum*)

The robust redhorse has not been observed in any streams located on Ft Jackson. Gills creek was surveyed for fish in 1994 (S.C. Wildlife and Marine Resources 1994). Lakes and ponds were surveyed in 1987 (Fish and Wildlife Associates, Inc. 1987). An aquatic survey was performed on Colonel's Creek which included surveys for fish in 2005 (Cooper *et al*. 2006). A rare fauna survey (Gaddy and Gaddy 2020) also found no evidence of this species in any streams located on MTC.

The proposed range footprint is situated in stands of pine, hardwood, or mixed pine/hardwood. No streams pass through the proposed range footprint and the closest stream is approximately 0.24 miles away from Eastern boundary of range footprint maximum construction limit. However, this stream flows south into Weston Lake which is a dammed impoundment. After exiting the post, it passes through privately owned dammed ponds, eventually emptying into the Congaree River.

It is anticipated that there would be no effect on this species as a result of the proposed range construction and operation.

Monarch butterfly (*Danaus plexippus*)

The Monarch butterfly has been observed on Ft. Jackson. This species is dependent on the milkweed plants in the genus *Asclepius*, for propagation. A pollinator survey was conducted by the University of South Carolina in 2017 on MTC's licensed area and the presence of Monarchs and milkweed plants were detected (Mousseau *et al.* 2017). The milkweed plants were found along roadsides in small numbers, the MPMG project footprint was not part of the study area. The proposed range footprint is situated in stands of pine, hardwood, or mixed pine/hardwood which is potentially conducive for milkweed. No milkweed was documented during surveys, but surveys were limited to roads.

It is possible that a few milkweed plants may be destroyed in the construction of the range, but we determine that this effect will be insignificant. Therefore, this project may affect this candidate species, but is not likely to adversely affect this species.

Little brown bat (*Myotis lucifugus*)

Survey efforts by SCARNG using acoustic methods in 2012-2016, as well as combined netting and acoustic surveys by the South Carolina Department of Natural Resources in 1997 (SCDNR 1997) and in 2020-2022 (SCDNR 2020a, 2021, 2022), using the same methods have yielded no presence of Little brown bats on MTC's licensed area. A limited survey in 1990-1992 for bats roosting in unused bunkers, firing range tunnels, and outbuildings on Fort Jackson only located Rafinesque's Big-eared bats and Big Brown bats (SCWMRD 1992). Roosting habitat does exist throughout the installation in the form of hollow trees, buildings, tunnels, and artificial roost structures.

The proposed footprint may have suitable roost habitat for the Little brown bat, but it is anticipated that this species will not be affected by the proposed range construction and operation due to its lack of presence on the installation.

Tricolored bat (*Perimyotis subflavus*)

The Tricolored bat (TCB) has been proposed for listing as endangered in the Federal Register (FR Doc. 2022–18852 Filed 9–13–22). For interim guidance we have referred to the 'Range-wide Indiana Bat & Northern Long-eared Bat Summer Survey Guidelines' (USFWS 2023). We reached step 3b on page 4 which suggests that no further surveys are recommended and that we should coordinate with the USFWS Charleston Field Office to discuss potential effects, develop conservation measures, and determine the need for incidental take authorization.

The TCB is one of the smallest bat species in North America. Once commonly found throughout its range spanning across the eastern and central US, southern Canada, and portions of Mexico, this species has drastically declined in recent years due to the introduction of the fungus *Pseudogymnoascus destructans* (*P.d.*) that causes the fatal White-Nose Syndrome. Continuing habitat fragmentation and loss are also contributing to declines.

Status of the species on the installation

This species has been detected and observed on MTC's licensed area while performing acoustic surveys in 2012-2016, as well as combined capture and acoustic surveys conducted by South Carolina Department of Natural Resources in 1995, 1996, 1997, and 2020-2022 (SCDNR 1997, 2020a, 2021, 2022). The acoustic survey results have demonstrated that the primary habitat utilized by TCBs on McCrady Training Center is concentrated around riparian and bottomland hardwood habitats near flowing streams and open water, although they have also been detected in upland mixed hardwood/pine habitats as well. The map 'Bats Study Sites' (Appendix 3, Folder 7) shows survey locations and occurrence records of the TCB on McCrady Training Center documented by the Adjutant General's Office (South Carolina Army National Guard) environmental staff. These surveys took place through either mist netting efforts, bat surveys, or incidental occurrences. The white dots represent the locations of either the mist net efforts or bat surveys that did not result in an occurrence of the TCB. The green dots represent an occurrence of the TCB through either mist net efforts, bat surveys, or incidental occurrences (natural resource staff seeing and confirming the presence of a specific species while working in the field). Capture efforts have resulted in four (4) total individual TCBs, two in 1995, one in 2020, and one in 2021. The closest location of a captured TCB to MPMG is the intersection of Colonel's Creek with Red Diamond Rd, over 3 miles away from the range footprint (Appendix 3, Folder 7). It is important to note that the habitat for the two captures (1995 and 2021) at this location was a riparian, bottomland hardwood forest adjacent to Colonel's Creek. The other 1995 capture was in a predominantly pine-dominated stand (SCDNR 1997, 1998). The 2020 capture was located next to Davis Pond. The habitat of both the 2020 and 2021 TCB captures has not changed since 1995 and still represents riparian, bottomland hardwood forest habitat (SCDNR 2020, 2021; CSU 2018).

Additionally, during inspections/use surveys of old range tunnels on McCrady Training Center's cantonment area, TCBs have been observed overwintering in/ utilizing the tunnels as hibernacula roosts. The closest tunnel location with a TCB roost is in tunnel #5 on the east side of MTC, over 7.5 miles away from the range footprint (Appendix 3, Folder 7), and detected.as recently as the winter of 2022.

On the west side of the installation, Fort Jackson has supported one bat survey in 1990-1992 performed by The Nature Conservancy, which included looking into unused bunkers, firing range tunnels, and outbuildings. No TCBs were identified during that survey, but we are working under the assumption that TCBs are likely breeding, roosting, and/or foraging in most of the suitable hardwood or pine-forested lands on the installation as well as in riparian areas, along edges, and small openings that include firebreaks and roads.

Habitat for TCBs

In the summer, TCBs are known to occur in many habitat types including forested areas, where they take advantage of tree foliage, both live and dead clusters of leaves and needles, as roosting sites (Perry and Thill 2007) as well as under tree bark (Hammesfahr *et al*. 2022). They can also roost in live or dead tree cavities (Menzel *et al*. 2003, USFWS 2023). Males prefer to roost in oaks, and roost in areas with more midstory hardwoods, more large pines, less canopy cover and farther from the nearest trees than random locations (Perry and Thill 2007). Maternity colonies, consisting of adult female bats and their young pups, commonly occupy clumps of foliage of canopy trees (pine or hardwood) as shelter (Perry and Thill 2007) or in basal cavities of trees (SCDNR, 2020b). They typically give birth between May and July and young can fly at three weeks of age. Females roost in larger trees than random and prefer mature forests (>50 years old) with complex structures and a hardwood component. In the mountains of NC, TCBs preferred to roost in older forests and roosted close to streams and closer to openings than expected (O'Keefe *et al*. 2009).

In the winter, hibernation sites for TCBs include live hardwood trees, with canopy closure and an abundance of cavities (Newman 2020) as well as caves, mines, abandoned buildings, culverts, and other underground or sheltered locations that maintain relatively stable temperatures and humidity levels. TCBs will also use man-made structures such as bat boxes and other artificial roosting options.

Forest Analysis Methods

To better define and quantify potential TCB suitable habitat found within the SCARNG MPMG Range footprint and Beaten area, a habitat analysis was performed.

Several factors that characterize suitable summer habitat for TCBs are water resources (i.e., slow moving streams and standing water) and forest structure (i.e., forest types, canopy cover, and canopy height). Some literature and observations from previous bat surveys on McCrady demonstrate that these factors are positively correlated with TCB presence and use. Alternately, none of these factors were strong predictors of summer habitat use on the coast of SC (Shute *et al*. 2021).

Using ArcGIS Pro 3.1 and publicly available feature layers published and/or updated within the last four years via ESRI's Living Atlas were used to run habitat analyses. These layers contained data regarding four habitat features: wetlands, tree canopy cover, forest canopy height, and forest types. To ensure the data was accurate, the USA Forest Types layer was qualitatively compared and developed during SCARNGs Vegetative Classification and Mapping Survey where the data overlapped.

The symbology of layers displaying percent canopy cover (USGS and ESRI, 2017) and Canopy Height (Lang et al., 2022) were formatted to display the data in five classes. Forest types (Fort Jackson Forest Stands, 2023) were classified by the predominant tree species within the sample area. The wetlands layer (USFWS and ESRI, 2019), classified as lacustrine, palustrine, and riverine, were considered as a water source and analyzed as an aggregate whole. This layer includes only designated wetlands and does not include ephemeral and/or incidental puddles or flooding.

As canopy cover and height are positively correlated with overall tree size, they were spatially joined and stands that exhibited canopy cover of at least 40% and a canopy height of at least 25 feet were highlighted as those that resembled forest interior (Figure 11).

The new Canopy Cover/ Canopy Height layer was then clipped to the Forest Types (Figure 12) to display the canopy cover and height of the different forest types within each stand (Figure 13).

We analyzed the proximity to wetlands as a function of use for any potential habitats; bats are likely to use areas located within a certain distance to water. A 0.25-mile proximity buffer was created around the water resources representing an estimated area of predicted bat use.

Forest Analysis Results

A majority (338 acres) of the available habitat found within the MPMG Range and Beaten Area overlaps with what is currently called Main Tank Range. This area is heavily disturbed, it has experienced repetitive live ammunition fire during military training since WWII. Primarily dominated by earlier successional scrub oak

habitat, this would most likely serve as foraging habitat for TCBs. However, this may not be the most suitable foraging habitat due to a lack of consistent water resources in the area.

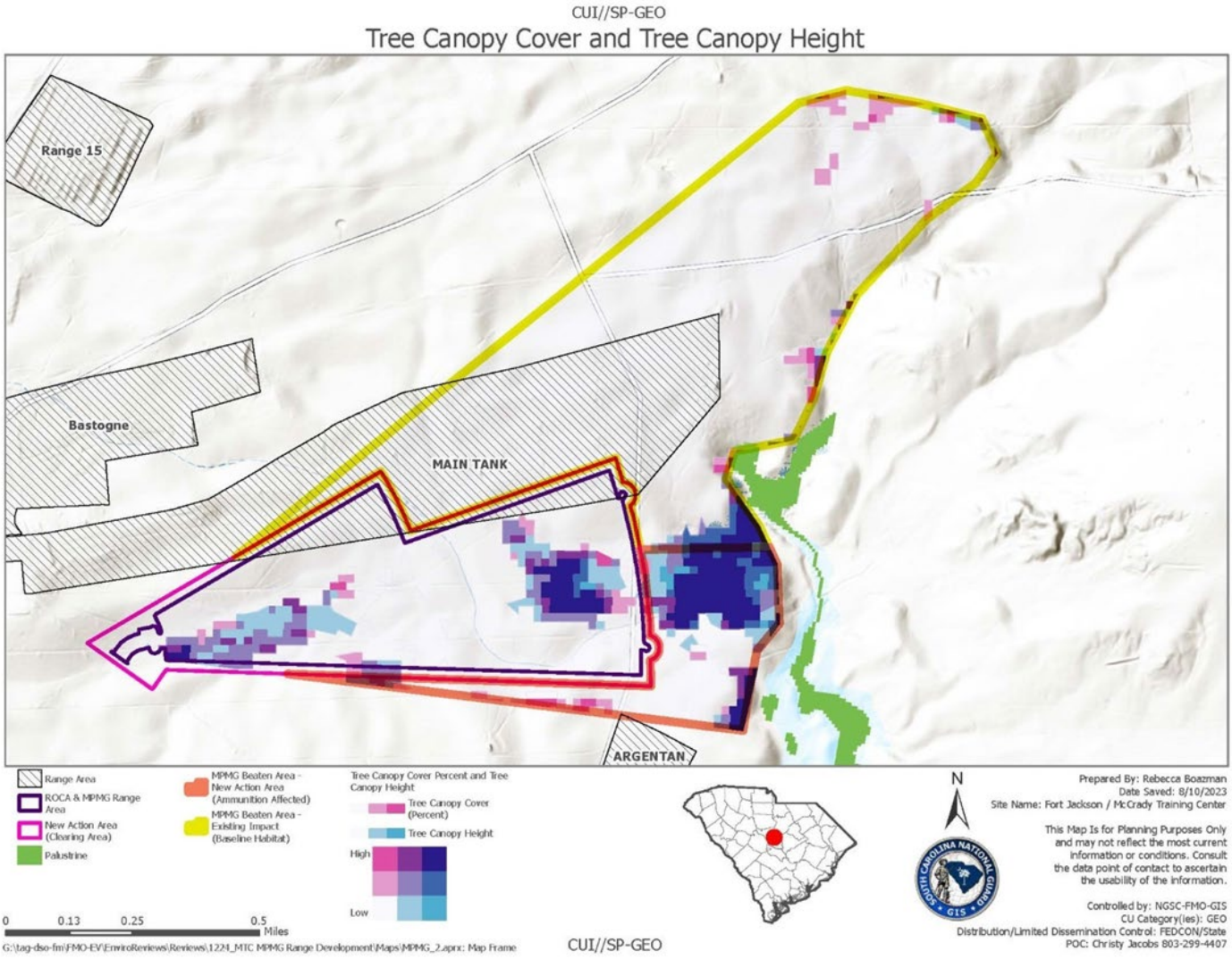


Figure 11: Map displaying the overlap of Canopy Cover (%) and Canopy Height (ft) of the forested areas within the MPMG Range and Beaten Area.

Within the MPMG range project Area (Range and the Beaten area) the areas that contain a canopy cover minimum of 48% with a maximum coverage of 70% have an average canopy height of 64 feet with a maximum of 75.44 feet (23 meters). The forested area experiencing notable canopy cover and height overlap is approximately 37.47 acres. The remaining 514.44 acres is comprised of early successional scrub oak habitat that contributes almost no canopy coverage (less than 16%) and an average canopy height of 16.4 feet.

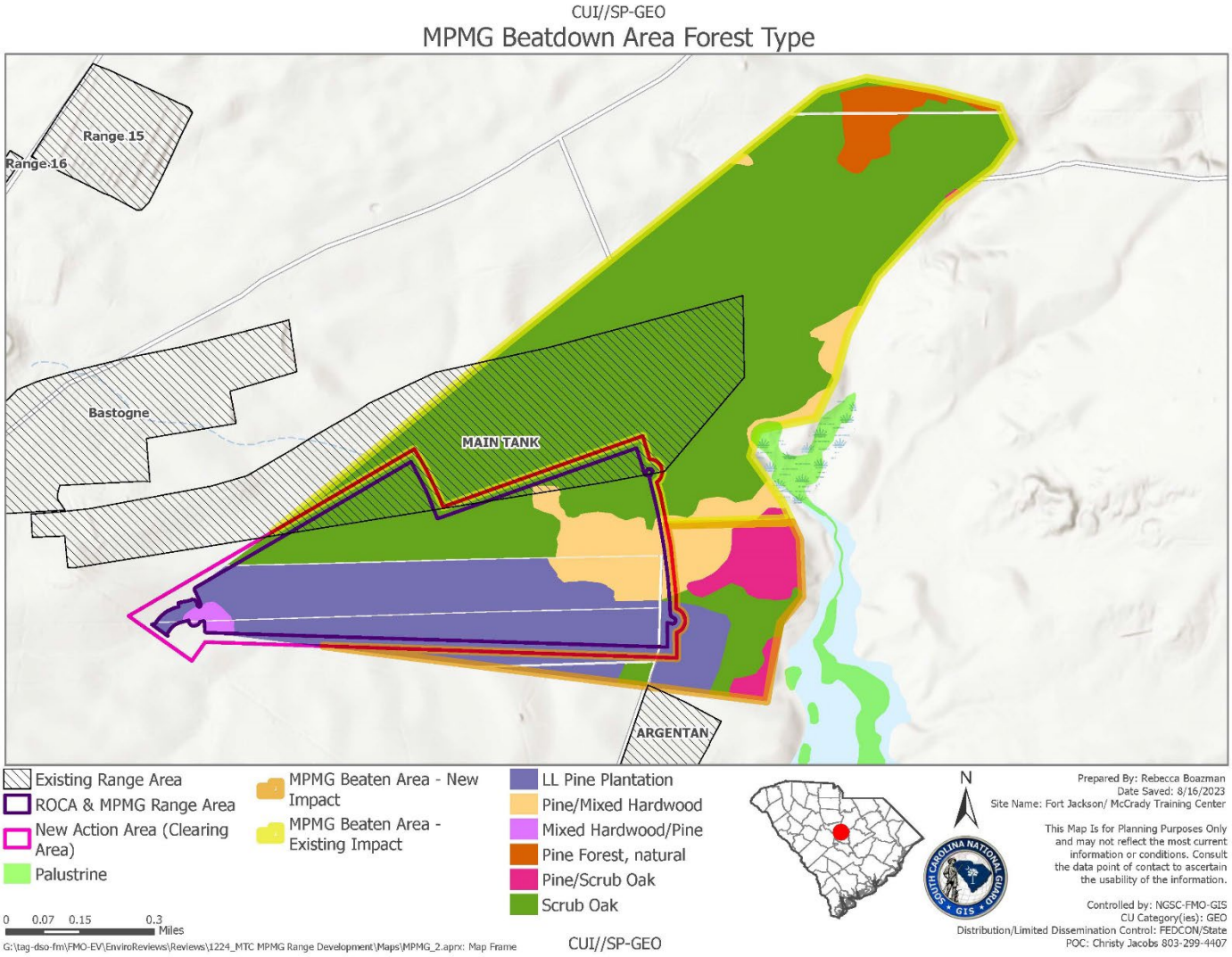


Figure 12: Map displaying the Forest Types within the MPMG Range and Beaten Area.

The MPMG Range and Beaten Area is comprised of 6 forest types: Scrub Oak (383.04 acres), Longleaf pine Plantation (117.70 acres), Mixed Hardwood (46.12 acres), Pine/Scrub Oak (20.23 acres), Natural Pine (13.89 acres), and Mixed Hardwood/ Pine (2.64 acres).

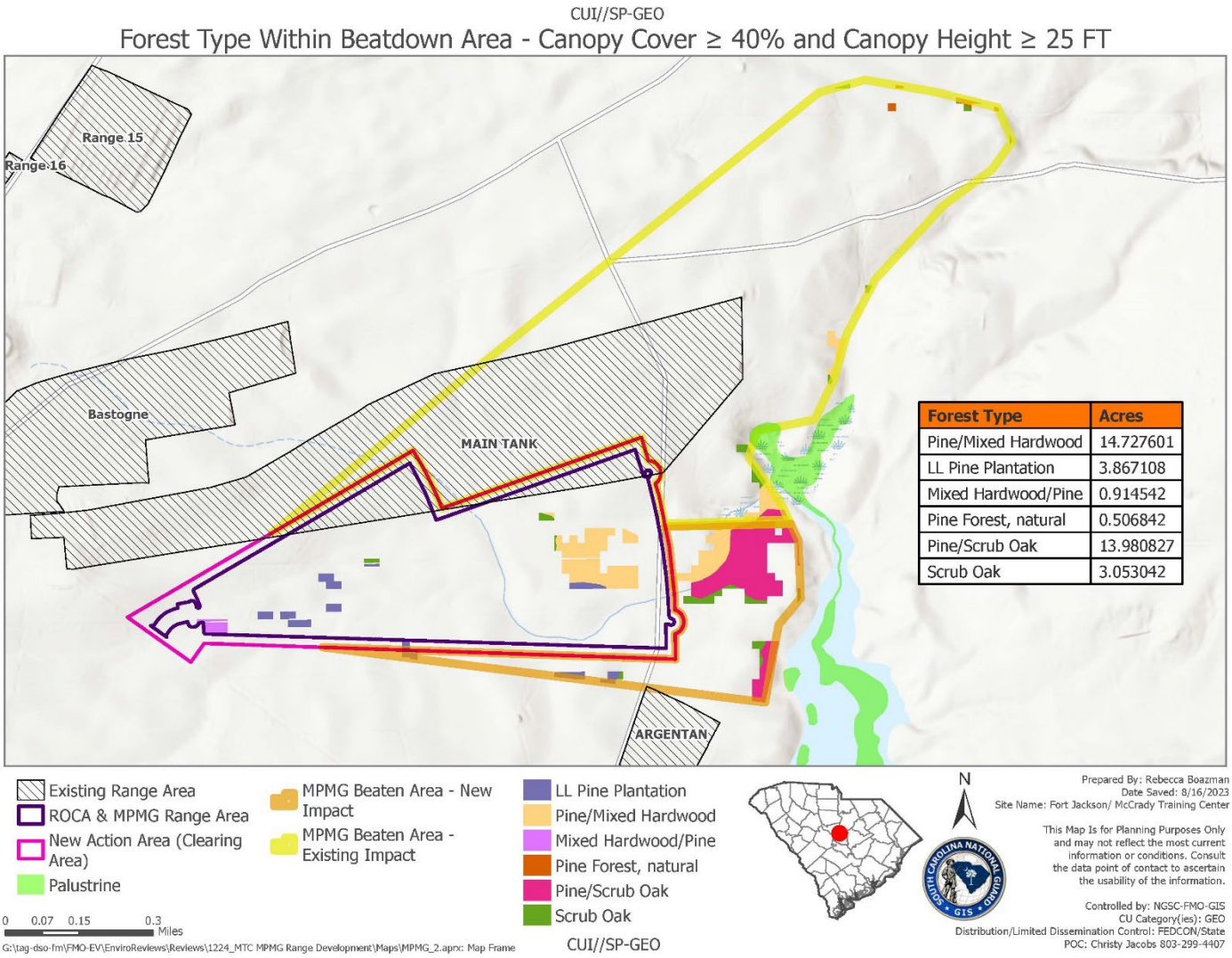


Figure 13: Map displaying the Forest Types that comprise stands resembling a "forest interior" with a minimum Canopy Coverage of 40 % and a minimum Canopy Height of 25 feet within the MPMG Range and Beaten Area.

The three predominant forest types (Figure 13) that exhibited a minimum canopy coverage of 40% and a minimum canopy height of 25 feet were Mixed Pine/Hardwood (14.73 acres), Pine/Scrub oak (13.98 acres), and Longleaf pine Plantation (3.87). The total area for these three stand types representing a forest with the tallest/largest trees was 32.58 acres, approximately 6% of the total 595.91-acre MPMG area. The Pine/Scrub oak forest type boasted the maximum canopy coverage of 70% and canopy height of 75.44 feet.

Our site visit of the MPMG Range and Beaten Area, also corroborated the vegetative data represented in the layers used in our habitat analyses.

Effects of the action on TCBs

There are two actions to be analyzed. The first action is the construction of the range which includes surveying for and removing UXO, removing vegetation in the maximum construction limits of the range footprint of 208

acres, building structures, installing electricity (2.5 acres), and installing culverts for stormwater management. The second action is the operation of the range which includes firing of weapon systems.

Breeding and Roosting

TCBs roost on live and dead trees in a variety of forested habitats, so roosting habitat exists in the range footprint, the Beaten Area, and in the area covered by SDZs in the form of live and dead trees, and other vegetation (USFWS 2023). The forest analysis reveals that only 32.58 relatively-continuous acres in both the range footprint and beaten area provide potential roosting and maternity roosting (breeding season) trees that the bats might prefer, although all of the acreage is potentially usable by bats.

This species can hibernate in winter using culverts, bridges, tunnels, and abandoned water wells. There are three 'WW2 Bomb-proof observation posts' in the Beaten Area but these structures currently allow too much light inside for bats to roost (see Section 'Habitat Mitigation').

The first action, the construction of the MPMG range will include UXO clearing, which may include ground disturbance, wildland fire, noise and visual stimuli. Effects to bats may include behavior modification or abandonment of roosting sites due to noise and visual stimuli. Detonation events would be brief and isolated, in most cases UXO is removed and taken to a demolitions pit (DOD, 2023). The construction of the range will also include clearing of vegetation from the range footprint, which will permanently prevent bats from using this area to breed, roost and possibly hibernate. The 208 acres to be removed represents only 0.41% of the entire potentially suitable acreage of Fort Jackson (51,313 acres), so we predict the effects to the local population will be minimal.

Construction-related impacts may include physiography, topography, and soil disturbance; surface water, including soil erosion, and increased wastewater and runoff; potential contamination from spills into groundwater; air emissions impacts; and hazardous waste from oil or solvents. Construction activities such as site grading, road construction, vertical and horizontal building, and other activities are likely to occur during the bat active season during day light hours. Noise and vibrations generated by heavy equipment within or directly adjacent to roosting trees could temporarily disturb roosting bats.

The second action, the operation of the range, will cause environmental effects such as vegetation damage, loud noises, increased risk and spread of wildland fire, toxic residues and metals, smokes, and potential bioaccumulation. Fired munitions will cause noise and shaking of trees which may disrupt maternity roosting and may lead to pup mortality. The north beaten area (323.69 acres) that is already impacted by existing range activity represents a baseline habitat. While this area might have vegetation hit from new angles, we anticipate minimal effects to any potential breeding and roosting habitat in this area. The newly impacted south beaten area (64.21 acres) will have trees hit by munitions which may lead to potential mortality of trees over time, which could possibly impact breeding and roosting. We suspect the SDZ area will have a slight chance of munitions damaging trees, but we predict this effect to be insignificant. There will be no increase in noise because the use of MPMG will shut down Main Tank range, both ranges use 0.50 cal and cannot be active at the same time, due to overlap, but the area of noise impacts will be slightly increased with the new range. Impacts of range and training noise on Indiana bats have been assessed at Camp Atterbury (Whitaker and Gummer 2002; USFWS 2010), Fort Leonard Wood (USFWS 2010), and Fort Drum (USFWS 2009; USFWS 2017). Results of these findings indicate, along with the abundance and installation-wide distribution of the bats on the sites, that sound intensity and duration associated with past training events have not adversely affected Indiana bats, as they may have habituated to such stimuli. The TCB may also become habituated to noise on firing ranges.

Anthropogenic noise has been shown to alter foraging behavior and success of bats (Bunkley *et al*. 2015; Schaub *et al*. 2008; Siemers and Schaub, 2011).

Foraging

In NW South Carolina, TCBs preferentially forage in early successional habitats with sparse vegetation (Loeb and O'Keefe 2006) but can also forage in other types of forested habitats and in riparian areas (SC DNR 2020b). At Savannah River Site near Aiken, SC a female TCB foraged in bottomland hardwoods, pine stands and upland hardwoods (Carter *et al*. 1999). At Savannah River Site foraging activity was greatest around waterways, bottomland hardwood forests and grass-brush and most calls were detected around clearcuts or areas devoid of vegetation (Menzel *et al*. 2003). During installation-level bat surveys conducted on McCrady Training Center in 1995-1997 and 2020-2022 by SCDNR, TCBs were predominantly found in bottomland-hardwood and riparian areas adjacent to water. We assume that all habitat types found within the maximum construction limits for the range footprint (208 acres) and the Beaten Area (387.91 additional acres) are suitable for TCB foraging. This includes Scrub Oak, Longleaf pine plantation, Pine/Scrub Oak, Bottomland Hardwood, Upland Hardwood, Pine forest, Hickory/Longleaf pine forest and open roads and firebreaks. Construction of the range footprint, where vegetation will be permanently removed, may allow bats to continue to forage in the newly-created 'open habitat' of the footprint, therefore the effects to foraging will be minimal.

The north Beaten area (323.69 acres) is already impacted by existing ranges and new vegetation damage will be less than that in the south Beaten area (64.21 acres), but both areas will remain available for foraging even though trees may be damaged or killed. The SDZ should remain available for foraging.

Bats have a low chance of being hit by munitions and/ or vehicles servicing the range since on average, the majority of range use will occur after sunrise and before sunset so we predict this effect to be insignificant.

Bats may be deterred from areas with high light levels, as a response to greater predation risks (Sparks *et al*. 2005). By angling the light away from potential foraging and roosting areas, the area will be darker thus providing bats more protection from predators.

Conservation Measures

In discussions with USFWS, we have agreed to minimize impacts to TCBs to the best of our ability. To achieve this goal, the SCARNG proposes to implement the following conservation measures.

Construction Activities and Materials

In order to minimize the impact construction may have on TCBs during their primary active foraging times, no construction activities will occur during night hours. All construction work will be performed between 30 minutes after sunrise and 30 minutes before sunset.

The construction site will remain dark, with no lights running during non-working hours and/or during the evenings/night. This will minimize light disturbance as well as attracting insect prey items and subsequent bats to the construction site.

TCBs are opportunistic when it comes to their roosts. Culvert pipes installed as infrastructure can incidentally serve as an excellent roost. Measures that may help reduce the likelihood of the TCB using newly installed infrastructure culverts include using culvert pipe with a diameter of 2 feet or less and/or smooth walled culvert

piping, whenever possible. Consequently, the size and material will not be suitable habitat and will discourage bat entrance into the infrastructure.

For future culvert maintenance, we will follow current guidance to minimize harm to bats. With no known bat occupation, unblocking and other actions that do not disturb structural integrity or block entrances and exits can occur at any time of the year (removes threat of flooding and blowouts that would injure roosting bats) (DOD, 2023).

Forest Management

The SCARNG has agreed to modify forest management activities to minimize further impacts to the TCB. First and foremost, the window for activities such as the clearing/grubbing phase of construction is restricted to September 1-December 14 and February 14-March 31. This will ensure that these activities do not interfere with hibernation and maternity seasons, two of the TCB's most sensitive seasons.

Additionally, whenever feasible and not a safety hazard, dead and dying trees will be left standing. Such standing trees provide essential roosting opportunities for TCBs during the summer, whether it be for maternity roosts with adult female bats and their pups or singular individuals.

Wetlands

Wetlands provide a significant resource to the TCB as both forage habitat and a water source. A study by an Austin Peay University graduate student found a positive correlation between stream health and bat species richness and evenness (Walker, 2022). Therefore, as part of our commitment to protect the integrity of the 1642 acres of wetland habitat on MTC, SCARNG will adhere to best management practices (BMPs) for wetlands to maintain associated habitat and water quality.

Invertebrates and Pollinators

A key aspect of supporting the TCBs is maintaining a healthy prey population through habitat management. TCBs, like all bats found in SC, are insectivorous and rely on small insects such as caddisflies, moths, beetles, wasps, flying ants, and flies for sustenance. To foster a supportive habitat for these insects, as well as all other invertebrates, the SCARNG will continue habitat management strategies such as plant propagation and pollinator plots. This ensures a robust food supply for the bats but also contribute to the overall health of the forest ecosystem by supporting diverse insect populations and benefiting other pollinator species present on MTC.

Roosts

We will conduct regular maintenance of known roosts when necessary and feasible to conserve the integrity of the roosts and their ability to provide for the bats at McCrady Training Center and Fort Jackson. (See Habitat Use Survey Standard Operating Procedure, Appendix 4, for more information.)

Monitoring

Currently, SCARNG conducts quarterly monitoring of its already established supplemental roosts for bat use.

The SCARNG will continue to conduct long-term monitoring of both supplemental and natural (if/when discovered) roosts to track and inventory bats and bat species that utilize them via Habitat Use Surveys and/or Emergence Counts (active and/or passive). Once established as additional supplemental roosts, the proposed Artificial Bunker Roost and Artificial Cave Roosts described in the following *Habitat Mitigation* section will be integrated into SCARNGs Bat Monitoring Program.

Monitoring will also include inspecting the various supplemental and/or natural roosts to identify any damage in need of repair that may prevent bats using them and/or present a safety hazard to surveyors. A Standardized Operating Procedure for Habitat Use Surveys can be found in Appendix 4.

Habitat Mitigation

Combining what we know from SCARNG bat surveys, habitat analyses of available forest and water resources available to bats on the MPMG Range, and subsequent site visits, we chose five sites for supplemental bat roosts (Figure 14). These sites were chosen based on their location in relation to the proposed area of take (MPMG Range), their proximity to surrounding key habitat resources utilized by bats (i.e., forage habitat and water resources), and their overall potential to provide for any bats displaced by the construction of the MPMG Range. TCBs will readily use man-made structures such as bat boxes and other artificial roosting options. These artificial habitats offer alternatives to the declining availability of natural roosting sites and contribute to the bats' ability to raise their young and carry out their summer activities. Additionally, they provide an opportunity to supply creative mitigation for potential losses of habitat such as those from construction.

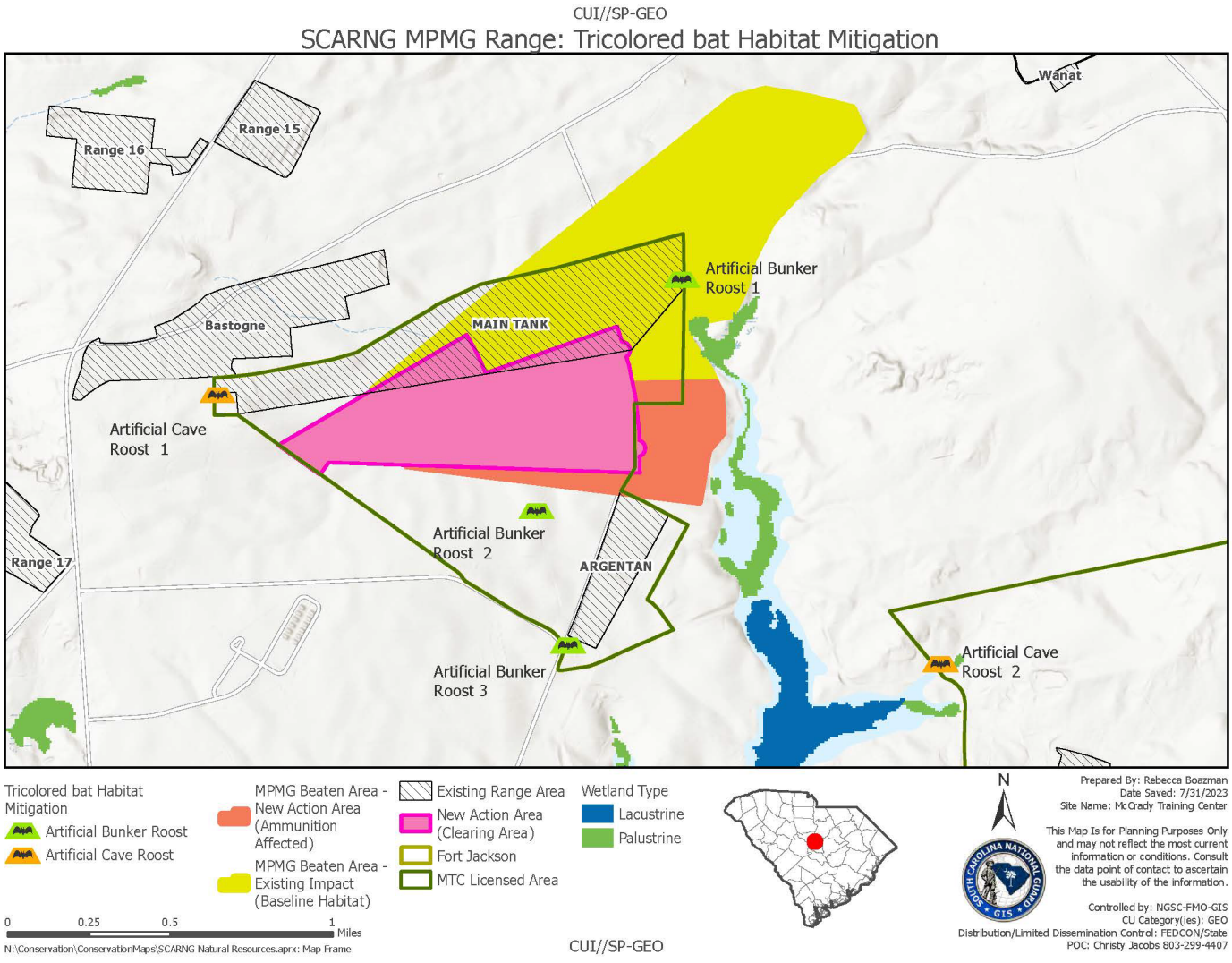


Figure 14: Map displaying the general locations of the five proposed artificial roosts for Habitat Mitigation.

At each of the roost sites, SCARNG proposes one of two types of artificial roosts: preexisting observation posts/bunkers and artificial cave/culvert roosts (Figure 14). Both structure types mimic hibernacula/winter roost habitat known to be utilized by TCBs. They are also structurally similar to six decommissioned Range Tunnels located on McCrady Training Center's cantonment area, where TCBs have been observed roosting. The Range Tunnels present an exemplary roosting opportunity for bats as they are constructed of concrete and covered by an earthen mound, resulting in a constant temperature sink, thereby providing a controlled environment.

When determining artificial roost locations, we ensured overlap between the estimated 1.5-mile and 3-mile home range areas surrounding the proposed artificial roosts and the 0.25-mile water resource area because unless sites were located within a certain distance to water, it was less likely bats would use the area (Figure 15). The 1.5-mile buffer represents the probable home range of a roosting TCB and the 3-mile buffer representing the probable maximum home range of a roosting bat. Within 1.5 miles of all 5 supplemental roosts (Figure 15) there is 3,862 acres (6.03 mi^2) of available riparian forage habitat for TCBs to use and 305.85 acres (0.47 mi^2) of water sources (i.e., streams and open water). Within 3 miles there is 12,612.35 acres (19.71 $miles^2$) of riparian area and buffer to use and 1,071.61 acres (1.67 mi^2) of water sources. Moreover, the Roost-Water Source Proximity analysis determined that all proposed artificial roosts were within a mile of a designated water source. The closest and largest source of both water and potential riparian forage to 4 of the 5 proposed supplemental roosts is Weston Lake, which may make it and its surrounding watershed drainages the primary water resource for TCBs (Figure 15).

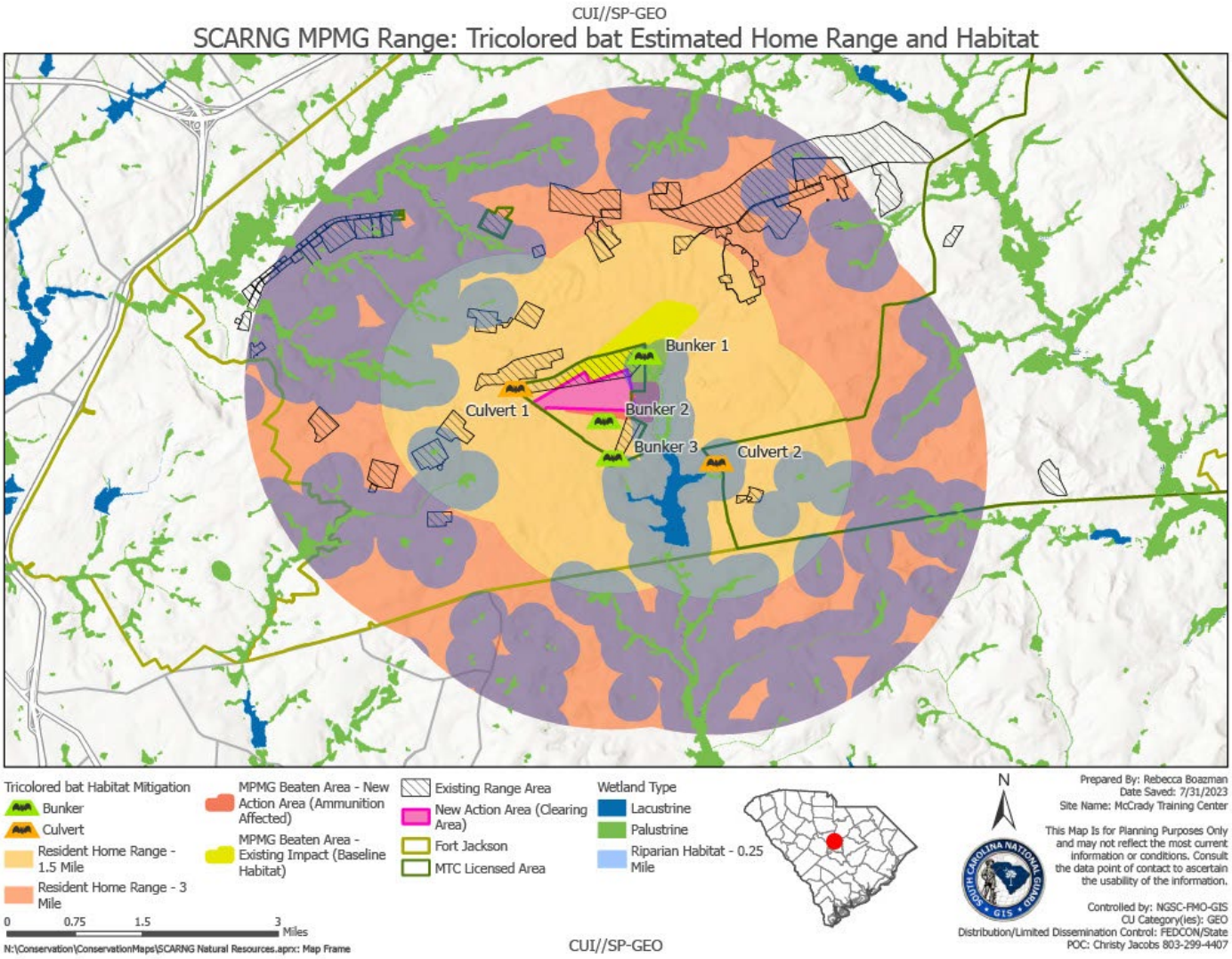


Figure 15: Map displaying the total available water resources and riparian forage habitat within an estimated 1.5 and 3-mile home range for bats residing in proposed artificial roosts.

Artificial Bunker Roosts

There are three preexisting bunkers (to be called Artificial Bunker Roosts) that present potential winter hibernacula habitat within/near the proposed MPMG Range and Beaten Area. When provided a 1.5-mile conservation buffer (USFWS, 2023) to represent the likely home range of a roosting bat, a majority of the current and proposed range area were covered (Figure 15).

Artificial Bunker Roost 1 is located in the Northeast corner of the Beaten Area (34.02941876, -80.8367341), Artificial Bunker Roost 2 is located south central of proposed MPMG just north of FB 19 off Southeastern bound TBD Road (34.01909419, -80.84454856), and Artificial Bunker Roost 3 is located just behind the Argentan Range firing line (34.01309466, -80.84286117).

The Artificial Bunker Roosts mimic the Range Tunnels as they are also earthen-covered concrete structures, but they will require some modifications to improve upon the potential of the artificial cave roost as winter hibernacula. These improvements include excluding excess light by blocking observation windows in the bunker,

installing a bat-friendly gate to prevent unauthorized entrance, and removing some ground-level vegetation around the entrance to each of the bunkers.

Artificial Cave Roost

SCARNG proposes two sites to construct/install Artificial Cave Roosts to serve as supplemental roost habitat/hibernacula. Using the design structure of Flahives' hibernaculum (Figure 16; Schofield *et al*. 2022) as a guide, these Artificial Cave Roosts are purpose-built to mimic cave-like habitat utilized by TCBs as hibernacula.

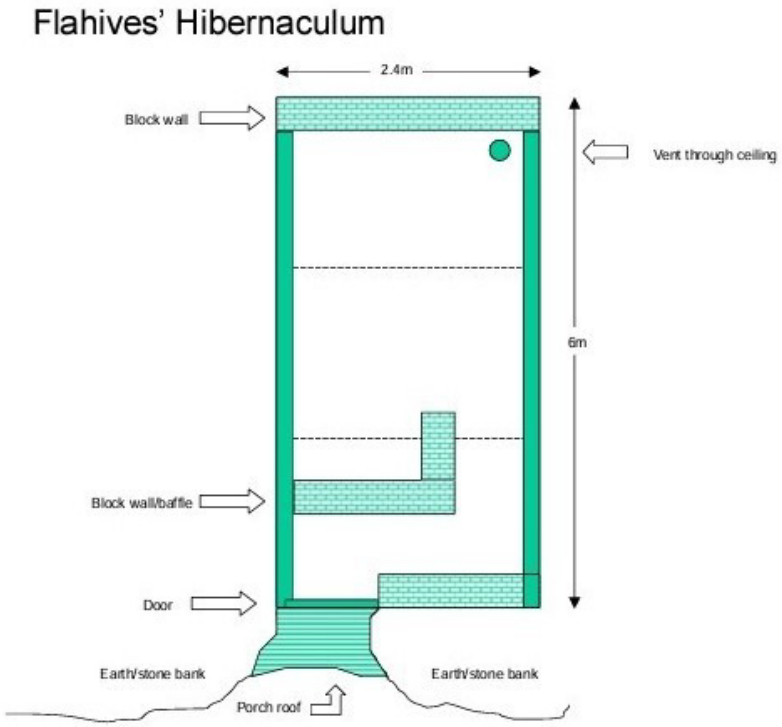


Figure 16: Structural plan for a Flahives' hibernaculum (Schofield et. al., 2022).

Artificial Cave Roost 1 will be located in the forested area behind firing points of SC ARNG licensed range area (Figure 14) and is farthest from designated water sources (0.73 mi.). Artificial Cave Roost 2 will be located in the forested area near the small wetland off FB15, on western panhandle of McCrady proper and is located the closest to a water source (< 0.10 mi.). The locations of the proposed Artificial Cave Roost sites are approximate to allow for minor location adjustment if required.

We focused on providing habitat than may be utilized more in the winter because 1) A majority of potential summer habitat (roost and/or forage) is found on McCrady proper surrounding the Colonels Creek watershed and 2) the MTC Environmental Office has a significant amount of supplemental summer roost habitat currently provided in the form of twenty-eight 3-chambered bat houses, six Rocket Roosts, and six decommissioned Range Tunnels, and five concrete Roost Towers, with future plans to install two additional Roost Towers on McCrady proper (Figure 17).

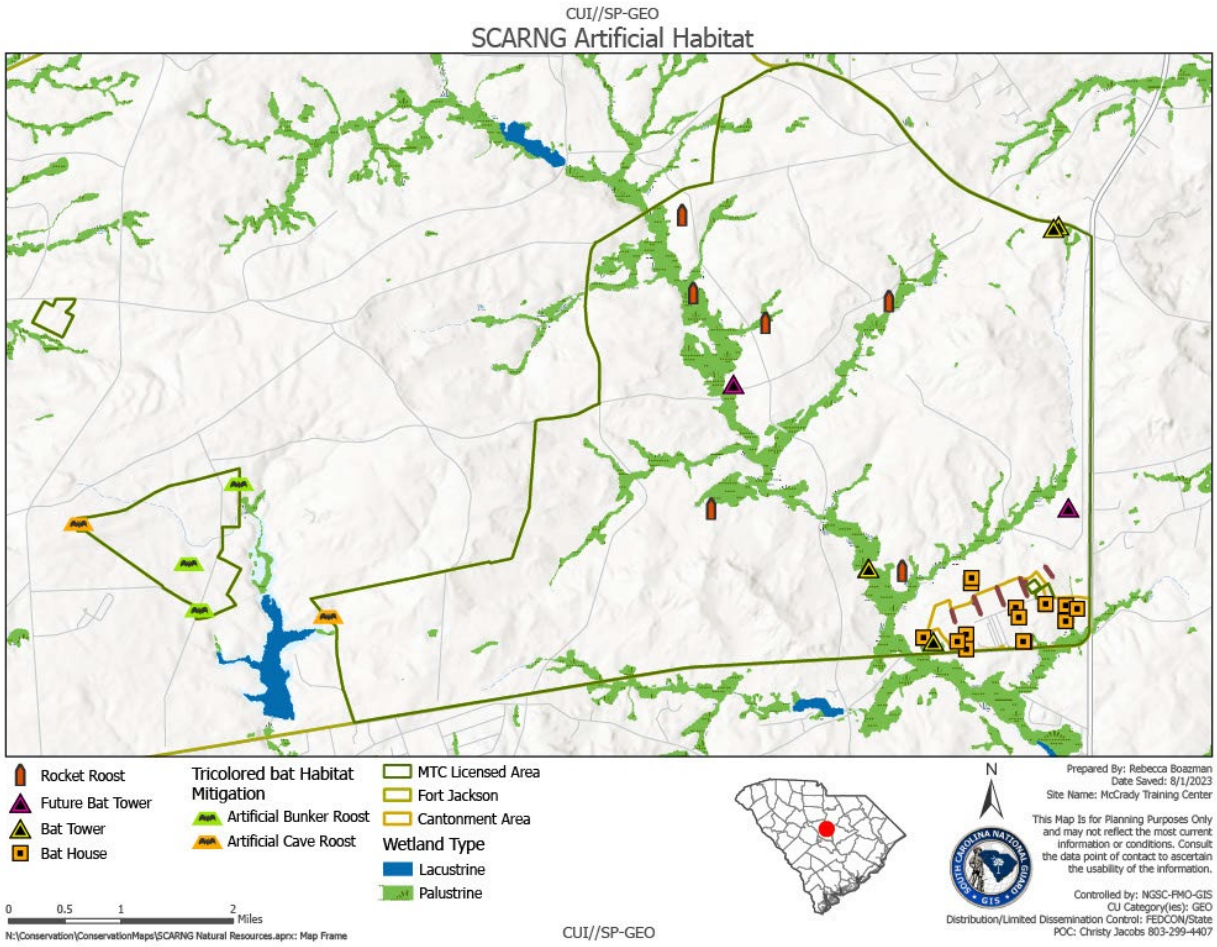


Figure 17: Map displaying all current, future, and proposed artificial roost habitats on McCrady Training Center.

Monitoring

To further contribute to knowledge of the TCB as well as other bat species, we will conduct monitoring of roosts, both supplemental and natural (if/when they are found) in the long-term. We will also conduct regular maintenance of known roosts when necessary and feasible to conserve the integrity of the roosts and their ability to provide for the bats at McCrady Training Center and Fort Jackson. (See draft Habitat Use Survey Standard Operating Procedure, Appendix 4, for more information).

Affect determination
It is anticipated that this project may affect and is likely to adversely affect this species.

'Harm' is anticipated to the habitat of the bats that will impair their behavioral patterns of breeding, feeding and sheltering, and by 'harassment' of bats by noise or munitions shaking roost trees, or if UXO explodes in their vicinity. Home range sizes for TCBs are under-studied, but at Savannah River Site one female had a home range of 978 acres (Carter *et al*. 1999). It is unknown how many bats might be affected, but 'harm' of at least 208 acres of bat breeding/roosting habitat in the range footprint and an additional 'harm' of 64.21 acres for habitat damage in the south Beaten Area is predicted.

This project may also lead to direct mortality of bats if they are roosting during the day on trees while vegetation clearing occurs, but this will be minimized by clearing vegetation during times that the bats can flush.

Purple balduina (*Balduina atropurpurea*)

The only documented location of this species on Fort Jackson is in Buffalo Creek bog, a distance of 3.7 miles from the project footprint (Bradley 2017; Nelson and Kelly, Jr. 1995) Fort Jackson has conducted multiple botanical surveys for rare and listed species and has not found any other populations (Bishop *et al*. 1996, Gaddy 2010, Gaddy 2016, McBee and Pittman 1995, Nelson 1992, Nelson and Kelly, Jr 1995). The preferred habitat for this plant includes wet pine flatwoods and savannas, seepage slopes, pitcher plant bogs and wet ditches. This type of habitat does not exist in the proposed range footprint. There are wetland habitats in the Beaten Area portion of the project, the effects to this area may include the potential injury/mortality of canopy trees. Opening the canopy in wetland areas can be beneficial to many species because it mimics occasional canopy-killing hot fires that used to burn through wetlands historically.

It is anticipated that there would be no effect on this species as a result of the proposed range construction and operation.

Ciliate-leaf tickseed (*Coreopsis integrifolia*)

The floristic surveys performed on Fort Jackson have failed to document the presence of this species (Bishop *et al*. 1996, Gaddy 2010, Gaddy 2016, McBee and Pittman 1995, Nelson 1992, Nelson and Kelly, Jr 1995). The preferred habitat for this plant includes streambanks and floodplains of blackwater streams. This type of habitat does not exist in the proposed range footprint. There are wetland habitats in the Beaten Area portion of the project, the effects to this area may include potential injury/mortality of canopy trees. Opening the canopy in wetland areas can be beneficial to many species because it mimics occasional canopy-killing hot fires that used to burn through wetlands historically.

It is anticipated that there would be no effect on this species as a result of the proposed range construction and operation.

Smooth coneflower (*Echinacea laevigata*)

The Smooth coneflower was downlisted to threatened effective 5 August 2022 (FR Doc. 2022–14291 Filed 7–5–22). Two populations of Smooth coneflower exist on Fort Jackson. Fort Jackson has conducted multiple botanical surveys for rare and listed species and has not found any other populations (Bishop *et al*. 1996, Gaddy 2010, Gaddy 2016, McBee and Pittman 1995, Nelson 1992, Nelson and Kelly, Jr 1995). The known populations are over six miles east of the proposed project. The two populations are found in mixed pine-hardwood habitats with loamy sand soil types that include Pelion, Vaucluse, and Ailey. These habitat and soil types exist in the project range footprint and the Beaten area and were surveyed from UXO-cleared roads during December 2022. No evidence of smooth coneflower was detected; therefore, there will be no effect on this species as a result of the proposed range construction and operation.

Bog spicebush (*Lindera subcoriacea*)

The Bog spicebush is an At-Risk species, not currently listed as either Threatened or Endangered under the Endangered Species Act. A specimen of the Bog Spicebush was discovered in the East Impact Area (EIA) in 1987 by Robert McCartney with the University of South Carolina (USC). It's location places it approximately 0.75 miles NNW of South Boundary of EIA Road from where it crosses Weston Lake. The coordinates recorded by USC are 34.026 decimal degrees by -80.8359 decimal degrees (Figure 18). Fort Jackson has conducted multiple botanical surveys for rare and listed species and has not found any other populations (Bishop *et al*. 1996, Gaddy 2010, Gaddy 2016, McBee and Pittman 1995, Nelson 1992, Nelson and Kelly, Jr 1995).

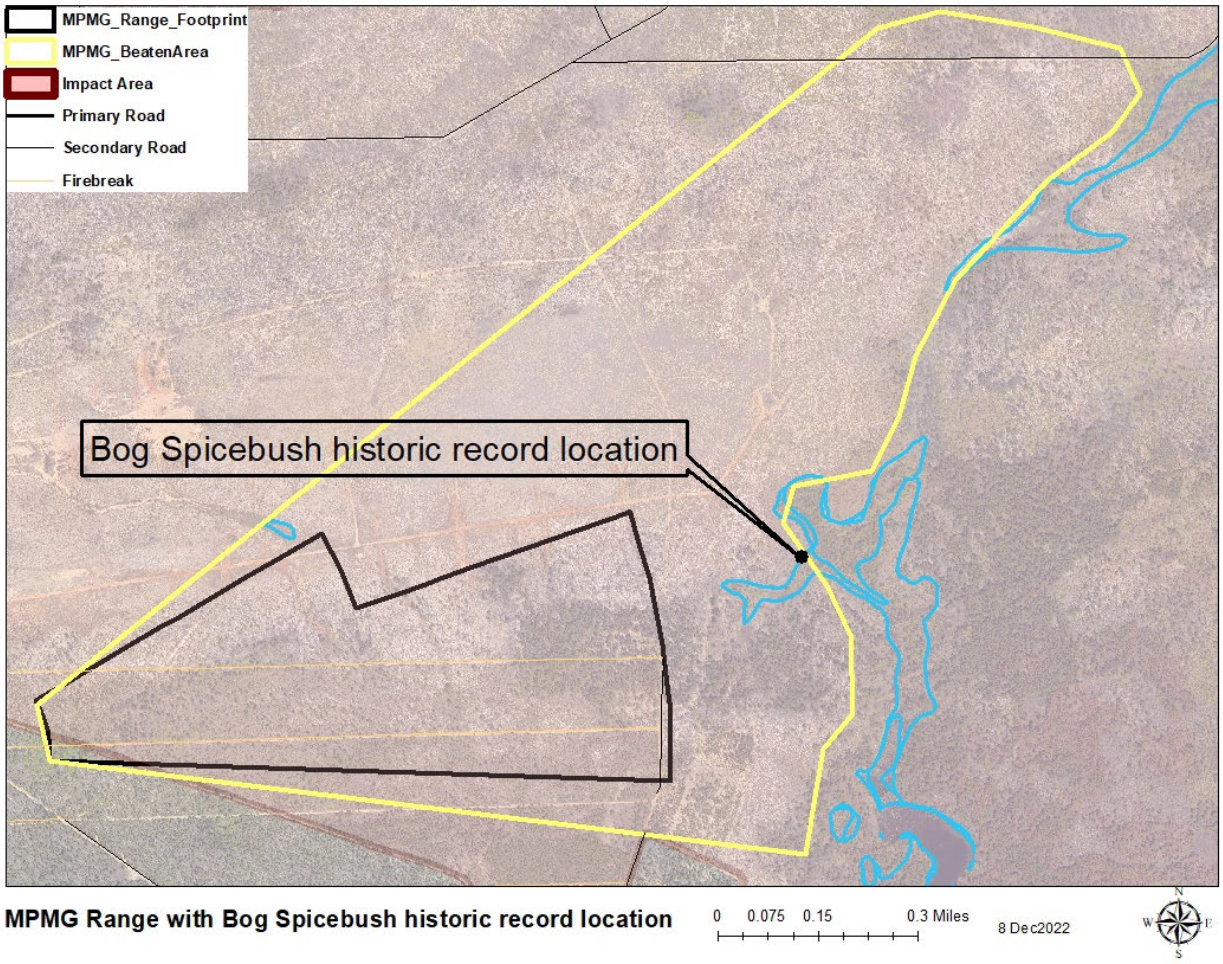


Figure 18: Bog Spicebush historic record location within the MPMG Beaten Area.

The Bog Spicebush preferred habitat includes shrubby, seepage wetlands with peaty mucky soils and continuous water source, such as hillside bogs, streamside thickets, streamheads, and pocosins; usually with sphagnum moss. The beaten area for the new range is predicted to extend to the location where the bog spicebush was found (Figure 18), but the location will be out of the line-of-sight from the firing points on this new range (Figure 19). This location is also in SDZs covered by other, existing ranges. The effects to the Beaten area may include the potential injury/mortality of canopy trees. Opening the canopy in wetland areas can be beneficial to many species because it mimics occasional canopy-killing hot fires that used to burn through wetlands historically. Even if trees die around the Bog Spicebush historic location, it will be beneficial to the Bog Spicebush as a means of opening the canopy. If any fires are caused by the range, that would also be beneficial to the Bog Spicebush, which needs frequent fire to maintain an open canopy (Appendix 3, folder 5). If the plant itself is damaged by fire, this would be a negative effect.

We conclude that this range construction and operation 'may affect but is not likely to adversely affect' Bog Spicebush, an At-Risk Species.

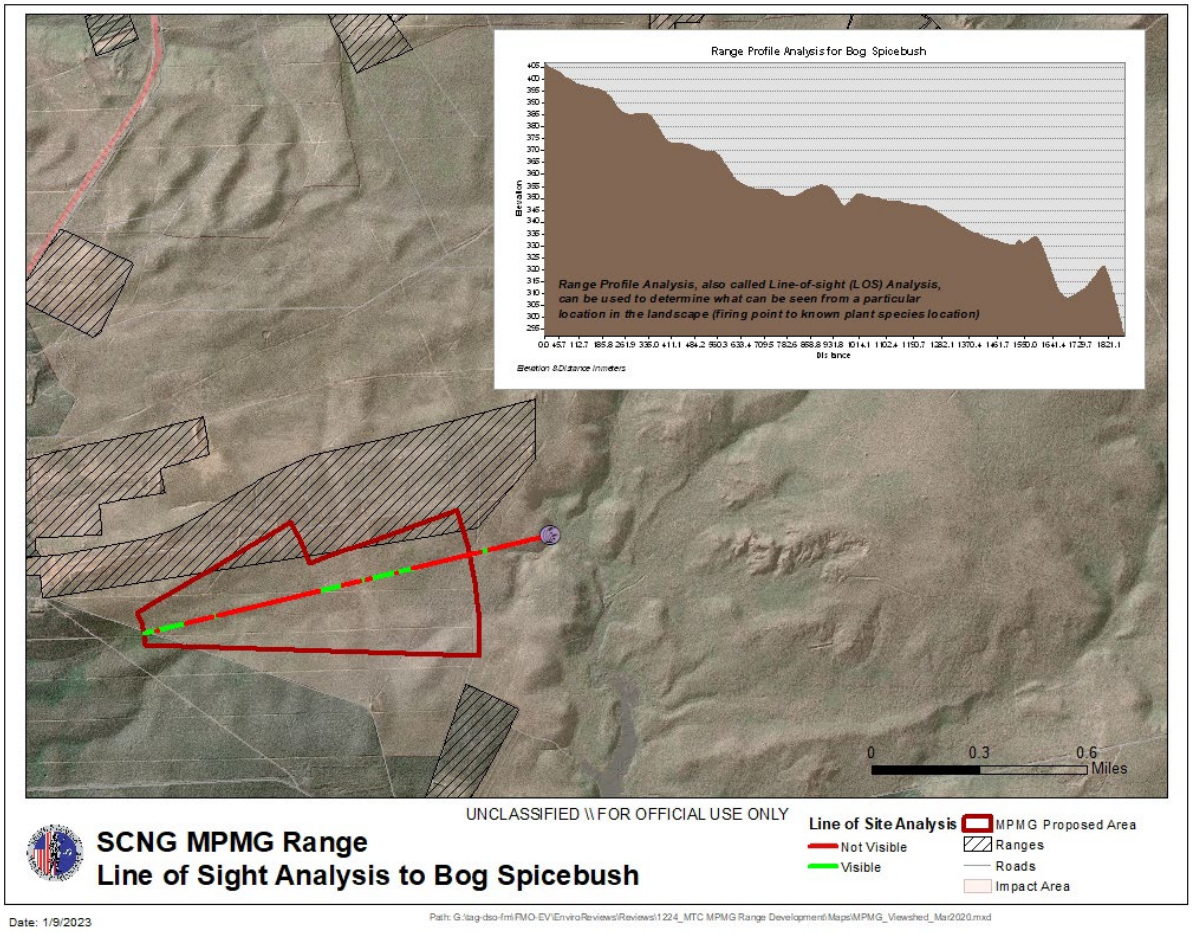


Figure 19: Bog Spicebush Line of Sight Analysis showing that the location where Bog Spicebush was detected is not visible from the firing points.

Rough-leaved loosestrife (*Lysimachia asperulaefolia*)

A population of Rough-leaved loosestrife was identified on the Fort Jackson Installation in 1991 along the Northeast corner of the East Impact Area near the Buffalo Creek drainage. The population is located over 3.7 miles from the proposed project footprint. Fort Jackson has conducted multiple botanical surveys for rare and listed species and has not found any other populations (Bishop *et al*. 1996, Gaddy 2010, Gaddy 2016, McBee and Pittman 1995, Nelson 1992, Nelson and Kelly, Jr 1995).

The preferred habitat for this plant includes moist or saturated sands with shallow organic soils, such as savannas/seep bogs in the sandhills and pocosins. This habitat does not exist in the range footprint. There are wetland habitats in the Beaten Area portion of the project, but the effects to this area may include the potential injury/mortality of canopy trees. Opening the canopy in wetland areas can be beneficial to many species because it mimics occasional canopy-killing hot fires that used to burn through wetlands historically.

It is anticipated that there would be no effect on this species as a result of the proposed range construction and operation.

Carolina-birds-in-a-nest (*Macbridea caroliniana*)

The floristic surveys performed on Fort Jackson have failed to document the presence of this species (Bishop *et al*. 1996, Gaddy 2010, Gaddy 2016, McBee and Pittman 1995, Nelson 1992, Nelson and Kelly, Jr 1995). The preferred habitat for this plant includes swamp forests, savanna edges, wet pinelands and ditches. There are pinelands and ditches in the project footprint and the area was surveyed from UXO-cleared roads during December 2022. No evidence of this species was detected. Appropriate habitat can also be found in the Beaten Area portion of the project, but the effects to this area may include the potential injury/mortality of canopy trees. Opening the canopy in wetland areas can be beneficial to many species because it mimics occasional canopy-killing hot fires that used to burn through these areas historically.

It is anticipated that there would be no effect on this species as a result of the proposed range construction and operation.

Canby's dropwort (*Oxypolis canbyi*)

The floristic surveys performed on Fort Jackson have failed to document the presence of this species (Bishop *et al*. 1996, Gaddy 2010, Gaddy 2016, McBee and Pittman 1995, Nelson 1992, Nelson and Kelly, Jr 1995). Botanists have stated that suitable habitat for this species likely does not exist on Fort Jackson, as it is typically found in pond-cypress savannahs in Carolina Bay formations dominated by grasses and sedges or ditches next to bays. These habitats are not present on Fort Jackson, in the project footprint, or in the Beaten Area.

It is anticipated that there would be no effect on this species as a result of the proposed range construction and operation.

Georgia aster (Symphyotrichum georgianum)

The floristic surveys performed on Fort Jackson have failed to document the presence of this species (Bishop *et al*. 1996, Gaddy 2010, Gaddy 2016, McBee and Pittman 1995, Nelson 1992, Nelson and Kelly, Jr 1995). The preferred habitat for this plant includes edges and openings in rocky, upland oak-hickory-pine forests. This habitat type does not exist in the project area or the beaten area.

It is anticipated that there would be no effect on this species as a result of the proposed range construction and operation.

Migratory birds

Nine birds of conservation concern, in addition to the Bald Eagle (analyzed separately) are found on Fort Jackson and may be impacted by this project (USFWS 2023b). These include American Kestrel, Bachman's Sparrow, Brown-headed Nuthatch, Chimney Swift, Eastern Whip-poor-will, Lesser Yellowlegs, Prairie Warbler, Red-headed Woodpecker, and Wood Thrush. To minimize impacts to nesting migratory birds we recommend that the construction clearing be performed, if practicable, during the months of September through March. Fort Jackson has invested decades of effort to restore and maintain Sandhills Longleaf pine habitat that benefit many of these bird species. Efforts have included the use of prescribed fire, Longleaf pine restoration, forest thinning, and a Kestrel nest-box program, all of which are activities we plan to continue.

Red-cockaded woodpecker (*Picoides borealis*)

Effects of the action on Red-cockaded Woodpeckers

The 2013 Biological Opinion Issued to US Army Ft. Jackson for the implementation of the ESMC, FWS Log No. 2013-F-0207, provides for incidental take for all groups of RCW's located in the East Impact Area (EIA). This area is defined as a limited management area (LMA) which cannot be surveyed by ground due to unexploded ordnance on site. This take is granted based on munitions being fired into this area by existing live fire ranges, wildfires, and the limited ability to manage these groups. Any new ranges must be separately consulted on using the most updated data which includes a new RCW cluster that did not exist in 2013.

Fort Jackson actively manages an increasing population of red-cockaded woodpeckers (RCWs) as described in the Integrated Natural Resources Management Plan (U.S. Army 2017) as well as an Endangered Species Management Component (ESMC) which details monitoring and management actions for the RCW. The RCW Recovery Plan: Second Revision (USFWS 2003) is followed as well as current research and best management practices for this endangered species. On Fort Jackson, the RCW Habitat Management Unit (HMU), an area to be managed for current and future use by RCWs, is divided into two Habitat Management Areas (HMAs). The first is the Limited Management Area (LMA) where specific RCW management practices cannot be used due to the presence of unexploded ordnance. The second is the Standard Density Management Area (SDMA) where standard management of the RCW and its habitat is possible (Figure 20). The LMA consists of approximately 4,485 acres and includes the entire East Impact Area (EIA).

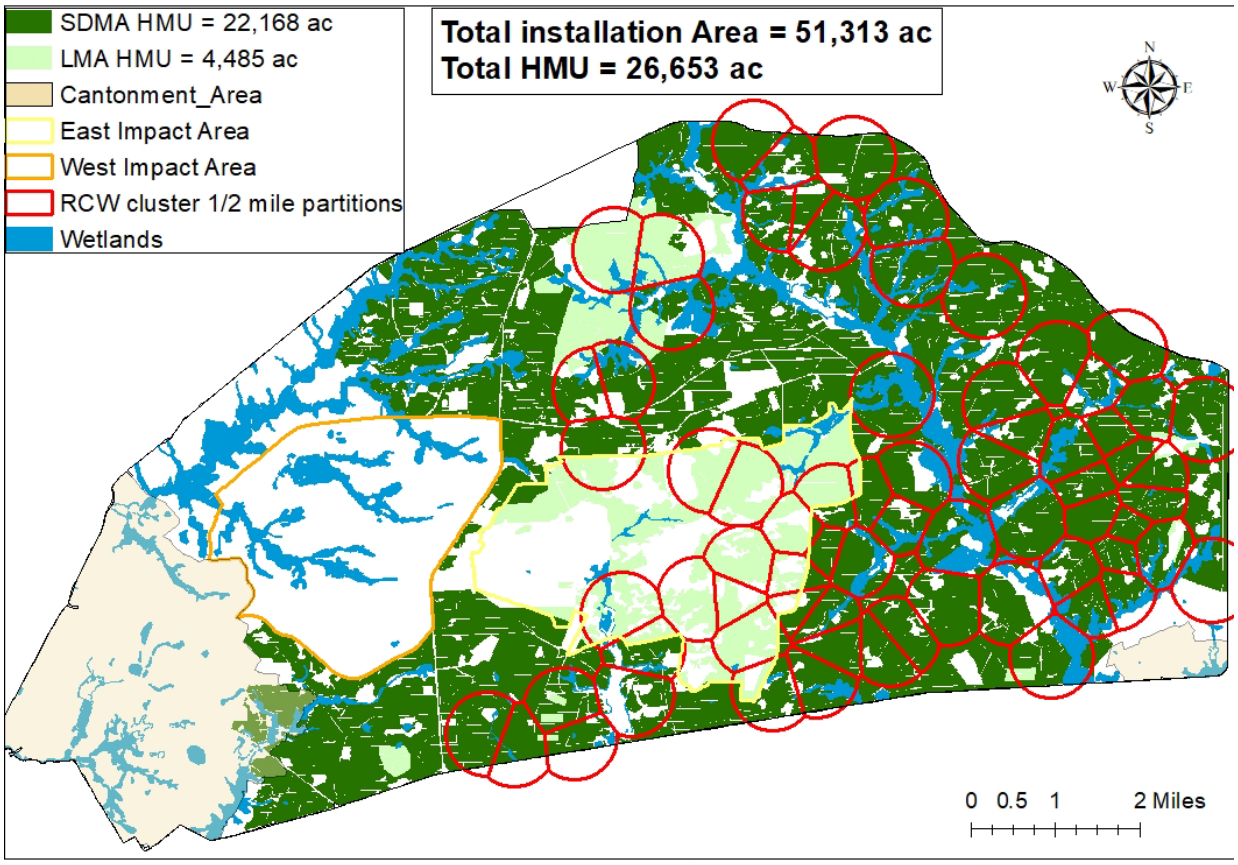


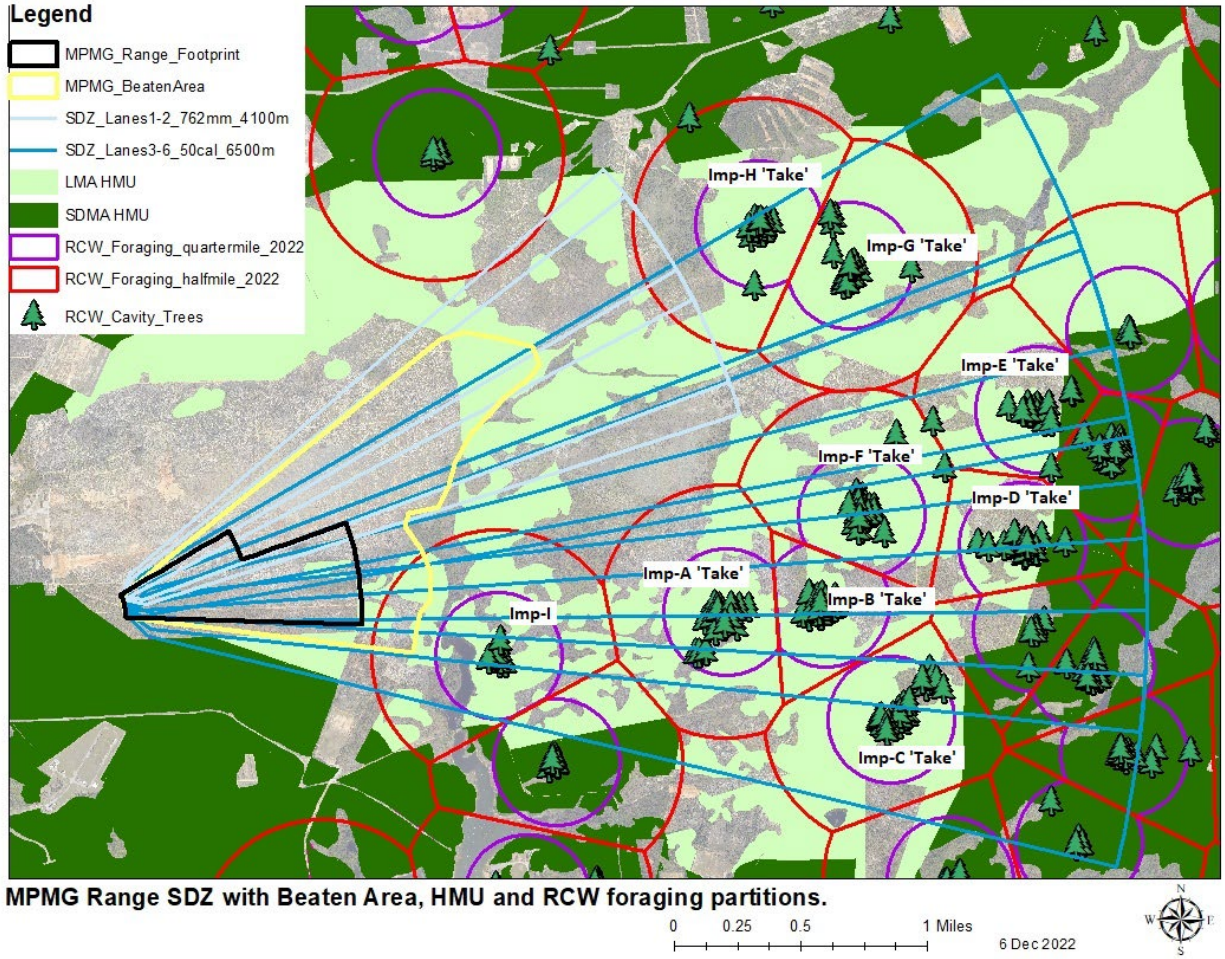
Figure 20: Fort Jackson Installation map showing current Red-cockaded Woodpecker half-mile foraging partitions, Habitat Management Unit and Impact Areas.

As a worse-case scenario, RCW foraging habitat will be lost due to both the construction, and over time the operation of this range, which could result in harm to endangered species habitat. Any RCW foraging habitat within the range footprint maximum construction limit or the beaten area is assumed to be removed from use by RCW, and the foraging habitat analysis in this BA will reflect that removal. There is a minimal chance that munitions might damage trees or strike RCWs in the SDZ as well, but we predict this damage to be insignificant.

Together the Range footprint maximum construction limit and the beaten area will remove or damage 94.8 acres of the LMA HMU of Fort Jackson (Figure 21). This HMU area is designated as LMA because it is within the East Impact Area. The East Impact Area contains unexploded ordnance (UXO) and is one of the areas of Fort Jackson where only limited RCW conservation actions can be implemented (USFWS, 2013). For example, trees cannot be harvested or planted and hardwood midstory cannot be controlled within this LMA. For this reason, the installation population goal does not depend upon these acres to support the growth of future groups of RCW. Current groups in the EIA are counted towards the installation's RCW population goal as long as they are monitored and artificial cavities can be installed and maintained. There are currently 3136.5 acres of potentially suitable habitat within the EIA LMA that support 9 clusters of RCW (Figure 21). Eight of the clusters were covered by 'take' for munitions firing into the area and limited ability to access the area in the most recent 2013 Biological Opinion (USFWS 2013, FWS Log No. 2013-F-0207), they include clusters Imp-A through Imp-H. Cluster Imp-I was found in 2016. All clusters need to be re-analyzed for the effects of this new range (email communication, Doug Morrow, 30June2023). Removing 94.8 acres will leave 3,041.7 acres to support 9 clusters. In Fort Jackson's ESMC

each cluster needs at least 200 acres of foraging habitat, which would require a minimum of 1,800 acres. Therefore, this project will leave a surplus of acreage to support existing clusters in the LMA.

The Range footprint maximum construction limit is 0.03 miles (54 meters) away from the nearest RCW half-mile foraging partition (Cluster IMP-I, Figure 21).



MPMG Range SDZ with Beaten Area, HMU and RCW foraging partitions.

Figure 21: MPMG Range SDZ, Beaten Area RCW Habitat Management Unit and clusters with ¼ and ½ mile radius foraging partitions. RCW cluster IMP-I is the red Foraging circle that the Beaten Area overlaps. RCW clusters with 'Take' next to their name were covered by an incidental take statement from 2013 (FWS Log No. 2013-F-0207).

The storm drainage culverts planned on the 35% design drawings will be 2450 feet away from any RCW trees (Appendix 3, Folder 1). Storm culvert locations for the project will only take place within the maximum construction footprint of the range. We are assuming a worst-case scenario that all trees will be removed from the MPMG Range Footprint already, so no additional tree removal for culvert creation will be required.

RCW Surveys for MPMG Project

Surveys are used to determine whether the nesting and/or foraging habitat of a RCW group will be adversely impacted by the proposed project prior to any land-disturbing activities in suitable habitat. The guidance provided in Section 8.I. and Appendix 4 of the RCW Recovery Plan is followed for project surveys on Fort Jackson; this includes a survey of the affected area for unknown cavity trees. The "affected area" includes the range

footprint, the Beaten Area, and a 1/2-mile buffer around the beaten area (Figure 22). All pinelands falling within that buffer **outside** of the impact area were surveyed on 1 December 2022 with ground-based surveys for RCW cavity and start trees. No cavity trees were observed.

Ground-based surveys that consist of walking transects through the forest cannot be safely performed within the East Impact Area, due to the presence of UXO. As a substitute, roads that were cleared of UXO were driven on 28 and 29 December 2022 and forests were scanned for cavity trees from the road (Figure 22). No RCW cavity trees were detected.

RCW-trained biologists conducted early morning aural surveys on two separate mornings (1 and 2 December 2022) at each of 4 accessible areas (1-4) along the East Impact Area boundary south of the proposed range location to listen for RCWs that might be roosting nearby (Figure 22). No RCWs were detected. Survey points 5-10 were surveyed twice each at dawn between 19 Dec 2022 and 6 January 2023 and no RCWs were detected.

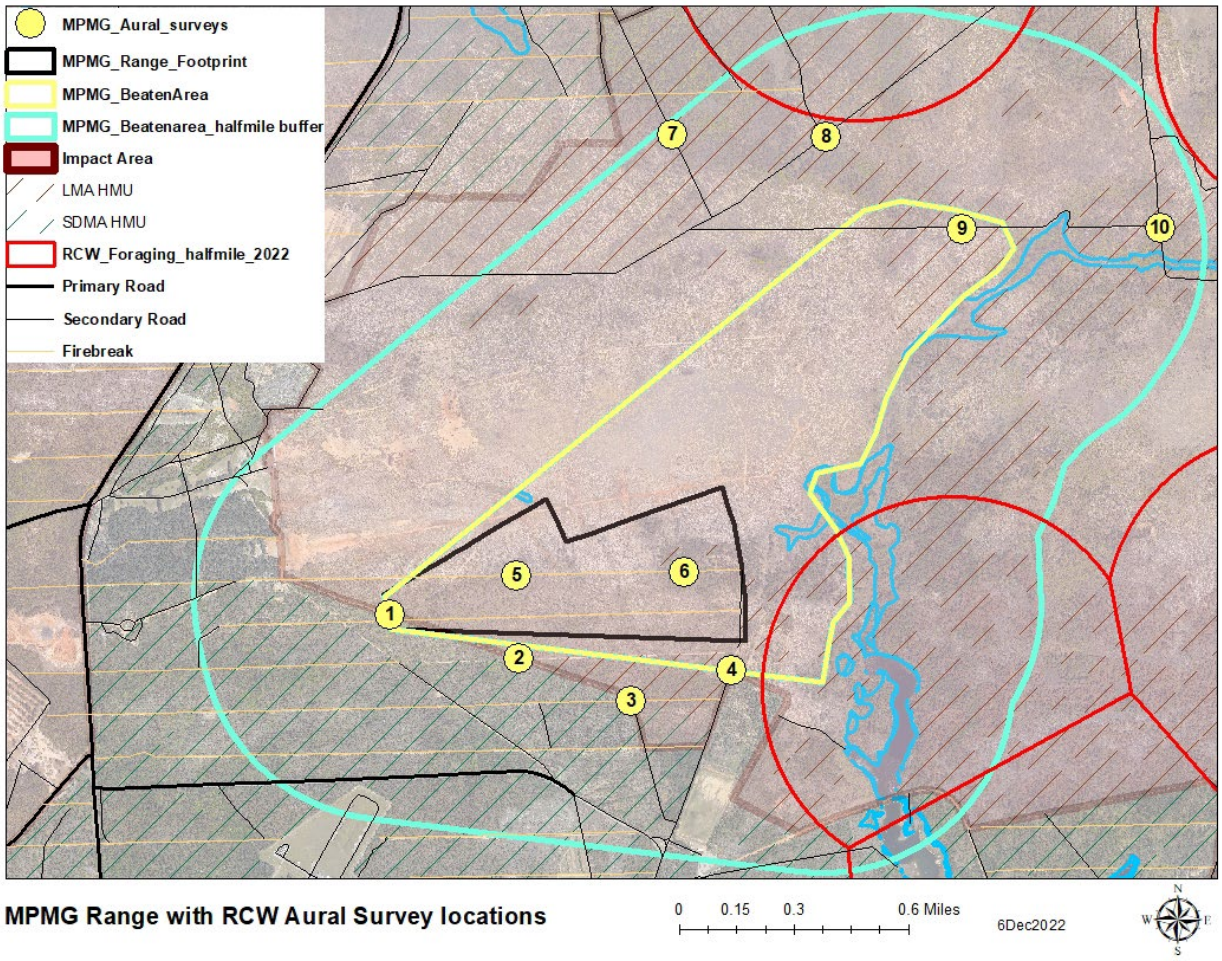


Figure 22: MPMG with RCW aural survey locations where surveys were performed in December 2022 and January 2023.

RCW Fort Jackson current population status

Monitoring 100% of our population documented 69 active clusters that contained 65 potential breeding groups in 2023. Fort Jackson has an average density of one active RCW cluster per 386.3 potentially suitable acres. The

location and operations of this MPMG Range will affect the ½ mile foraging partition of one active red-cockaded woodpecker (RCW) cluster. This cluster is designated IMP-I.

Cluster IMP-I was first located in 2017, it has been active and successfully fledged chicks every year since. It successfully fledged 4 chicks in 2023, 2 chicks in 2022, 2 chicks in 2021, 3 chicks in 2020, 2 chicks in 2019, 3 chicks in 2018, and 2 chicks in 2017. Two helpers were present during 2023, 2022 and 2021, one helper was present during 2020 and 2019, and no helper was present in 2018 or 2017. There are six active RCW partitions within 1.25 miles of cluster Imp-I. The breeding male is 6 years old and has been the breeder in this cluster since 2019. The breeding female is 3 years old and has been the breeder since 2021.

A May 2005 memorandum entitled "Implementation Procedures for Use of Foraging Habitat Guidelines and Analysis of Project Impacts under the Red-cockaded Woodpecker (RCW) Recovery Plan: Second Revision (USFWS, 2005)" describes what should be considered when federal entities analyze projects that may affect RCWs. There are potentially 5 levels of analysis to consider in the preparation of biological assessments, with the analyses conducted in the following order: 1) foraging partition, 2) group, 3) neighborhood, 4) population, and 5) recovery unit. Not all levels are necessary, and the analysis stops at the level at which no more effects are found.

RCW Foraging Partition Level Analysis

Of the 94.8 acres of potentially suitable LMA to be removed, only 17.35 acres are within the half-mile radius partition of a known RCW cluster (IMP-I). The RCW Implementation Procedures Memo (USFWS 2005) requires that a foraging analysis be performed using the Foraging Matrix analysis tool for this active RCW cluster that will be impacted by this project (Appendix 2). Cluster IMP-I lies in the East Impact Area and is not accessible for surveying or performing a ground-based forest inventory. Therefore, surrogate forest stand data was used to estimate the effect of the project on cluster IMP-I. On federally owned properties, like Fort Jackson, our goal is to aim for the highest 'Recovery Standard' (RS) (RCW Recovery Plan, USFWS 2003), to provide sufficient good quality foraging habitat for each existing RCW cluster and continue to increase the number of clusters on the landscape (U.S. Army 2017). Although, when reviewing small projects for their impacts on RCWs, the benchmark used is 'Managed Stability Standard' (MSS) (USFWS 2005). This standard is to preserve at least 75 acres of foraging habitat within the ¼ mile partition of each cluster post-project (Criteria 1). A second criterion is that this ¼ mile should provide at least 3,000 square feet of pine basal area of trees ≥10'' DBH, over 30 years old, and not separated by more than 200 feet from other foraging stands.

IMP-I meets the MSS both pre- and post-project (Appendix 2, Table 2). It does not affect habitat within the quarter-mile radius of the cluster. This project will preserve 86.25 acres both before and after the project within ¼-mile radius of the cluster center (Criteria 1 above). Imp-I provides 4,672.36 square feet of pine basal area of trees ≥10'' DBH, over 30 years old, and not separated by more than 200 feet from other foraging stands within ¼ mile of the cluster both before and after the project (Criteria 2 above). Therefore, this project will have 'no effect' on the ability of Imp-I to meet MSS. The beaten area only affects 14.9 ac of potential good quality foraging habitat (PGQFH, USFWS 2003) and 5.84 ac of non-habitat, which sums to 20.74 ac of habitat removal (Appendix 2 page 2, Table 2). Out of 20.74 ac of potential habitat lost as a result of this project, only 17.35 acres was considered LMA HMU and would be removed from Fort Jackson's LMA HMU management in the future (Figure 20).

Table 2: Effects of MPMG on RCW Cluster Imp-I

RCW Cluster Imp-I		Pre-project	Post-project	Amount lost
¼-mile partition	Acres	86.25	86.25	0
	Pine BA ≥10" DBH	4,672.36 ft^2	4,672.36 ft^2	0
½-mile partition	Acres of PGQFH*	210.34	195.44	14.9
	Acres of non-habitat	17.86	12.02	5.84

*PGQFH - Potential good quality foraging habitat (USFWS 2003)

IMP-I does not meet the RS pre- or post-project (Appendix 2), mainly due to a lack of forest stands meeting all the requirements of 'Good Quality Foraging Habitat'. Most of the deficiencies are due to a lack of large-diameter pines and a surplus of small-diameter pines. Fort Jackson will continue to manage the impact area with fire but cannot manage with timber harvest where UXO is present. The ability to meet RS is not required as part of this project analysis.

Nesting habitat will not be affected by this project, the RCW trees for Cluster Imp-I are outside of the area of affect and will not be visible from the firing points according to modeling (Figure 23). Birds may be disturbed, injured or killed by weapons firing if they are foraging in the 'Beaten Area', but we predict the probability to be insignificant.

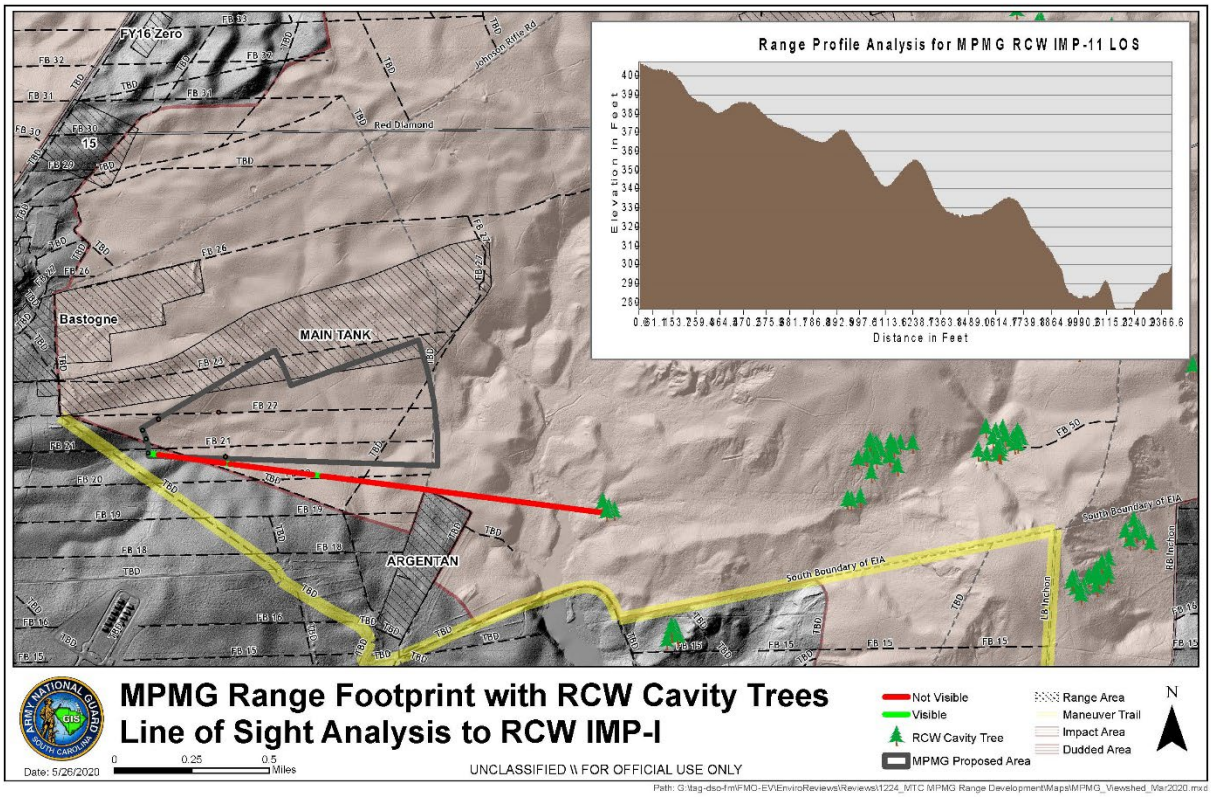


Figure 23: Red-cockaded Woodpecker trees in Cluster Imp-I and their visibility from firing points on MPMG Range as estimated from Line-of-Sight modeling.

RCW Analysis Conclusion

Based on the information provided in this Foraging Partition Level analysis, higher level assessments are not needed (USFWS, 2005).

Cluster IMP-I may lose a portion of its foraging habitat but will continue to meet MSS and is expected to persist after range construction and operation. There may be additional harassment or harm to foraging RCWs and to their habitat from munitions being fired into the Range Footprint, Beaten Area and the SDZ, but we predict these effects to be insignificant, therefore this project 'may affect and is not likely to adversely affect' the RCW.

As long as all current access permissions from Ft Jackson Range Operations remain in place, we will continue to have limited access to all RCW clusters in the EIA. If any cavity trees are found to be damaged by munitions it will be reported to USFWS.

Conclusions

Based on the information provided in this BA, we have concluded that the proposed construction and operation of the MPMG range at Fort Jackson 'may affect and is likely to adversely affect' the TCB (Proposed endangered species). The range 'may affect but is not likely to adversely affect' the Monarch (Candidate but not a listed species), the RCW (Endangered species) and the Bald Eagle (covered under BGEPA). The project will have 'no effect' on other threatened/endangered animal or plant species listed in Richland County, South Carolina. If at any time additional information is discovered that would require a modification of this assessment, Section 7 consultation would be reinitiated.

We are predicting to 'harm' of at least 208 acres of TCB potential habitat in the range footprint and an additional 'harm' of 64.21 acres for habitat damage in the south Beaten Area (Figure 9).

The concurrence of the USFWS with the findings of this Biological Assessment is requested.

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Appendix 1

Appendix I: Listed Species in Richland County

This appendix consists of supplemental information for all species discussed in this document, providing species' federal and state listing status (if applicable), habitat, and primary threats to species' population.

Species are first categorized as animal or plant, then organized by taxa (i.e., Amphibian, Bird, Crustacean, etc.) in alphabetical order. Species within each taxa are again listed in alphabetical order by Genus.

Amphibians

Chamberlain's dwarf salamander (*Eurycea chamberlaini*)

Federal Status: At-Risk

State Status (if applicable):

Habitat:
Wet areas, particularly seepages near small streams and other wetland types. Most typically found under sphagnum moss or leaf and/or pine straw litter and small debris.

Threats:

- Habitat loss and alteration (i.e. forestry practices that alter the canopy structure of their habitat)

Birds

Bald Eagle (*Haliaeetus leucocephalus*)

Federal Status: Protected under the Bald and Golden Eagle Protection Act (1940)

State Status (if applicable): Threatened

Habitat:
Coastlines, rivers, large lakes or streams which provide adequate feeding grounds; typically nest in SC between late October and late May; tend to return year after year to the same nest tree, once they have successfully established a nest.

Threats:

- Human activities that can cause them to abandon nest, or to not properly incubate eggs, or care for young

American wood stork (*Mycteria americana*)
Federal Status: Threatened

State Status (if applicable): Endangered

Habitat:
Storks are birds of freshwater and estuarine wetlands, primarily nesting in cypress or mangrove swamps. They feed in freshwater marshes, narrow tidal creeks, or flooded tidal pools. Particularly attractive feeding sites are depressions in marshes or swamps where fish become concentrated during periods of falling water levels.

Threats:
- Habitat loss
- Disruption of water flow in habitat

Red-Cockaded Woodpecker (*Picoides borealis*)

Federal Status: Endangered

State Status (if applicable): Endangered

Habitat:
Nest in mature pine with low understory vegetation (<4.9ft); forage in pine and pine hardwood stands > 30 years of age, preferably > 10" dbh

Threats:
- Reduction of older age pine stands
- Encroachment of hardwood midstory in older age pine stands
- Fire suppression

Crustaceans

Broad River spiny crayfish (*Cambarus spicatus*)

Federal Status: At-risk

State Status (if applicable):

Habitat:
Streams that belong to the Broad River Basin that also exhibit signs of flash flooding, including sand deposits and logjams. Usually found in or beneath debris.

- Threats: Habitat degradation and/or loss
- Inadequate data/knowledge of species, its abundance, and population health

Fishes

Shortnose Sturgeon (*Acipenser brevirostrum***)**

Federal Status: Endangered

State Status (if applicable): Endangered

Habitat:
Occurs in most major river systems along the eastern seaboard.

Threats:
- Habitat alterations from discharges
- Dredging or disposal of material into rivers
- Development activities involving estuarine/riverine mudflats and marshes
- Commercial exploitation up until the 1950s

Robust redhorse *(Moxostoma robustrum)*

Federal Status: At-Risk

State Status (if applicable):

Habitat:
Inhabits southeastern Piedmont Plateau and upper Coastal Plain sections of large South Atlantic slope rivers. Piedmont reaches are characterized by rock shoals, outcrops, and pools, particularly along the Fall Line. The upper Coastal Plain reaches typically have sandy banks and beds interspersed with a few shoals and occasional gravel bars. The upper Coastal Plain reaches also have extensive networks of swamps, oxbows, and floodplains. Woody debris and fallen trees seem to provide preferred habitat for adult robust redhorse in the Oconee River, and clean gravel bars are necessary for spawning and development of larval fish.

Threats:
- Habitat loss
- Disruption of spawning migrations from dams and impoundments
- Predation and competition by introduced nonnative species
- Significant deterioration of water quality due to sedimentation and pollution
- Limited range of known populations and low rates of recruitment to the adult population represent challenges to the species' future.

Insects

Monarch butterfly (*Danaus plexipus*)

Federal Status: Candidate

State Status (if applicable):

Habitat:

In the spring and summer, the monarch butterfly's habitat is open fields and meadows with milkweed. In winter, it can be found on the coast of southern California and at high altitudes in central Mexico.

Threats:

- Loss of breeding habitat
- Degradation of overwintering habitat

Mammals

Little brown bat (*Myotis lucifugus*)

Federal Status: At-Risk

State Status (if applicable):

Habitat:
Little brown bats are habitat generalists, using most cover types available to them in a variety of ecosystems. Much of their foraging activity is associated with aquatic habitats so lakes and streams seem to play a significant factor in habitat use. However, not much is known about specific habitat use and home range in South Carolina.

Threats:

- White-nose Syndrome (WNS) caused by the fungus, *Pseudogymnoascus destructans*
- Pesticide applications
- Loss of roost site habitat from deforestation
- Control measures in nursery colonies
- Collection of bats for experimentation
- And disturbance of individuals during hiberation

Tricolored bat (*Perimyotis subflavus*)

Federal Status: Proposed Endangered

State Status (if applicable): Threatened

Habitat:
They are not often found in buildings or in deep woods, seeming to prefer edge habitats near areas of mixed agricultural use. Hibernation sites are found deep within caves, mines or culverts in areas of relatively warm, stable temperatures.

Threats:

- White-nose Syndrome (WNS) caused by the fungus, *Pseudogymnoascus destructans*
- Habitat loss

Plants

Purple honeycomb head/ Purple balduina (*Balduina atropurpurea*)

Federal Status: At-Risk

State Status (if applicable):

Habitat:
Wet pine flatwoods and savannas, seepage slopes, pitcherplant bogs, and wet ditches; often occurs with yellow honeycomb-head.

Threats:

- Ditching, draining, and filling in wetlands.
- Fire suppression and plowing firebreaks through habitats.
- Conversion of habitat to pine plantations and developments.

Ciliate-leaf tickseed (*Coreopsis integrifolia*)

Federal Status: At-Risk

State Status (if applicable):

Habitat:
Low floodplain woodlands, stream banks and floodplains of blackwater streams, edges of swamp forests bordering longleaf pinelands or bordering brackish marshes, moist sandy banks and low flat floodplains of rivers and creeks, limestone streambanks, mesic woodlands, next to/near boat ramps and campground parking

Threats:

- Damaging of streams and clearcutting bottomlands
- Right of way maintenance (mowing and herbicide application)
- Vehicle parking and trampling
- Siltation and pollution of streams

Smooth Coneflower (*Echinacea laevigata*)

Federal Status: Threatened

State Status (if applicable):

Habitat:
Prairie remnants, open woods, cedar barrens, roadsides, clearcuts, dry limestone bluffs, and power line rights-of-way, usually on magnesium and calcium rich soils.

Threats:

- Fire suppression
- Exotic weeds

Bog spicebush (*Lindera subcoriacea*)

Federal Status: At-Risk

State Status (if applicable):

Habitat:
Shrubby, seepage wetlands with peaty-mucky soils and continuous water source, such as hillside bogs, streamside thickets, streamheads, and pocosins; usually with sphagnum moss.

Threats:

- Clearing, draining, and filling wetlands.
- Fire suppression in surrounding uplands and fire exclusion from wetlands.
- Sedimentation in wetlands from road-building and upland development.
- Fragmentation of habitat can destroy all the male plants or all the female plants in an area, leaving the remaining plants unable to sexually reproduce.

Rough-Leaved Loosestrife (*Lysimachia asperulaefolia)*

Federal Status: Endangered

State Status (if applicable):

Habitat:
In the sandhills of the Carolinas in ecotones or edges between longleaf pine uplands and pond pine pocosins, on moist to seasonally saturated sands and on shallow organic soils overlaying sand

Threats:

- Fire suppression
- Drainage
- Siltation from erosion
- Residential and industrial development.

Carolina-birds-in-a-nest (*Macbridea caroliniana*)

Federal Status: At-Risk

State Status (if applicable):

Habitat:
Saturated and intermittently-flooded swamp forests of blackwater stream floodplains, seepage forests associated with large brown or red water floodplains, sandhill hillside seepage bogs, planted pine stands on organic blackwater floodplain soils, and disturbed sites such as roadsides, power and gas line rights-of-way, etc.

Threats:

- Habitat loss
- Indiscriminant use of herbicides
- Competition from non-native/invasive flora and fauna species

Canby's Dropwort (*Oxypolis canbyi)*

Federal Status: Endangered

State Status (if applicable):

Habitat:
Found in pond-cypress savannahs in Carolina Bay formations dominated by grasses and sedges or ditches next to bays; prefer borders and shallows of cypress-pond pine ponds and sloughs

Threats:

- loss or alteration of wetland habitats

Georgia Aster *(Symphyotrichum georgianum)*

Federal Status: At-Risk

State Status (if applicable):

Habitat:
Woodlands or piedmont prairies dominated by native plants, with acidic soils that vary from sand to heavy clay.

Threats:

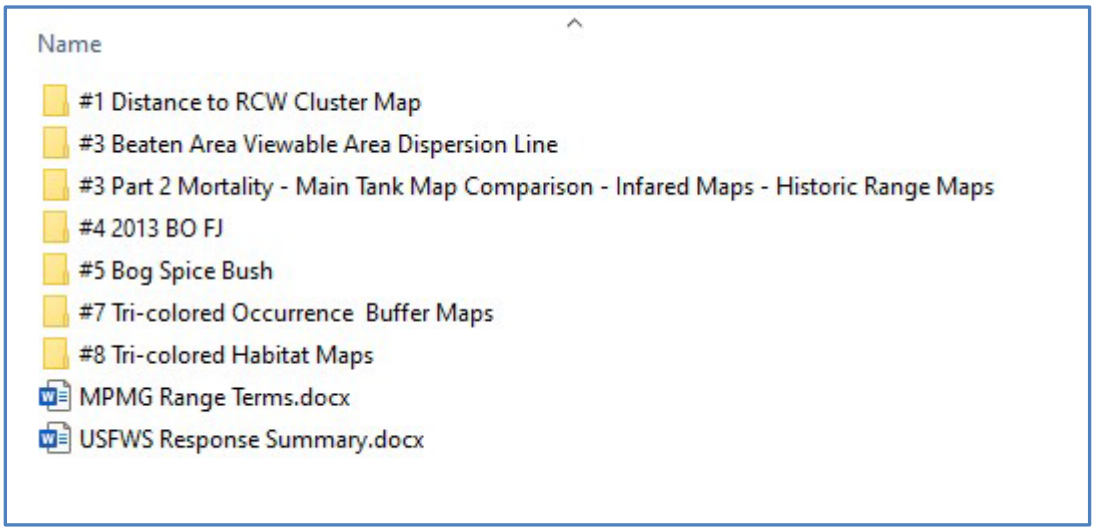
- loss or alteration of habitat from human development

Appendix 2

RCW Matrix Tool Foraging Habitat Analysis results entitled 'MPMG Appendix 2_Cluster_Imp-I_15Nov22a.pdf'

Appendix 3

Files provided to USFWS on 22 June 2023 in response to request for additional information.



Appendix 4

Standard Operation Procedure: Artificial Bat Roost/Habitat Use Surveys

Objective: This standard operating procedure outlines the steps to conduct surveys and monitor known bat roosts/habitats to assess their use by bat species on SCARNG properties. The goal is to gather data on bat activity and identify the presence of bat species utilizing the provided roosts or habitat structures.

Known Roosts:

- Range Tunnels
- Concrete Roost Towers
- 3-Chamber Bat Houses
- Rocket Roosts
- Bomb-proof Observation Posts/Bunkers (once established)
- Culverts (once established)

Survey Methods

- Active/In-person Surveys: Consist of actively visiting/ surveying habitats in person to asses bats present and the habitat themselves.
- Passive Surveys: Consists of deploying passive recording technology such as cameras and/or temperature/humidity sensors to monitor usage patterns and conditions of the habitats to provide constant monitoring over an extended period of time.

Materials and Equipment:

- **Active/In-Person Surveys:**
  - Data recording forms or electronic data collection devices
  - Digital camera
  - Map, GPS or navigation tools (optional)
  - Copy of Survey SOP (if needed)
  - Headlamps/Flashlights
  - WNS Protocol-adherent gear (i.e., Tyvek suits, disposable garbage bags, etc.)
  - Disinfectant (i.e., Clorox wipes, bleach spray, etc.)
- **Passive Surveys:**
  - Map, GPS or navigation tools (optional)
  - Data recording forms or electronic data collection devices
  - Trail cameras and/or spy cameras with infrared or no-glow technology (to avoid disturbing nocturnal wildlife)
  - Temperature/Humidity Sensors
  - Temperature/Humidity Data Loggers
  - Secure mounting devices or tree straps for camera placement
  - Extra batteries and memory cards for camera operation
  - Headlamps/Flashlights

- WNS Protocol-adherent gear (i.e., Tyvek suits, disposable garbage bags, etc.)
- Disinfectant (i.e., Clorox wipes, bleach spray, etc.)

Survey Preparation:

1. Obtain necessary permissions: Obtain the required permissions from relevant authorities (i.e., Range Ops, EOD) before conducting the surveys in sensitive areas such as the Beaten/Impact Area.
2. Check equipment:
    a. Active/In-Person Surveys: Ensure that all survey equipment and data recording devices are in working order and batteries charged before commencing the survey.
    b. Passive Surveys: Ensure that all trail and/or spy cameras and temperature/humidity sensors are in proper working condition and batteries charged before deployment.

Survey Procedure:

Active/In-Person Surveys:

1. Pre-Survey:
    a. Visit each artificial bat roost/habitat site and inspect for any damages or obstructions that might prevent bats from using them and/or make further surveys unsafe for surveyors.
    b. Record the condition of each roost and document any necessary maintenance or repairs.
    c. Set up data recording forms or electronic data collection devices to document survey results.
2. Survey Implementation:
    a. Surveys should be conducted at least biannually, if not quarterly, focusing on winter and summer seasons, to capture variations in bat activity and habitat use throughout the different seasons.
    b. **BEFORE** entering large habitats such as the Range Tunnels, Bunkers, and Culverts, put on WNS Protocol adhering gear (i.e., Tyvek suits)
        i. Smaller roosts such as the Roost Towers, Bat Houses, and Rocket Roosts do not require wearing Tyvek suits/apparel.
    c. Record the number of bats observed, species identification (if possible), and the time of occurrence, as well as the weather conditions at the time of the survey including temperature and humidity.
    d. It is important to minimize disturbance while conducting these surveys. Therefore, it is important to work quickly to gather all necessary data in a timely fashion. Remain quiet when conducting surveys in large structures such as culverts, bunkers, and tunnels to reduce noise disturbance.
3. Remember to follow White Nose Syndrome protocol when conducting habitat use surveys. This includes but is not limited to:
    a. Wearing Tyvek suits when entering structures and removing/disposing of the suits when completing the surveys.
    b. Disinfect all survey equipment using disinfecting wipes **before and after** conducting surveys.
4. Data Analysis:
    a. Compile and analyze the survey data to identify patterns in bat activity and the usage of artificial bat roosts/habitats by different species.
    b. Note any changes in bat activity over time, such as seasonal variations or the arrival of migratory species.

Passive/Camera Surveys:

1. Put on WNS Protocol adhering gear (i.e., Tyvek suits) **BEFORE** entering habitat
2. Camera Placement:
    a. Mount trail and/or spy cameras in strategic locations where wildlife, including bats, are likely to pass by or frequent. Ideal spots may include wildlife trails, water sources, feeding areas, or roost entrances.
    b. Position the cameras at an appropriate height to capture clear images or videos of passing animals, while avoiding obstructions or excessive movement caused by vegetation.
3. Camera Settings:
    a. Adjust camera settings for optimal performance in the survey environment. Configure the cameras for infrared or no-glow mode to avoid disturbing nocturnal wildlife.
    b. Set the camera's time and date stamp to ensure accurate record-keeping of wildlife activity.
4. Survey Duration:
    a. Conduct the passive habitat use surveys for a during summer and winter seasons to capture a comprehensive picture of bat presence and activity patterns during sensitive seasons (I.e., maternity and hibernation).
5. Data Retrieval:
    a. Regularly check and retrieve data (in-person or remotely) from the trail and/or spy cameras at appropriate intervals (e.g., weekly or monthly) to monitor wildlife activity and ensure that camera memory cards have sufficient space and batteries have sufficient power for continued recording.
6. Data Storage & Analysis:
    a. Store collected images in secure, appropriately accessible and labeled file.
        i. Optional Tip: Organize files in Folders and Subfolders by Habitat Name/Surveyed> Survey Date (i.e., Folder Name: Bunker 1> Subfolder Name: 5 January 2023)
    b. Review and analyze the collected images or videos to count bat presence, other wildlife, and their behavioral patterns.
        i. It is important to note that cameras are unlikely to provide photos at a high enough quality to ID the bat species themselves. Combining this passive survey method with periodic site visits will provide opportunities to ID present bat species more accurately.
        ii. Should anything notable be observed from pictures such as an interesting species or damage to the habitat, an impromptu site visit may need to be scheduled.
    c. Record relevant data, such as date, time, temperature, humidity, and location of wildlife sightings, and any specific behaviors observed.

Survey Results and Data Storage Recommendations:

1. Document the survey findings, including species and number of individuals observed, and conditions of artificial bat roosts/habitats, and any other notable observations from each survey.
2. Provide recommendations for any required maintenance or repairs to the roosts/habitats based on the structural inspections.
3. Store data in an organized, accessible form for easy retrieval and sharing upon request.

Data Integrity and Ethics:

1. Ensure that all survey data is accurately recorded and preserved for future reference or analysis.
2. Practice ethical guidelines for bat surveying, including minimizing disturbances to bats and their habitats during the surveys.

Note: This standard operating procedure is a general guideline for conducting artificial bat roost/habitat use surveys. Specific survey methods may vary depending on regional regulations, bat species of interest, and available resources. Always consult with bat experts or relevant authorities to tailor the survey approach to the specific study area and objectives.

Remember to follow all applicable laws and regulations related to bat conservation and survey activities.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Carolina Ecological Services Field Office
176 Croghan Spur Road, Suite 200
Charleston, South Carolina 29407

August 6, 2024

Shaun R. Nelson, Chief
National Guard Bureau
111 South George Mason Drive
Arlington, VA 22204-1382

Attn: Michelle Wilcox

Re: Fort Jackson's Multi-Purpose Machine Gun Range project, Richland County, SC
FWS Project Code: 2023-0069117

Dear Shaun R. Nelson:

This letter transmits the U.S. Fish and Wildlife Service's (Service) conference opinion (CO) for the Construction and Operation of the Multipurpose Machine Gun (MPMG) Range, McCrady Training Center on Fort Jackson, in Richland County, South Carolina. The referenced action involves the construction of a standard-design MPMG live fire range with automated target systems. The Service received your email on March 11, 2024, requesting to initiate formal consultation for the Action described in the Biological Assessment. You determined that the Action *may affect, likely to adversely affect* the tricolored bat (*Perimyotis subflavus*).

Your agency also made a determination of *may affect, but is not likely to adversely affect* for the red-cockaded woodpecker (*Picoides borealis*). The Service concurs with your determination that the proposed action *may affect, but is not likely to adversely affect* the species listed above.

A Conference Opinion is equivalent to a biological opinion but addresses species that are not yet listed under the ESA and/or proposed critical habitats not yet designated. The Service may adopt a conference opinion as a biological opinion if and when the evaluated species is listed/designated, and while the action agency's discretion and involvement in the action continues. The enclosed CO answers your request for formal consultation and concludes that the Action is not likely to jeopardize the continued existence of the tricolored bat. This finding fulfills the requirements applicable to the Action for completing consultation under §7(a)(2) of the Endangered Species Act of 1973, as amended, 16 U.S.C.1531 *et seq.* (ESA). A complete administrative record of this consultation is on file in our office. Thank you for your continued interest in the conservation of threatened and endangered species. If you have any questions regarding this consultation, please contact Julia Plasynski at julia_plasynski@fws.gov.

Sincerely,

Christy Johnson-Hughes

Christy Johnson-Hughes
Project Leader
South Carolina Ecological Services

Enclosure

Conference Opinion

Construction and Operation of the Multipurpose Machine Gun Range, McCrady Training Center on Fort Jackson, South Carolina

FWS Log #: 2023-0069117

Prepared by:

U.S. Fish and Wildlife Service
South Carolina Field Office
176 Croghan Spur Road, Suite 200
Charleston, SC 29407

Christy Johnson-Hughes

Christy Johnson-Hughes, Project Leader

August 7, 2024

Date

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1. Background

1.1 Introduction

A biological opinion (BO) is the document that states the findings of the U.S. Fish and Wildlife Service (Service) required under section 7 of the Endangered Species Act of 1973, as amended (16 USC 1531 et seq.; [ESA]), as to whether a federal action is likely to:

- jeopardize the continued existence of species listed as endangered or threatened; or
- result in the destruction or adverse modification of designated critical habitat.

This is a Conference Opinion (CO). A Conference Opinion is equivalent to a biological opinion but addresses species that are not yet listed under the ESA and/or proposed critical habitats not yet designated. Therefore, the ESA prohibitions against jeopardizing species, destroying critical habitat, and taking animals do not yet apply. The Service may adopt a conference opinion as a biological opinion if and when the evaluated species is listed/designated and while the action agency's discretion and involvement in the action continue.

The federal action agency for this consultation is the United States Department of Defense (DoD), and the federal action addressed in this CO is the South Carolina Army National Guard's (SCARNG) proposed construction and operation of a Multipurpose Machine Gun (MPMG) Range at McCrady Training Center (MCT) on Fort Jackson, Richland County, South Carolina (the Action). This CO considers the effects of the Action on the tricolored bat (TCB, *Perimyotis subflavus*). The TCB does not have designated critical habitat; therefore, this CO does not address critical habitat.

Our analysis within this CO is primarily based on the information provided in the DoD's biological assessment entitled "Biological Assessment for the Proposed Construction and Operation of the Multipurpose Machine Gun Range, McCrady Training Center on Fort Jackson, SC", dated March 7, 2024 (Assessment, DoD 2024), and other sources of information cited herein. The information provided in the Assessment is incorporated by reference in this Opinion.

Additionally, the DoD determined in their March 7, 2024, Assessment (p. 37), the Action *may affect, not likely to adversely affect* (NLAA) the red-cockaded woodpecker (RCW, *Picoides borealis*). The Service concurs with this determination that the Action is NLAA the RCW.

1.2 Consultation History

This section lists key events and correspondence during the course of this consultation. A complete administrative record of this consultation is on file in the Service's South Carolina Ecological Services Field Office.

2011-11-21 – The Service received a letter from the State of South Carolina Military Department requesting information for the development of an Environmental Assessment for the proposed

construction and operation of four new small arms training ranges within the McCrady Training Center, including the Multipurpose Machine Gun range (MPMG).

2011-12-27 – The Service responded to the State of South Carolina Military Department with comments on the proposed project (FWS #2012-I-0063). The project was delayed due to lack of funds.

2020-03-30 – Informal consultation was reinitiated for the construction of the MPMG range and again the project was delayed due to funding.

2022-11-03 – The Service was notified by the South Carolina Army National Guard and Fort Jackson Army Installation that they were reinitiating for the MPMG range, and an updated species list was requested via email. The Service responded and directed them to our Information for Planning and Conservation (IPaC) to generate an updated species list for the project. The Service also recommended the inclusion of the TCB in their evaluation as a proposed species.

2023-04-24 –The Service received a written request to initiate formal consultation on TCB.

2023-05-24 – The Service provided DoD via email requesting more information was necessary to initiation formal consultation.

2023-06-27 – An in-person meeting occurred between the Service, Fort Jackson, and SCARNG staff to tour the proposed project area.

2023-07-17 – An online meeting occurred between the Service and the South Carolina Military Department discussing conservation measures and overlapping beaten areas.

2023-07-26 – An online meeting occurred between the Service, Fort Jackson, and SCARNG to discuss TCBs on Fort Jackson.

2024-03-11 – The Service received an updated Biological Assessment and a written request to initiate formal consultation.

2024-04-11 – The Service provided DoD an email confirming all information required to initiate consultation was either included with the Biological Assessment or was otherwise accessible for our consideration and reference.

2024-07-15 The Service and DoD discussed project plans, including the updated sensitive periods to avoid harm to tricolored bats.

2024-07-17 – The Service requested a two-week extension from DoD to finalize the CO.

2024-07-18 – DoD granted a two-week extension for the completion of the CO.

1.3 Analytical Framework

A CO that concludes a proposed Federal action is *not* likely to *jeopardize the continued existence* of listed species and is *not* likely to result in the *destruction or adverse modification* of critical habitat fulfills the Federal agency's responsibilities under §7(a)(2) of the ESA.

> *"Jeopardize the continued existence* means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR §402.02).
> "*Destruction or adverse modification* means a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species" (50 CFR §402.02).

The Service determines in a CO whether we expect an action to satisfy these definitions using the best available relevant data in the following analytical framework (see 50 CFR §402.02 for the regulatory definitions of *action, action area, environmental baseline, effects of the action*, and *cumulative effects*).

a. *Proposed Action*. Review the proposed Federal action and describe the environmental changes its implementation would cause, which defines the action area.
b. *Status*. Review and describe the current range-wide status of the species or critical habitat.
c. *Environmental Baseline*. Describe the condition of the species or critical habitat in the action area, without the consequences to the listed species caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early consultation, and the impacts of State or private actions which are contemporaneous with the consultation.
d. *Effects of the Action*. Predict all consequences to species or critical habitat caused by the proposed action, including the consequences of other activities caused by the proposed action, which are reasonably certain to occur. Activities caused by the proposed action would not occur but for the proposed action. Effects of the action may occur later in time and may include consequences that occur outside the action area.
e. *Cumulative Effects*. Predict all consequences to listed species or critical habitat caused by future non-Federal activities that are reasonably certain to occur within the action area.
f. *Conclusion*. Add the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, formulate the Service's opinion as to whether the action is likely to jeopardize species or adversely modify critical habitat.

2. Proposed Action

This section describes the proposed federal Action, including any measures that may avoid or minimize adverse effects to listed species and the extent of the geographic area affected by the Action. The term "action" is defined in the implementing regulations for section 7 as "all

activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies in the United States or upon the high seas" (50 CFR 402.02).

The South Carolina Army National Guard (SCARNG) holds a nonexclusive license to approximately 15,000 acres on the southeast portion of U.S. Army Garrison Fort Jackson in Richland County, South Carolina. This licensed area, the McCrady Training Center (MTC), is the primary training facility for the SCARNG. The federal action agency, DoD, proposes the construction and operation of a Multipurpose Machine Gun Range (MPMG) (the Action) at McCrady Training Center (MCT) on Fort Jackson (location). The need for the Action is due to a lack of training facilities within a 2-hour travel distance that meet qualification requirements. The proposed standard-design MPMG live fire range with automated target systems (ATS) will provide SCARNG with the ability to train and qualify soldiers on the M60 Machine Gun (MG), M240B MG, M249 Squad Automatic Weapon, MK19 40mm MG, and M24 Sniper Rifle.

There are two distinct components to the Action: construction and operation/maintenance of the range which are described in further detail in the following subsections.

2.1 Construction of the Range

The first component of the proposed Action is the construction of the 6-lane MPMG range and Range Operations and Control Area (ROCA) (Assessment p. 9). The proposed maximum construction limit for the area is 208 acres (Figure 2-1). Construction will require clear-cutting, grubbing, grading, and the construction of targets and infrastructure within an existing range impact area (East Impact Area, EIA). The maximum construction limit for the range is currently composed of the following habitat types: 101.49 acres of longleaf pine plantation, 72.88 acres of scrub oak (currently impacted by other ranges), 18.12 acres of longleaf pine forest, 6.46 acres of mixed pine/hardwood, 5.01 acres of open roads and firebreaks, and 4.04 acres of hickory-longleaf forest (Figure 2-1). The electrical right-of-way will clear an additional 2.5 acres of pine forest (Figure 2-2).

Two lanes of the range will be standard 800-meter (0.497 mile) lanes equipped with eight (8) Stationary Infantry Targets (SITs). Four lanes will be standard 1,500-meter (0.932 mile) target lanes and include SITs and Stationary Armory Targets (SATs). Construction of the SATs utilizes a treated railroad tie retaining wall on three sides and a protective earthen berm. The SITs have concrete emplacement with a geotextile/gravel drainage layer, a treated railroad tie front wall protection, and a protective earthen berm. No moving targets are proposed for the MPMG. Unexploded ordinance (UXO) clearance would take place in the maximum construction limits and would use ground penetrating radar and metal detecting to identify UXO. If live UXO are encountered it would be detonated in place, inert UXO would be moved off-site. UXO clearance is done by the Department of Army and not contracted by SCARNG. Therefore, the timing of UXO clearance is unknown at this time, but it must be done before the project implementation date.

Construction will also include all utility services, information systems, roads, walkways, storm drainage, and site improvements. All electricity will be provided from the existing Fort Jackson

primary power line on Wildcat Road, via installation of a new overhead utility line and right-of-way and will run onto the ROCA portion of the range for the support facilities and downrange to support the ATS operation (Figure 2-2). The current design will have 13 power poles and the right-of-way will be a length of 3,563 feet. The primary facilities within the ROCA include: a control tower, general instruction building, operations/storage building, ammunition breakdown building, concrete pads for contracted portable latrine facilities, bleacher enclosure, covered mess shelter, and a vehicle parking lot.

Storm drainage is expected to continue along its current drainage patterns. Existing drainage is from west to east across the entire range. To maintain existing flow patterns and prevent ponding throughout the site, several proposed road culvert locations are shown on the 30% grading plans. Based on the current design phase, culvert size has not been determined. However, SCARNG will follow all current guidance provided by the storm water permit on future culvert maintenance. The ROCA is proposed within a topographic “saddle” so additional culverts will be provided to route stormwater around the ROCA. To meet stormwater, sediment, and erosion control requirements, a stormwater basin will likely be required within the range maximum construction limits, adjacent to the ROCA. This will be confirmed and designed after the 30% design. The basin will aid in prevention of runoff in the ROCA; and excavated fill material will be used for downrange targets that need to be elevated.

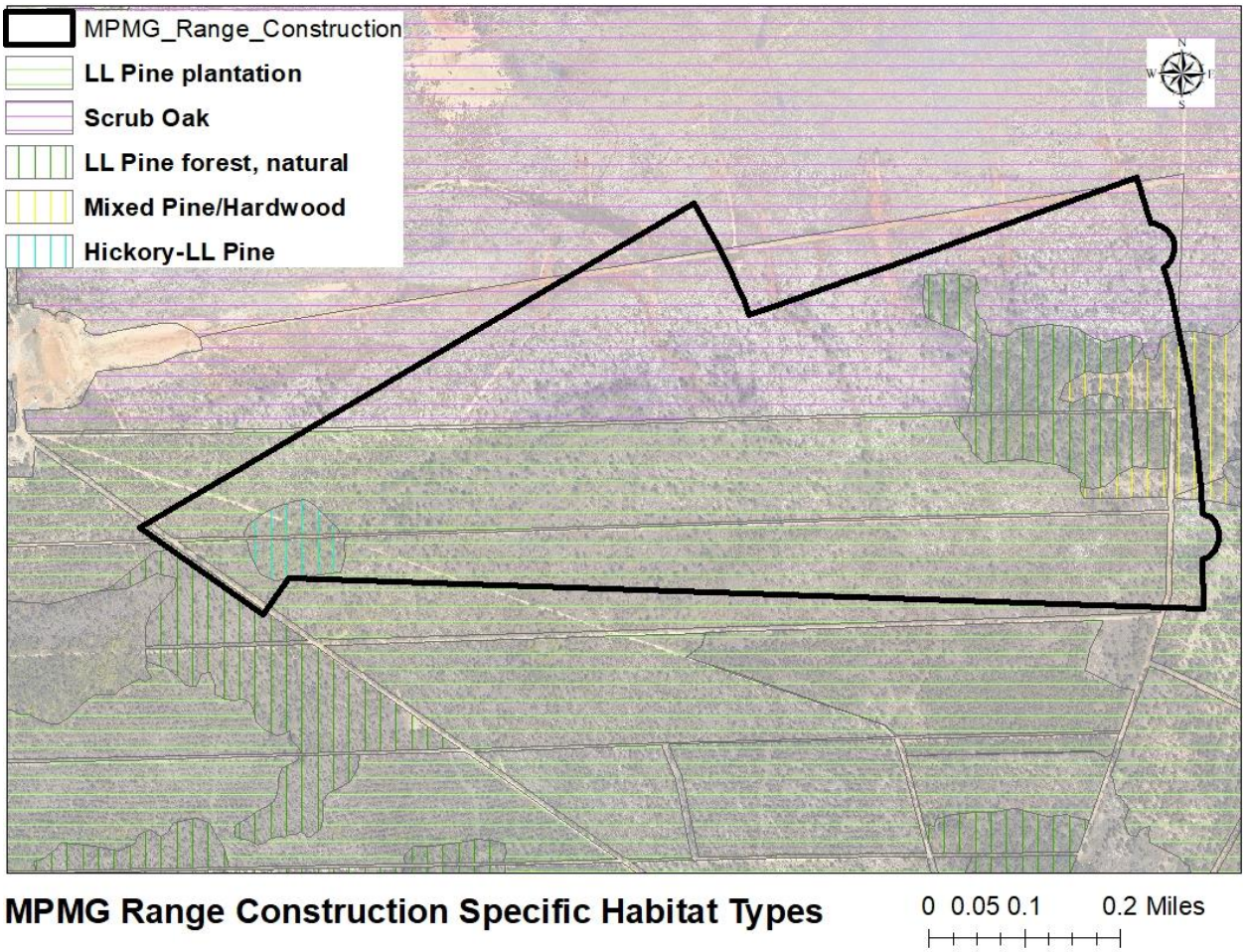

Figure 2-1. Maximum construction limit of the MPMG range with specific habitat types.

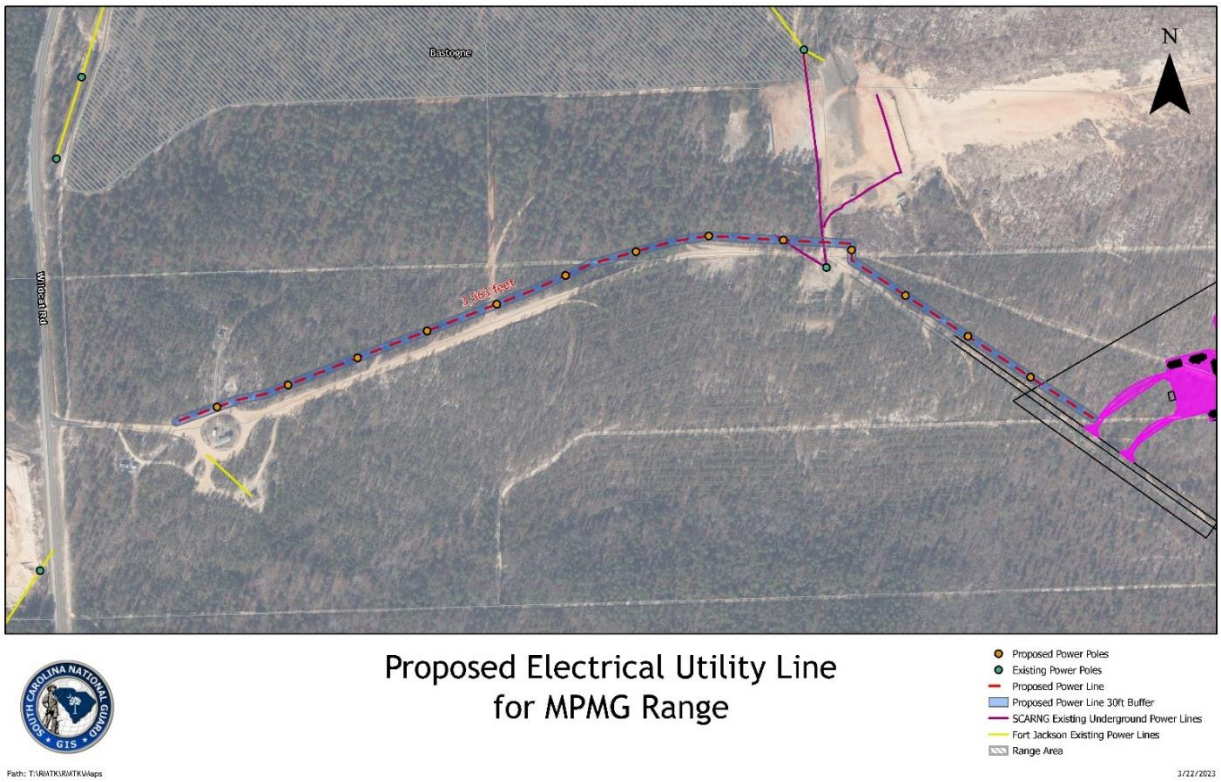

Figure 2-2. MPMG proposed electrical utility line.

2.2 Operation of the Range

The second component of the proposed Action is the operation of the MPMG range (Assessment p. 9). The operation of the range includes a 4,796-acre Surface Danger Zone (SDZ) (Figure 2-3). The SDZ falls within the EIA, the designated area that weapons are generally fired into, producing ordnance impacts or detonations. Over time, trees downrange of firing points in the SDZ may incur some degree of damage or mortality from fired munitions hitting or shearing trees, either directly or from ricochet. To quantify potential tree mortality, the beaten area was determined. The beaten area is the area where a majority of any tree damage or mortality would take place. It is predicted that 99% of munitions fired on the range will fall within the beaten area. The area outside the beaten area is expected to remain a forested habitat with negligible damage to trees and no predicted additional tree mortality. Also due to the topography of the landscape there are minimal impacts to wetlands or the headwaters of Weston Lake.

The beaten area was estimated in the following way:

1. DoD considered the range location, the type of munitions to be fired, the type of vegetation, and the surrounding terrain.
2. The current topography was then compared to historical infrared imagery to determine the eastern beaten area boundary for surrounding active ranges.

3. DoD then looked at the existing beaten areas, the viewshed, light detection, and ranging hillshade images, and determined that a ridge located ~1.3 miles (2 km) from the firing line is the easternmost boundary of the current beaten area and the predicted beaten area for the MPMG range.
4. The northern and southern boundaries of the beaten area were determined using the dispersion lines of the SDZ in accordance with Department of Army Pamphlet 385-63 (DA PAM). The Beaten Zone Memo found in the Assessment further explains the methodology used to predict the beaten area (Assessment, DoD 2024, Appendix 3).

The beaten area beyond the maximum construction limits is 387.91 acres (Figure 2-4). The beaten area is divided into two parts, the northern section and the southern section. The area to the north overlaps with the existing Main Tank range represents a baseline habitat (323.69 acres) because this area is already impacted by firing from existing ranges and tree damage is present. The proposed MPMG is a new action but may not change the baseline habitat appreciably. New impacts are anticipated within the southern predicted beaten area (64.21 acres). Both the northern and southern sections of the beaten area are shown on Figure 2-4.

The beaten area acres are composed of the following habitat types: 310.24 acres of scrub oak, 21.78 acres of longleaf pine plantation, 19.91 acres of pine/scrub oak, 22.10 acres of mixed pine/hardwood, and 13.88 acres of pine forest. There is a 3-acre wetland seep in the mixed pine/hardwood habitat that straddles the north and south section of the beaten areas. This seep flows east into Cedar Creek which is outside of the beaten area. The seep is not viewable from MPMG and is not expected to receive munitions. The beaten area and the entire impact area is burned with prescribed fire every two years and multiple fires are started each year from operation of the ranges. MPMG will not significantly increase the incidence of wildfire in the impact area.

The weapons planned for this range use primarily lead-based ammunition. No high explosive munitions will be used. Noise levels (including frequency and duration) post construction are projected to be comparable to the baseline as similar or smaller weapons and ammunition will be used. The Main Tank and MPMG will not be in use at the same time. On average, the MPMG range will only be used during daylight hours.

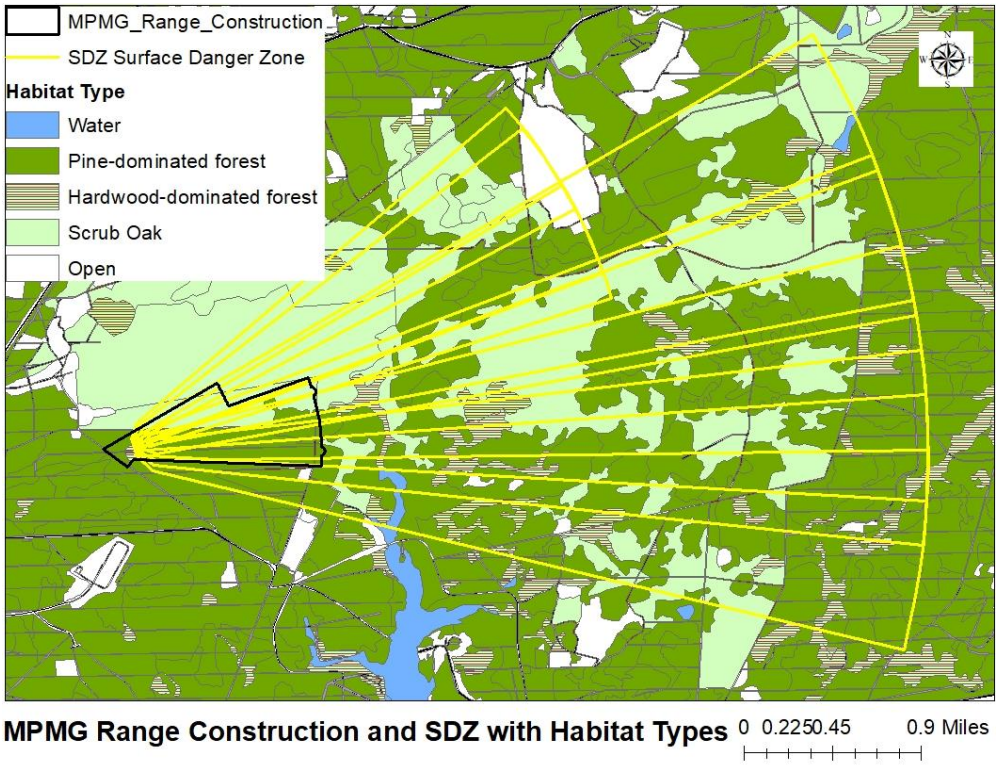

Figure 2-3. Map of the Surface Danger Zone with habitat types.

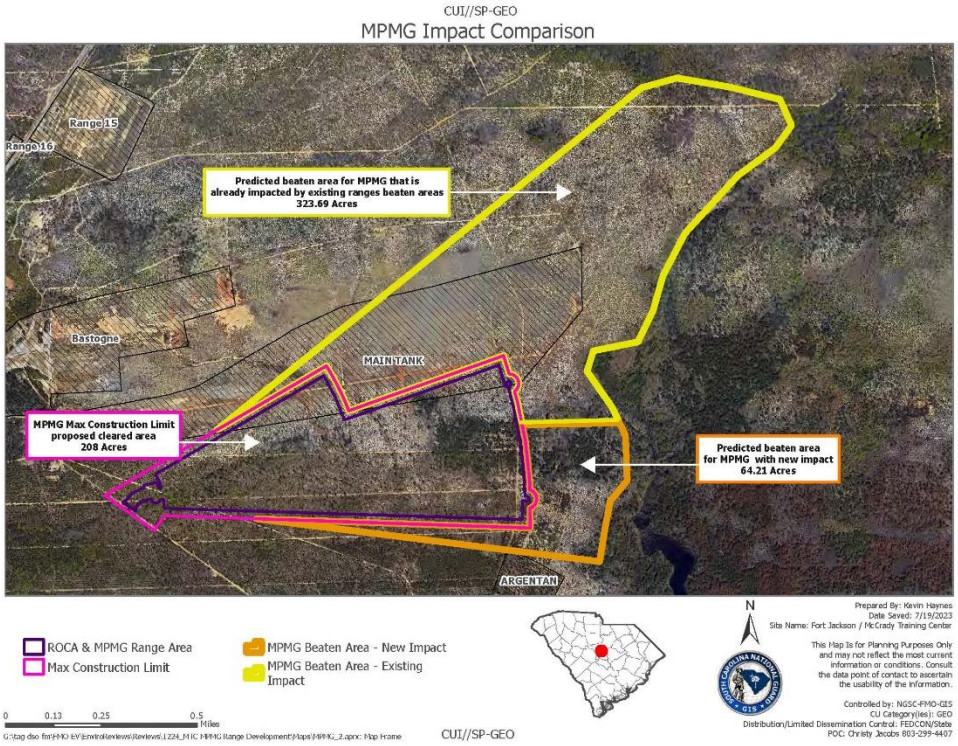

Figure 2-4. MPMG beaten area divided into the northern section and the southern section.

2.3 Action Area

The action area is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR §402.02). Delineating the action area is necessary for the Federal action agency to obtain a list of species and critical habitats that may occur in that area, which necessarily precedes any subsequent analyses of the effects of the action to particular species or critical habitats.

It is practical to treat the action area for a proposed Federal action as the spatial extent of its direct and indirect "modifications to the land, water, or air" (50 CFR §402.02). Indirect modifications include those caused by other activities that would not occur but for the action under consultation. The action area determines any overlap with critical habitat and the physical and biological features therein that we defined as essential to the species' conservation in the designation final rule. For species, the action area establishes the bounds for an analysis of individuals' exposure to action-caused changes, but the subsequent consequences of such exposure to those individuals are not necessarily limited to the action area.

Figure 2-5 shows the locations of all activities that the proposed Action would cause and the spatial extent of reasonably certain changes to land, water, or air caused by these activities, based on the descriptions and analyses of these activities in sections 2.1–2.2. The Action Area for this

CO includes the MPMG range construction limit, the transmission line, and the SDZ area, including the MPMG beatdown area, and the artillery targets, totaling 5,004 acres.

MPMG is proposed to be built within the EIA (Assessment p. 8). A 2014 assessment concluded which tested whether a substantial threat of release of munitions constituents of concern posed a risk to the environment off-range (U.S. Army Environmental Command et al. 2014). The munitions constituents of concern assessed were metals (antimony, copper, lead, tungsten, zinc, and uranium), explosives (cyclotrimethylenetrinitramine or RDX), and propellants (nitroglycerin and perchlorate). Cedar creek watershed drains out of the EIA into Weston Pond to the east and south of the proposed MPMG location (Figure 2-1). It was determined that munitions constituents of concern are unlikely to migrate off the impact area footprint via Cedar Creek at concentrations that pose an unacceptable risk to human or ecological receptors. For this reason, the Weston Lake or areas that drain south are not considered part of the action area.

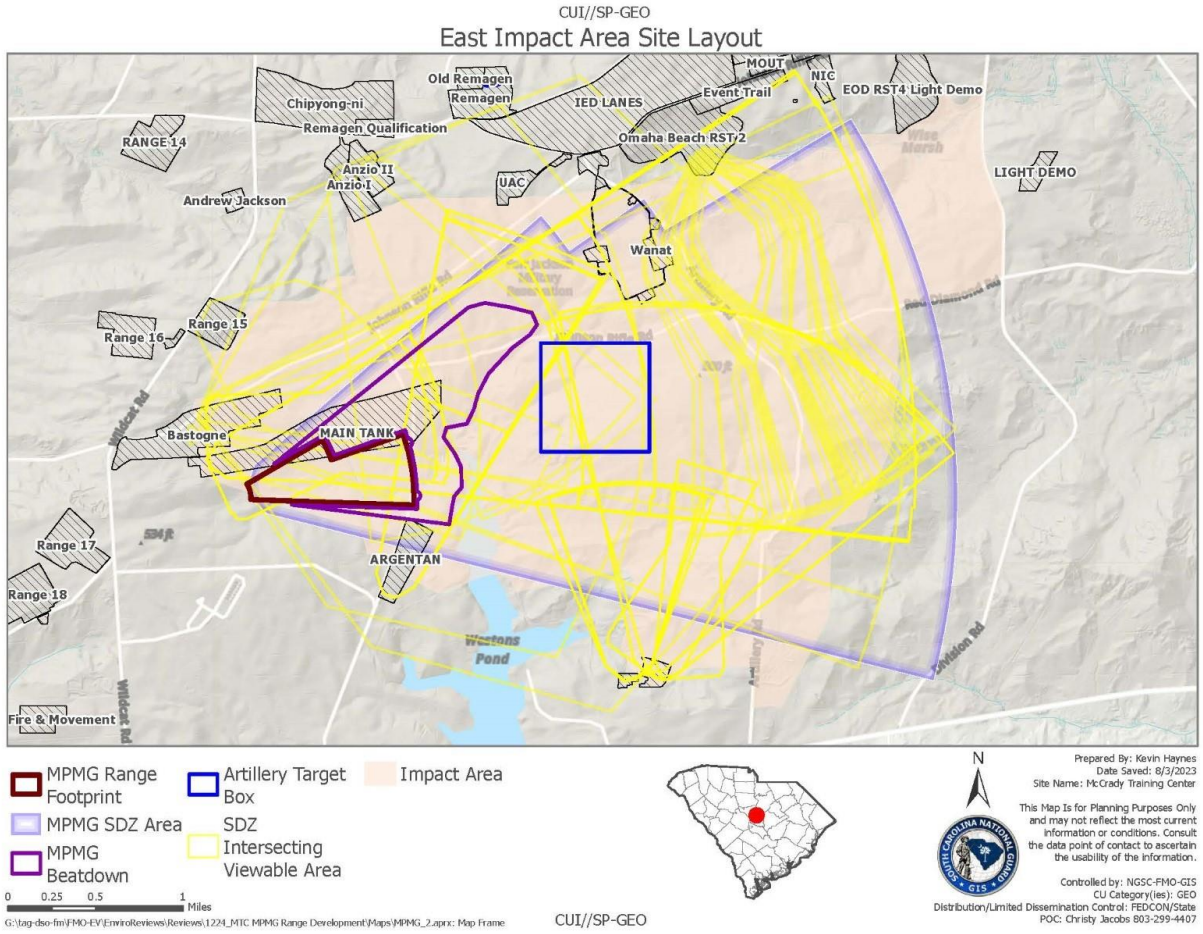

Figure 2-5. Fort Jackson East Impact Area Site Layout

2.4 Term of the Action

Once constructed, the MPMG range will be active approximately 85 to 100 days per year, based on the anticipated demands of military units with the requirement to qualify on the MPMG. Range qualification days will mostly occur on drill weekends and annual training periods with approximately three consecutive active qualification days for each event. This Opinion analyzes the entirety of the action from the construction phase through the life of the operation.

2.5 Other Activities Caused by the Action

A CO evaluates all consequences to species or critical habitat caused by the proposed Federal action, including the consequences of other activities caused by the proposed action, that are reasonably certain to occur (see definition of "effects of the action" at 50 CFR §402.02). Additional regulations at 50 CFR §402.17(a) identify factors to consider when determining whether activities caused by the proposed action (but not part of the proposed action) are reasonably certain to occur. These factors include, but are not limited to:

(1) past experiences with activities that have resulted from actions that are similar in scope, nature, and magnitude to the proposed action;
(2) existing plans for the activity; and
(3) any remaining economic, administrative, and legal requirements necessary for the activity to go forward.

In its request for consultation, DoD did not describe, and the Service is not aware of, any additional activities caused by the Action that are not included in the previous description of the proposed Action. Therefore, this CO does not address further the topic of "other activities" caused by the Action.

2.6 Proposed Conservation Measures

The Action also includes implementing minimization measures and Best Management Practices (BMPs) to minimize impacts to the TCBs. The DoD has identified BMPs designed to avoid, reduce, or minimize the degree of impact from the proposed Action to TCBs (Assessment, p. 24–27). The Service considers these measures listed in this section essential to limit impacts to TCBs and their habitats. If any of these measures are not implemented, there may be effects of the action that were not considered in this CO and reinitiation of consultation may be required.

Project impacts to TCBs within the Action Area will be minimized through the following measures:

1. No construction activities will occur during night hours. All construction work will be performed between 30 minutes after sunrise and 30 minutes before sunset.

2. The construction site will remain dark, with no lights running during non-working hours and/or during the evenings/night. By angling the light away from potential foraging and

roosting areas, the area will be darker, thus providing bats more protection from predators.

3. The size and material of culverts will not be suitable habitat and will discourage bat entrance into the infrastructure. Measures that may help reduce the likelihood of the TCB using newly installed infrastructure culverts include using culvert pipe with a diameter of 2 feet or less and/or smooth walled culvert piping, whenever possible.

4. For future culvert maintenance, DoD will follow current guidance to minimize harm to bats. With no known bat occupation, unblocking and other actions that do not disturb structural integrity or block entrances and exits can occur at any time of the year (removes threat of flooding and blowouts that would injure roosting bats) (Department of Defense 2023).

5. The clearing, grubbing, and UXO clearance phases of construction will avoid sensitive timeframes (Pup Season - May 1 – July 15 and Winter Torpor - December 15 – February 15) to not interfere with hibernation and maternity seasons, two of the TCB's most sensitive seasons.

6. Whenever feasible, dead and dying trees will be left standing. Such standing trees provide essential roosting opportunities for TCBs during the summer for maternity roosts with adult female bats and their pups or individuals.

7. SCARNG will adhere to best management practices for wetlands to maintain associated habitat and water quality to the maximum extent practicable.

8. To foster a supportive habitat for these insects, as well as all other invertebrates, the SCARNG will continue habitat management strategies such as plant propagation and pollinator plots. Pesticide usage will be limited to as-needed spot treatments to support conservation of invertebrates and pollinators.

9. SCARNG natural resources staff will conduct regular maintenance of artificial roosts when necessary and feasible to identify any damage in need of repair that may prevent bats using them and/or present a safety hazard to surveyors using the Habitat Use Survey Standard Operating Procedure, in Appendix 4 of the Assessment. The MTC Environmental Office has a significant amount of supplemental summer roost habitat currently provided in the form of twenty-eight 3-chambered bat houses, six Rocket roosts, six decommissioned range tunnels, and five concrete roost towers, with plans to install two additional roost towers on MTC.

10. The SCARNG will continue to conduct long-term monitoring of both supplemental and natural (if/when discovered) roosts to track and inventory bats and other wildlife that utilize them via Habitat Use Surveys and/or Emergence Counts (active and/or passive).

3. Tricolored Bat

This section presents information about the regulatory, biological, and ecological status of TCB at a range-wide scale that provides context for evaluating the significance of probable effects caused by the proposed action. This information provides the background for analyses in later sections of the Opinion.

3.1 Status of the Species

This section summarizes best available data about the biology and condition of the TCB throughout its range that are relevant to formulating an opinion about the Action. The Service published its proposal to list the TCB as endangered on September 14, 2022, (87 FR 56381–56393). The Service published a SSA for the TCB in December 2021 (USFWS 2021). Please refer to the SSA for more information on the TCB.

3.1.1 Species Description

TCB is one of the smallest bats in eastern North America and is distinguished by its unique tricolored fur that appears dark at the base, lighter in the middle, and dark at the tip (Barbour and Davis 1969). TCB often appear yellowish (varying from pale yellow to nearly orange), but may also appear silvery-gray, chocolate brown, or black (Barbour and Davis 1969, Hamilton and Whitaker 1979, Mumford and Whitaker 1982). Males and females are colored alike, but females are consistently heavier than males (LaVal and LaVal 1980). Newly volant young are much darker and grayer than adults (Allen 1921). Other distinguishing characteristics include 34 teeth, a calcar (i.e., spur of cartilage arising from the inner side of the ankle) with no keel, and only the anterior third of the uropatagium (i.e., the membrane that stretches between the legs) is furred (Barbour and Davis 1969, Hamilton and Whitaker 1979).

3.1.2 Life History

During the spring, summer, and fall, TCB primarily roost among live and dead leaf clusters of live or recently dead deciduous hardwood trees (Veilleux et al. 2003, Perry and Thill 2007, Thames 2020). In the southern and northern portions of the range, TCB will also roost in Spanish moss and a lichen species (Davis and Mumford 1962, Poissant 2009, Poissant et al. 2010). In addition, TCB have been observed roosting during summer among pine needles, eastern red cedar, within artificial roosts (e.g., barns, beneath porch roofs, bridges, concrete bunkers), and rarely within caves (Jones and Pagels 1968, Barbour and Davis 1969, Jones and Suttkus 1973, Humphrey et al. 1976, Hamilton and Whitaker 1979, Mumford and Whitaker 1982, Whitaker 1998, Briggler and Prather 2003, Feldhamer et al. 2003, Ferrara and Leberg 2005, Perry and Thill 2007, Damm and Geluso 2008, Thames 2020). Female TCB exhibit high site fidelity, returning year after year to the same summer roosting locations (Allen 1921, Veilleux and Veilleux 2004*a*). Female TCB form maternity colonies and switch roost trees regularly (Veilleux and Veilleux 2004*a*, Quinn and Broders 2007, Poissant et al. 2010). Males roost singly (Perry and Thill 2007, Poissant et al. 2010).

In the southern U.S., TCB behavior, habitats and habitat use differs significantly from the rest of the range. TCB can be active at any time of the year including the winter. Bats will enter a brief torpor lasting days rather than months when temperatures substantially drop (Layne 1992, Grider et al. 2016, Limon et al. 2018, Newman 2020, Stevens et al. 2020, Newman et al. 2021). Research indicates that when air temperatures are below 40°F, bats are likely in a deeper torpor that requires more time to arouse (Jordan 2020). Temperatures below 40ºF are most likely to occur between December 15th and February 15th in the year-round active portion of their range. Winter torpor generally occurs between December 15 and February 15 in South Carolina.

Southern TCB are unique in their frequent exploitation of road-associated culverts as winter roosts as well as trees. Newman (2020: Newman et al. 2021) documented TCB roosting in bridges and trees during the winter in the Upper Coastal Plain of South Carolina. The majority of the winter tree roosts were cavities of live trees and trees were used on warmer days and bridges on colder days (Newman et al. 2021). Culverts account for the majority of hibernacula documented in Mississippi, Georgia, and Louisiana (Limon et al. 2018, North American Bat Monitoring Program 2021). In road-associated culverts in the southern U.S., TCB move within and between culverts throughout the winter (Anderson et al. 2019).

Research has not been conducted in the year-round active range for TCB to identify their site fidelity, however, prior studies in the hibernating range have shown TCB exhibit high site fidelity, returning every year to the same summer roosting locations (Allen 1921, Veilleux and Veilleux 2004*b*), and switch roost trees regularly (e.g., between 1.2 days and 7 days) (Veilleux and Veilleux 2004*b*, Quinn and Broders 2007, Poissant et al. 2010), while males roost singly (Perry and Thill 2007, Poissant et al. 2010).

TCB form maternity colonies usually in trees. The number of individuals in a maternity colony varies across their range. For example, in Indiana maternity colonies consist of 1 to 8 (mean = 4.4) females and pups (Veilleux and Veilleux 2004*a*), in Arkansas colonies ranged from 3-13 (mean = 6.9) adult females and pups (Perry and Thill 2007), and the largest colony on record was reported in a Massachusetts barn (19 adult females and 37 young) (Hoying and Kunz 1998). After giving birth females will nurse their pups, which are fully dependent on their mothers as they are not yet able to fly (i.e., non-volant). It is during this late pregnancy and pupping season that TCBs are the most vulnerable. Pupping season is recognized as occurring from May 1 to July 15 in the southern part of their range. Female TCBs will use the same roost tree throughout the summer and among successive years (Veilleux and Veilleux 2004*a*). However, based on limited primary literature, they may also switch roost trees within their summer habitat throughout the maternity period both before and after young are volant (Whitaker 1998, Amelon 2006).

For TCB in the year-round range, the most sensitive timeframes occur during the pup season and winter torpor, both periods where TCB are not able to easily flush and need to reserve energy.

Table 3-1. Sensitive periods for TCB in South Carolina.

Sensitive Period	**Dates**
Pupping Season	May 1 to July 15

Winter Torpor	December 15 to February 15

3.1.3 Numbers, Reproduction, and Distribution

TCB are known from 39 States, Washington D.C., four Canadian Provinces, and Guatemala, Honduras, Belize, Nicaragua, and Mexico (Figure 3-1). The species' current distribution in New Mexico, Colorado, Wyoming, South Dakota, and Texas is the result of westward range expansion in recent decades (Geluso et al. 2005, Adams et al. 2018, Hanttula and Valdez 2021) as well as into the Great Lakes basin (Kurta et al. 2007, Slider and Kurta 2011). This expansion is largely attributed to increases in trees along rivers and increases in suitable winter roosting sites, such as abandoned mines and other human-made structures (Benedict et al. 2000, Geluso et al. 2005, Slider and Kurta 2011). The Service is updating the range map to identify Area of Influence (Figure 3-2) and can be found on the species webpage (USFWS 2024).

TCB hibernate in more caves and mines than any other cave-hibernating bat species in eastern North America (Sealander Jr and Young 1955, Barbour and Davis 1969,). TCB may use small caves and mines that are unsuitable to other cave-hibernating bat species (Barbour and Davis 1969, Hamilton and Whitaker 1979, Mumford and Whitaker 1982); however, hibernating TCB have been observed in greater numbers in hibernacula with stable temperatures (Briggler and Prather 2003). Raesly and Gates (1987) found TCB hibernating in 80% of the 50 locations surveyed in Pennsylvania. Almost every cave in Indiana has contained at least one TCB (Mumford and Whitaker 1982); and small numbers of TCB have likely occupied most of Missouri's 6,400 caves (Perry 2021).

Prior to the arrival of WNS, hibernating TCB colonies varied between one (1) and 5,300 individuals; however, 40% of hibernacula had between just one (1) and 10 individuals. The largest TCB hibernating colony (n = 5,300) was observed in Georgia in 2010 (North American Bat Monitoring Program 2021). TCB was highly abundant and widespread, with over 140,000 bats observed hibernating in 1,951 known hibernacula spread across >1 billion ac in 34 states and one (1) Canadian province. TCB numbers vary temporally and spatially, but abundance and occurrence on the landscape were generally stable (Cheng et al. 2022, Wiens et al. 2022). Although the majority of winter colony sizes were small (<100 individuals), the vast majority of individuals included in our dataset occupied a small subset of hibernacula; for example, in 2000, 32% of the known winter colonies contained 90% of total known winter abundance.

The Action Area is located within the TCB Southern RPU (Figure 3-1). Historically, of the known hibernacula, the Northern RPU contained approximately 58% of winter hibernacula and 66% of the total TCB abundance. The Southern RPU contained approximately 32% of winter hibernacula and 22% of the total abundance and the Eastern RPU was the smallest, comprising approximately 11% of winter hibernacula and 11% of the total abundance. Please refer to the SSA for more information on the numbers, reproduction, and distribution of the TCB.

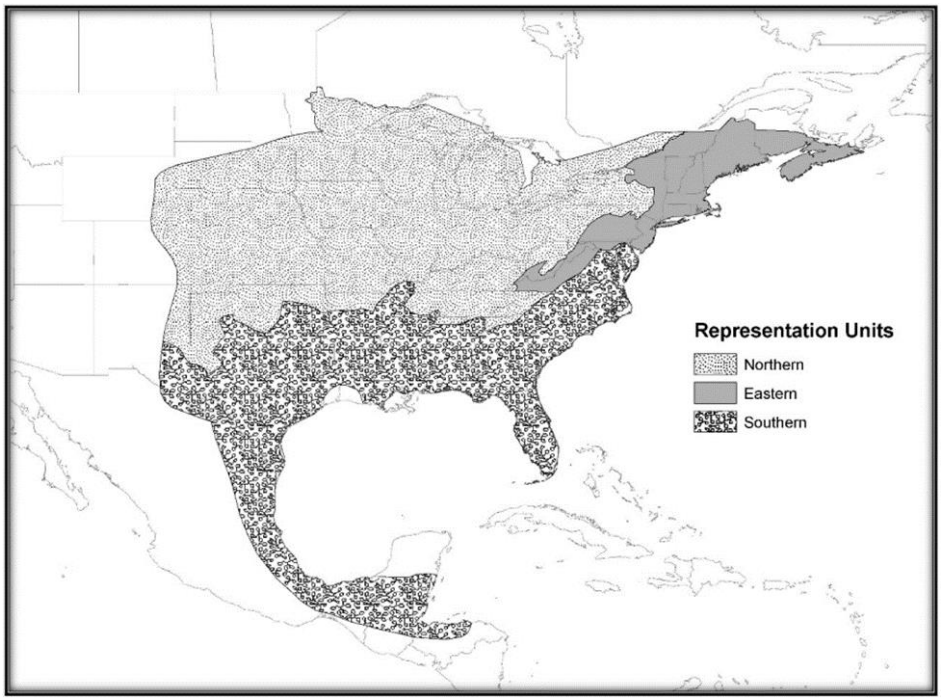

Figure 3-1. Range of TCB organized into three Representation Units (USFWS 2021).

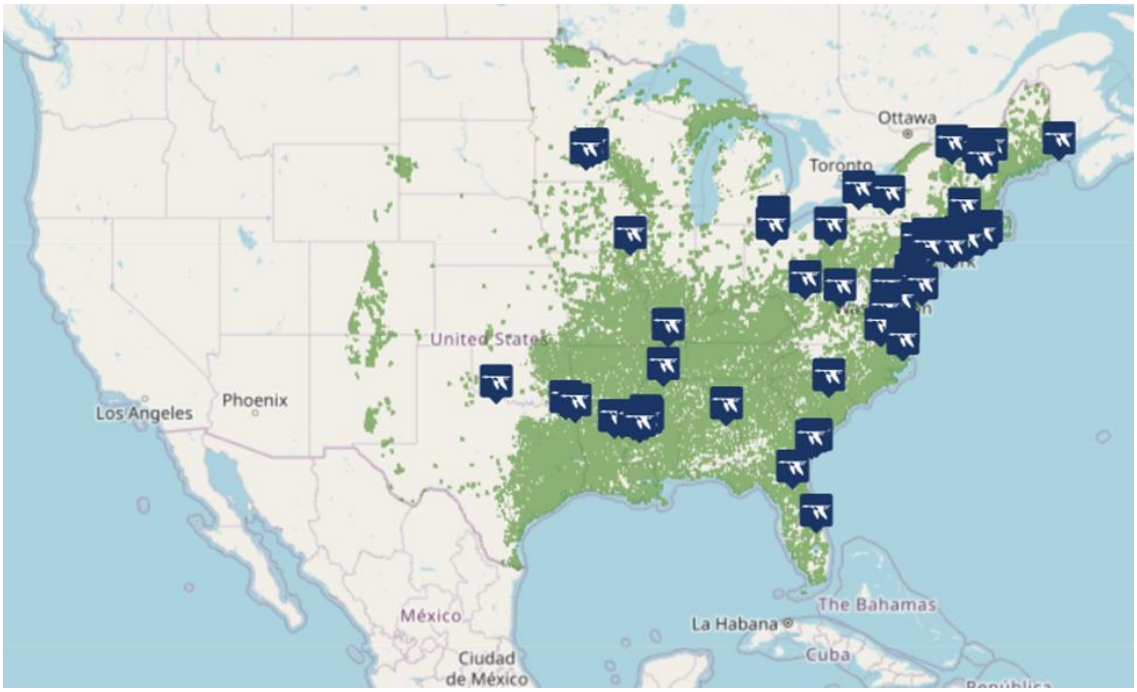

Figure 3-2. TCB Area of Influence (USFWS 2024*a*).

3.1.4 Conservation Needs and Threats

The conservation needs for TCB are similar to other bats, including a sufficient quantity of suitable habitat for each season (migration, winter, and summer). Threats to TCB include WNS, mortality from wind energy projects, habitat loss, and climate change. Please refer to the SSA for more information on the conservation needs for and threats to TCB (USFWS 2021).

White-nose Syndrome: The predominant threat to the TCB is White-nose Syndrome (WNS) (USFWS 2021). WNS is a disease of bats that is caused by the fungal pathogen *Pseudogymnoascus destructans* (Pd). Pd invades the skin of bats, initiating a cascade of physiological and behavioral processes that often lead to mortality. WNS impacts physiology, water balance, and arousal patterns of some species of hibernating bats in lethal ways (Cryan et al. 2010, Willis et al. 2011, Reeder et al. 2012). There is currently no known practicable cure. The effect of WNS on TCB has been extreme. Section 5.1.4 provides further details of the history of WNS. Cheng et al. (2021) concluded WNS caused estimated population declines of 90–100% across 59% of TCB range. The spread of WNS is correlated with the distribution of caves and climate (Maher et al. 2012). See the SSA (USFWS 2021) for more information regarding WNS impacts.

Wind Related Mortality: Wind related mortality of TCB is also proving to be a consequential stressor at local and regional levels. TCB are killed at wind energy projects primarily through collisions with moving turbine blades.

Loss of Habitat: Loss of roosting, foraging, and commuting habitat may lead to minor or significant impacts to TCB depending on the timing, location, and extent of the removal. Impacts to forested habitats, as well as mines, caves, culverts, bridges, and other cave-like structures may affect TCB. Loss or modification of winter habitats may also result in adverse effects to TCB, especially given the species' high site fidelity and narrow microclimate requirements for hibernation. Additionally, disturbance (e.g., human entry) during hibernation results in increased arousals in TCB, which leads to increased energy expenditure at a time when food and water resources are scarce or unavailable.

Climate Change: Changing climatic variables including changes in temperature and precipitation influence TCB's resource needs, such as suitable summer and winter roosting habitat, foraging habitat, and prey availability. Although pervasive across TCB's range, the magnitude, direction, and seasonality of climate change will vary geographically (e.g., some regions will experience more frequent droughts which may lead to reduced TCB survival or reproductive success; alternatively, some regions will experience heavier and more frequent precipitation events that may lead to decreased foraging bouts and insect availability).

Disturbance or Noise: Noise, such as vibration and general human disturbance, are stressors that may disrupt normal feeding, sheltering, and breeding activities of the TCB. Many activities, such as (use examples from BA) may result in increased noise/vibration/disturbance that may result in effects to bats. Significant changes in noise levels in an area may result in temporary to permanent alteration of bat behaviors. Recent studies have indicated that anthropogenic noise

can alter foraging behavior and success of bats (Schaub et al. 2008, Siemers and Schaub 2010, Bunkley et al. 2015). The novelty of these noises and their relative volume levels will likely dictate the range of responses from individuals or colonies of bats. At low noise levels (or farther distances), bats initially may be startled, but they would likely habituate to the low background noise levels. At closer range and louder noise levels (particularly if accompanied by physical vibrations from heavy machinery and the crashing of falling trees) many bats would probably be startled to the point of fleeing from their day-time roosts and in a few cases may experience increased predation risk. For projects with noise levels greater than usually experienced by bats, and that continue for multiple days, the bats roosting within or close to these areas are likely to shift their focal roosting areas further away or may temporarily abandon these roosting areas completely .

3.2 Environmental Baseline

This section describes the best available data about the condition of the TCB in the Action Area without the consequences caused by the proposed Action.

3.2.1 Action Area Numbers, Reproduction, and Distribution

Through acoustic surveys, TCBs have been detected and observed on MTC's licensed area. The acoustic survey results have demonstrated that the primary habitat utilized by TCBs on MTC is concentrated around riparian and bottomland hardwood habitats near flowing streams and open water, as well as in upland mixed hardwood/pine habitats. Capture efforts have resulted in four total individual TCBs, two in 1995, one in 2020, and one in 2021. The closest location of a captured TCB to MPMG is the intersection of Colonel's Creek with Red Diamond Road, over 3 miles away from the range maximum construction limit (Figure 3-3). The habitat for the two captures (1995 and 2021) at this location was a riparian, bottomland hardwood forest adjacent to Colonel's Creek. The other 1995 capture was in a predominantly pine-dominated stand (South Carolina Department of Natural Resources (SCDNR) 1997, 1998). The 2020 capture was located next to Davis Pond. The habitat of both the 2020 and 2021 TCB captures has not changed since 1995 and still represents riparian, bottomland hardwood forest habitat (SCDNR 2020, 2021, Colorado State University 2018).

Additionally, during bat inspections/use surveys of old range tunnels on MTC's cantonment area, TCBs have been observed overwintering in/utilizing the tunnels as hibernacula roosts. The closest tunnel location with a TCB roost is on the east side of MTC, over 7.5 miles away from the range maximum construction limit. The location of these tunnels that serve as hibernacula roost are located to the southeast of the Action Area and shown in the red circle on Figure 3-3. TCBs were detected as recently as the winter of 2022.

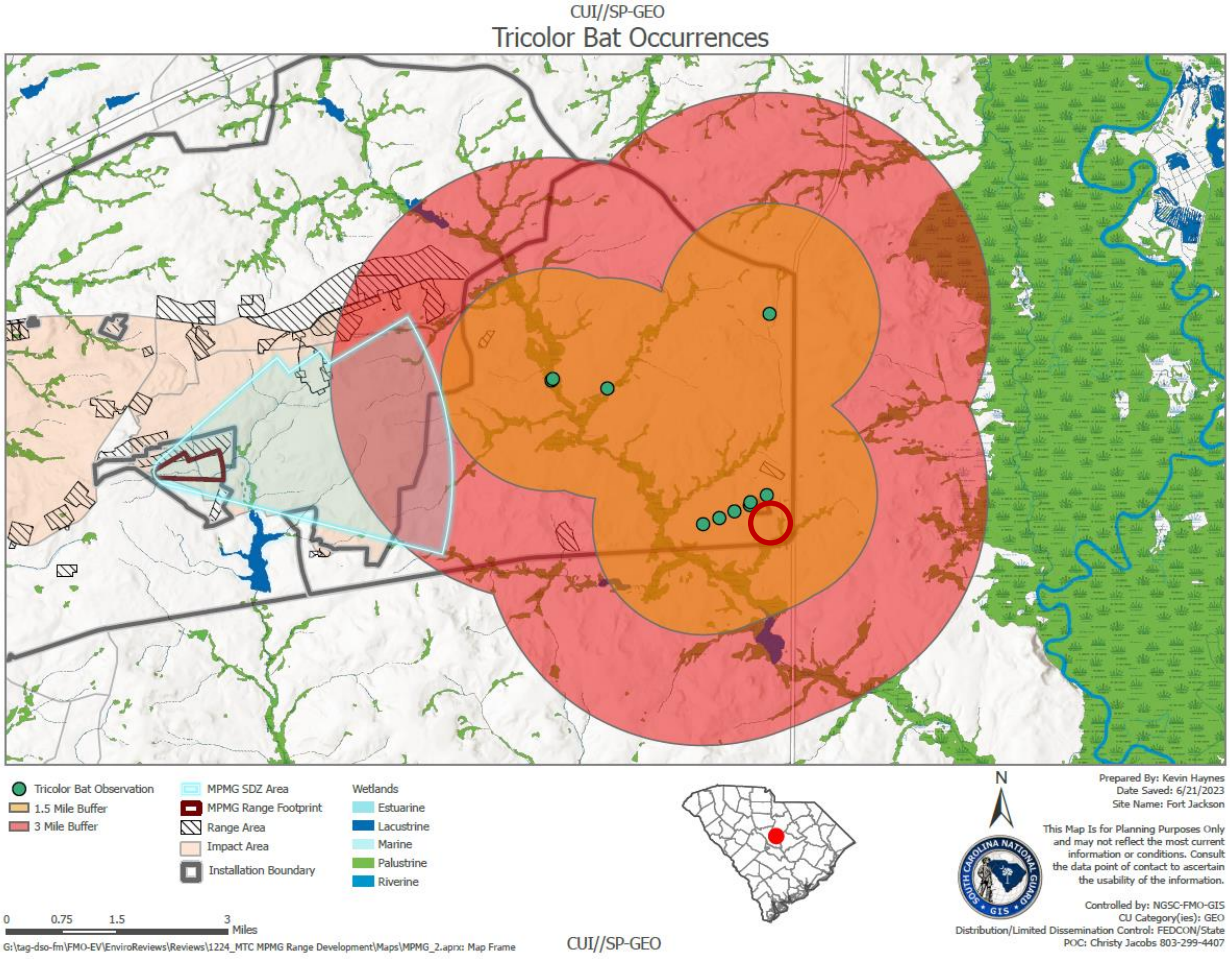

Figure 3-3. TCB occurrences near the Action Area.

On the west side of the installation, Fort Jackson supported one bat survey in 1990-1992, performed by The Nature Conservancy, which included looking into unused bunkers, firing range tunnels, and outbuildings. No TCBs were identified during that survey. However, TCBs may be breeding, roosting, and/or foraging in most of the suitable hardwood or pine-forested lands on the installation as well as in riparian areas, along edges, and small openings that include firebreaks and roads.

To better define and quantify potential TCB suitable habitat found within the MPMG range maximum construction limits and beaten area, a habitat analysis was performed. Several factors that characterize suitable habitat for TCBs are water resources (i.e., slow moving streams and standing water) and forest structure (i.e., forest types, canopy cover, and canopy height). Some literature and observations from previous bat surveys on MTC demonstrate that TCB presence is positively correlated with greater access to water, more hardwoods, more canopy cover, and taller trees (SCDNR 1997, 1998, 2020*a*, 2021, USFWS 2024*b*).

The three predominant forest types that exhibited a minimum canopy coverage of 40% and a

minimum canopy height of 25 feet were pine/mixed hardwood (14.73 acres), pine/scrub oak (13.98 acres), and longleaf pine plantation (3.87). The total area for these three stand types representing a forest with the tallest/largest trees was 32.58 acres, approximately 6% of the total 595.91-acre MPMG (composed of 208 acres range maximum construction limits plus 387.9 acres beaten area). The 32.58 acres identified in the habitat analysis provide the highest potential for areas where TBC may prefer to roost (including maternity roosting trees), however the whole 595.91-acre MPMG is considered suitable habitat.

3.2.2 Action Area Conservation Needs and Threats

White-nose Syndrome

WNS was first detected in South Carolina in March of 2013 at Table Rock State Park. Since that first occurrence in Pickens County, the fungus has been detected in nine (9) additional counties. SCDNR staff conduct testing for *Pd* and WNS in caves and mines that are known to be home to hibernating bats. Testing conducted in Piedmont sites in 2017 and 2018 came back positive for the fungus on bats or in the cave environment. None of the bats had any obvious signs of disease. South Carolina's warmer, shorter winters mean bats spend less time in their hibernacula, the environment that favors the fungus. Two counties that boarder the Piedmont and Coastal Plain of South Carolina resulted in a confirmation and a potential for WNS. The location of the Action Area falls within Richland County, which first tested positive for WNS in 2014, additionally TCBs have tested positive for WNS in South Carolina (SCDNR 2020*b*).

Wind Related Mortality

There are no planned wind facilities within the Action Area.

Loss of Habitat

The Action includes tree removal during the construction phase and may result in habitat loss for the TCB. The South Carolina coastal plain has experienced and continues to experience loss and modification of potential TCB roosting and foraging habitat through tree removal. Tree removal occurs primarily as a result of timber harvest, development, and land clearing for agriculture. Wildland fire and/or prescribed fire may also result in habitat loss for TCB as well. Depending on the timing and intensity of a wildland fire or prescribed burn there could be injury or harm to TCB individuals, particularly if it occurs during the pup season (when non-volant pups are present) or when bats are in winter torpor in the area. The Action Area includes DoD Lands that have been managed with prescribed fire for decades.

Climate Change

Climate change may increase insect availability during winter and thus increase winter activity and perhaps expand the winter range of the species. Additionally, a warming climate may further limit the spread of the psychrophilic *Pd* spores.

Disturbance or Noise

Information related to impacts of range and training noise on TCBs is not available, however impacts to Indiana bats (*Myotis sodalis*) has been assessed at Camp Atterbury (Whitaker Jr and Gummer 2002, USFWS 2010), Fort Leonard Wood (USFWS 2010), and Fort Drum (USFWS 2009, U.S. Army Garrison Fort Drum 2017). Results indicate, along with the abundance and installation-wide distribution of the bats on the sites, that with the sound intensity and duration associated with past training events Indiana bats may have habituated to such stimuli. The TCB may also become habituated to noise and shock waves on firing ranges.

3.3 Effects of the Action

This section analyzes the effects of the proposed Action on the TCB, which includes all consequences to listed species that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (50 CFR §402.02).

We identified and described the activities included in the proposed Action in sections 2.2. Our analyses of the consequences caused by each of these activities follows.

3.3.1 Construction of the Range

Construction of the MPMG range will require surveying for and removing UXO, removing vegetation (i.e., clear-cutting, grubbing, and grading) in the maximum construction limits of the range of 208 acres, building structures, installing electricity (2.5 acres), installing culverts for stormwater management, and the construction of targets. We consider removing vegetation to be the main stressor to TCB and outline that later in this section. First, we will discuss the other actions that are part of construction of the MPMG range.

UXO clearance:

UXO clearance and vegetation removal will occur outside of the sensitive timeframes (Table 3-1). The existing Main Tank range overlaps the northern portion of the proposed MPMG range. Other typical land uses and activities on Fort Jackson include military vehicle and dismounted maneuvers, bivouacking, helicopter landing zones, firing points, live-fire ranges and associated safety zones, impact areas, forestry, and other natural resources management, hunting and fishing, and cantonment. Therefore, bats within the Action Area are already exposed to a certain level of noise, exhaust, dust, vibration, and lighting. The UXO clearance is more likely to startle TCB due to the substantially greater noise levels and visual disturbance. However, if detonated, the action will be a short-term event with effects that are relaxed almost immediately (pulse effect).

An evaluation of the UXO contamination of the MPMG range has been conducted and surveyors found two Munitions and Explosives of Concern (MEC) and numerous Highly Explosive (HE) fragments. However, this number is likely underrepresented due to vegetation still being present, surveying methodology, and other factors. The data and information regarding UXO contamination is limited, and it is still unknown if the UXO will need to be moved off-site (inert) or detonated in place (live). Additionally, the area of the range has been categorized according to the probability of encountering more explosive material (High Risk, Medium Risk, and Low Risk). The areas with the highest probability mostly overlap with the Main Tank area, as seen in Figure 3-4 (U.S. Army Corps of Engineers 2013).

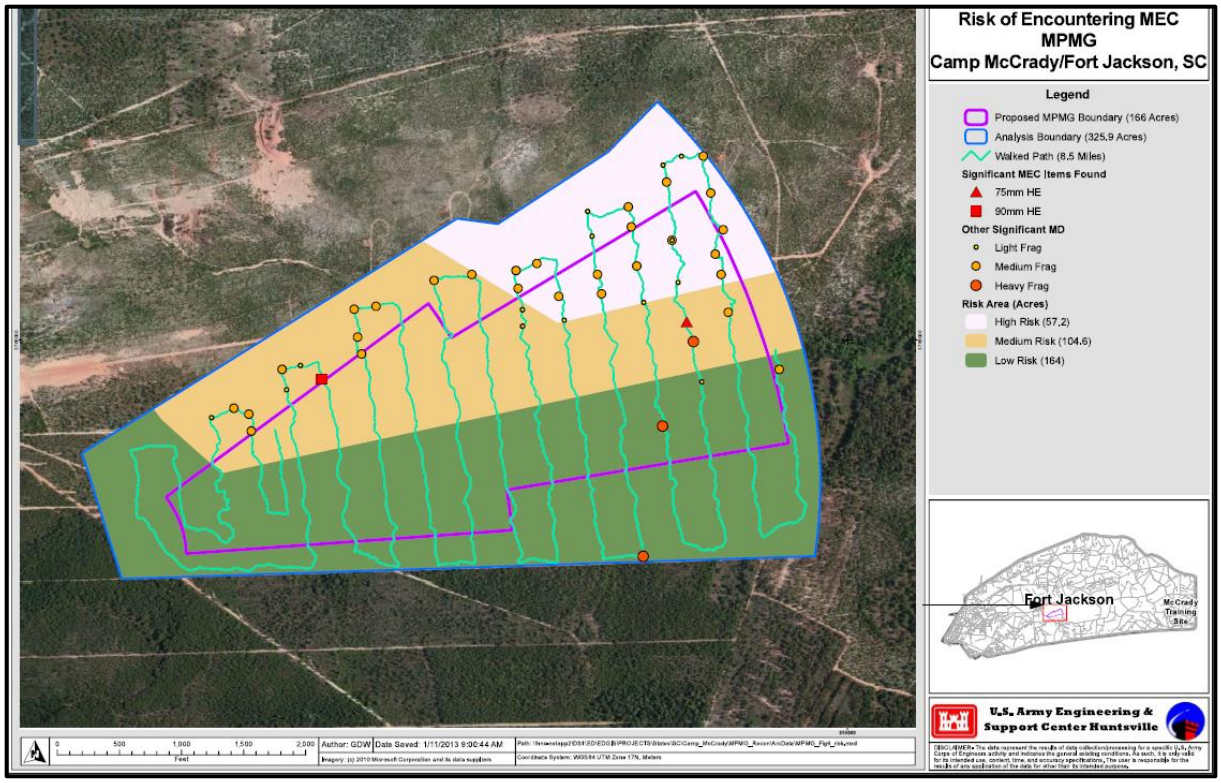

Figure 3-4. Risk of encountering MEC in the MPMG range area

Bats and other mammals are likely to startle or flush in response to noise and visual disturbances associated with an increase of human presence during the surveying and removing of UXOs, which could affect foraging or roosting activities and if done during the pupping season expose pups to predation. However, the UXO clearance will occur outside of sensitive timeframes, have a limited duration (pulse effect) and limited frequency of occurrence. Therefore, this action may affect, but is not likely to adversely affect TCB because the effects will be insignificant.

Construction of infrastructure (buildings, electricity, culverts, targets):

The forest analysis revealed that 32.58 acres in both the range maximum construction limit and beaten area provide potential roosting and maternity roosting (breeding season) trees that the bats

might prefer, although all the acreage is potentially usable by bats. Construction activities, such as building structures, installing electricity and culverts, and the construction of targets will result in an increase of human presence and potential exposure of TCB to noise, exhaust, vibration, and sediment/dust in the Action Area. Impacts may also include changes to physiography, topography, and surface water, including soil disturbance, soil erosion, and increased wastewater and runoff; potential contamination from spills into groundwater; air emissions impacts; and hazardous substances from oil or solvents. Construction activities such as road construction, vertical and horizontal building, and other activities are likely to occur outside of the bat sensitive seasons and during daylight hours.

The installation and use of artificial lights during, and after, construction activities can potentially cause disturbance (i.e., fleeing) and reduced fitness among the listed bat species. Bat behavior, such as foraging and reproduction, can be affected by artificial lighting, causing adverse reactions and dispersal away from lighting (Rydell 1992, Downs et al. 2003). In addition, artificial lighting can potentially affect travel between roosting and foraging areas. Lighting has also been shown to have a potential neutral or beneficial effect on bats. Jung and Kalko (2010) demonstrated that many species of bats in Panama foraged around streetlights, taking advantage of the high abundance of insects. Jones and Rydell (1994) identified there may be differences in tolerable light levels amongst bat species and that evening emergence time is probably affected by the ability to avoid predation.

DoD has proposed conservation measures to minimize disturbance. No construction activities will occur during night hours. All construction work will be performed between 30 minutes after sunrise and 30 minutes before sunset. The construction site will remain dark, with no lights running during non-working hours and/or during the evenings/night. This will minimize light disturbance as well as attract insect prey items and subsequent bats to the construction site. Bats may be deterred from areas with high light levels, as a response to greater predation risks (Sparks et al. 2005). By angling the light away from potential foraging and roosting areas, the area will be darker, thus providing bats more protection from predators. Exposure to noise, exhaust, dust, vibration, and lighting will be limited in duration and intensity during timeframes that are less likely to impact TCB. Due to these reasons, noise, exhaust, dust, vibration, and lighting may affect TCB, but are not likely to adversely affect because the effects are expected to be insignificant.

TCBs are opportunistic when it comes to their roosts. Newly installed culvert pipes can incidentally serve as an excellent roost. DoD has proposed conservation measures to minimize any risk. First, the size and material of culverts will not be suitable habitat and will discourage bat entrance into the infrastructure. TCBs are opportunistic when it comes to their roosts. Culvert pipes installed as infrastructure can incidentally serve as an excellent roost. Measures that may help reduce the likelihood of the TCB using newly installed infrastructure culverts include using culvert pipe with a diameter of 2 feet or less and/or smooth walled culvert piping, whenever possible. Additionally, for future culvert maintenance, DoD will follow current guidance to minimize harm to bats. With no known bat occupation, unblocking and other actions that do not disturb structural integrity or block entrances and exits can occur at any time of the year (removes threat of flooding and blowouts that would injure roosting bats)

(Department of Defense 2023). The installation of culverts may affect but is not likely to adversely affect because the effects are expected to be discountable due to the proposed conservation measures (Section 2.6).

We believe that adverse effects to TCB from changes in water quality (i.e., introduction of sediments and contaminants to nearby drinking water sources) are unlikely because the Action will be limited to an insignificant scale given the implementation of BMPs and lack of a consistent water source within the construction limit. When feasible, DoD will adhere to BMPs for wetlands to maintain associated habitat and water quality to the maximum extent practicable. Wetlands provide a significant resource to the TCB as both forage habitat and a water source (Section 2.6). A study by an Austin Peay University graduate student found a positive correlation between stream health and bat species richness and evenness (Walker 2022).

Additionally, DoD has proposed further conservation measures to benefit TCB (Section 2.6). To foster a supportive habitat for these insects, as well as all other invertebrates, the SCARNG will continue habitat management strategies such as plant propagation and pollinator plots. Pesticide usage will be limited to as-needed spot treatments to support conservation of invertebrates and pollinators. This ensures a robust food supply for the bats but also contributes to the overall health of the forest ecosystem by supporting diverse insect populations and benefiting other pollinator species present on MTC.

Stressor: Loss of Habitat

Habitat removal will directly affect approximately 208 acres of potential suitable habitat, permanently prevent bats from using this area to breed, roost, and possibly hibernate. These losses could adversely affect TCB either directly or indirectly. Tree removal activities will avoid sensitive timeframes (Table 3-1) to not interfere with winter torpor and pupping season, two of the TCB's most sensitive seasons.

Direct effects to TCB include individuals being crushed by felled/falling trees, volant bats flushing a roost tree and being susceptible to predation, and decreased foraging efficiency leading to decreased fitness and survival. Since many TCBs would be expected to survive a roost tree being felled (Belwood 2002), it is expected that a small but unknown percentage of the TCB would be killed while the rest would survive and be temporarily displaced. A TCB that is forced to evacuate a tree being felled will expend energy in finding another roost tree, but such energy expenditure is not likely to adversely affect the bat because TCB commonly change roost trees (Poissant 2009). It has been shown that TCB may be injured or killed while fleeing disturbance during daylight hours due to an increased likelihood of predation (Poissant 2009). A bat relocating to a new roost tree during daytime may be temporarily exposed to increased predation pressure.

The amount of mortality would not be determinable since dead TCBs would likely go unnoticed, and estimating such mortality is difficult since TCB density data is not available. Although mortality could potentially occur at any time of the year, it is assumed that mortality would be highest during the pupping season if maternity roost trees are felled, and during cold winter

weather when TCB individuals may be in torpor in a roost tree that is felled. However, the DoD has proposed conservation measures (Section 2.6) to minimize impacts during the two most sensitive seasons.

The changes in landcover may be associated with losses of suitable roosting or foraging habitat, longer flights between suitable roosting and foraging habitats due to habitat fragmentation, fragmentation of maternity colony networks, loss of connectivity between roosting and foraging habitat, and direct injury or mortality. The Service is unaware of habitat fragmentation causing adverse impacts of bat demography at the neighborhood level. Bat home ranges including foraging habitat can span hundreds of acres (Foster and Kurta 1999, Owen et al. 2003, Broders et al. 2006, Henderson and Broders 2008, Lacki et al. 2009, Helms 2010, Johnson et al. 2012, Silvis et al. 2015, Swingen et al. 2018, Wisconsin DNR 2018, Hyzy et al. 2020, Divoll et al. 2022). Research has not been conducted on South Carolina year-round active range bats to identify their breeding distances, however, prior studies on TCB have shown migration records between winter hibernacula and summer habitat include less than 80 km (50 miles) (Barbour and Davis 1969), 44 km (27 miles) (Samoray et al. 2019), and 137 km (85 miles) (Griffin 1940) identifying the ability to travel distances spanning further than the neighboring Action Area. As such, it is expected the bats will have flexibility of foraging habitat and breeding opportunity further than the location of the Action Area. Due to this expected uncertainty and assumed flexibility, the Service does not anticipate the neighboring bat population to experience adverse effects due to the Action.

The indirect effects of removing a roost tree while it is unoccupied depend on how individual TCB use that tree at other times, whether as a maternity roost or an alternate summer roost. Removal of a primary maternity roost likely has the greatest impact, but the loss of any previously established roost causes bats to spend time and energy seeking a new roost that meets their requirements in that area. Site fidelity, where TCB may return each year to the same summer roosting locations, can be affected by the removal of unoccupied trees. Bats may return to the same roost trees expecting their familiar site.

Tree removal associated with the proposed Action represents a small portion of foraging and roosting habitat within the larger forest land available in South Carolina. The South Carolina Forestry Commission estimated the area of forest land in South Carolina to be approximately 12.86 million in 2019 (South Carolina Forestry Commission 2021). TCB range in South Carolina does span the entire state. Forest land throughout the range and the state have remained relatively stable between 2014 and 2019, dipping slightly (<1%) to the current estimate of 12.86 million acres.

DoD has proposed conservation measures (Section 2.6) to minimize impacts from this stressor, including constructing the MPMG outside of the sensitive timeframes. Due to their generalist habits in roost selection and the abundance of forested lands, the potential adverse effects will be short-term as the bats will be able to relocate to other forest land within or nearby Fort Jackson, as only 0.41% of the potential suitable habitat within Fort Jackson (51,313 acres) will be removed.

3.3.2 Operation of the Range

The operation of the range may cause environmental effects such as vegetation community conversion or damage and increased risk and spread of wildland fire and may occur across 4,796 acres of the SDZ. Operation of the range will occur at all times of the year and will not avoid the sensitive seasons. Fired munitions may cause noise and vibration/shaking of trees which could disrupt maternity roosting and may lead to pup mortality. The fired munitions may also cause direct mortality of TCB individuals.

Over time, trees downrange of firing points in the SDZ may incur some degree of damage or mortality from fired munitions hitting or shearing trees, either directly or from ricochet. The weapons planned for this range use primarily lead-based ammunition. No high explosive munitions will be used.

The north beaten area has undergone repetitive live ammunition fire during military training since WWII and is heavily disturbed as a result. Primarily dominated by earlier successional scrub oak habitat, this would most likely serve as foraging habitat for TCBs. However, this may not be the most suitable foraging habitat due to a lack of consistent water resources in the area. While this area might have vegetation hit from new angles with the operation of MPMG, we anticipate minimal effects to any potential habitat in this area.

The newly impacted south beaten area (64.21 acres) may have trees hit by munitions which may lead to potential loss of trees over time. We expect the south beaten area to become beaten similar to the north beaten area over time. Minor tree mortality is predicted to occur and tree snags may increase.

DoD has also proposed measures that can benefit TCB. Whenever feasible, dead and dying trees will be left standing. Such standing trees provide essential roosting opportunities for TCBs during the summer for maternity roosts with adult female bats and their pups or individuals. To foster a supportive habitat for these insects, as well as all other invertebrates, the SCARNG will continue habitat management strategies such as plant propagation and pollinator plots. Pesticide usage will be limited to as-needed spot treatments to support conservation of invertebrates and pollinators. This ensures a robust food supply for the bats but also contributes to the overall health of the forest ecosystem by supporting diverse insect populations and benefiting other pollinator species present on MTC. This action may affect TCB, but it is not likely to adversely affect because the increase in snags will be beneficial to TCB.

Fire and burning may have positive, negative, or no effect on bat ecology, and potential effects may vary among time of year, fire frequency, ambient temperatures, and intensity of burns (Johnson et al. 2009, Perry 2012, Ford et al. 2016, Perry et al. 2016). Noise, smoke, and heat associated with fire could disturb bats but many bats roost high in tree canopies so low-intensity fires are less likely to cause injury than high-intensity fires (Dickinson et al. 2010). Even though we cannot predict when a wildland fire may occur, the risk of increasing wildland fire due to the operation of the MPMG will be insignificant since the impact area already burns regularly as a result of operation of the current ranges. It catches fire multiple times each year and is

completely burnt out with prescribed fire every two years. Due to regular fire, the fuel levels remain low and thus results in low intensity burns. We anticipate the impacts from smoke will be limited in frequency and duration. Additionally, the bats in the area are already exposed to smoke and fire.. This action may affect TCB, but it is not likely to adversely affect TCB because the effects are expected to be insignificant.

Direct effects to TCB include potential injury or mortality of individuals by the fired munitions. The amount of mortality would not be determinable since dead TCBs would likely go unnoticed, and estimating such mortality is difficult since TCB density data is not available. Although mortality could potentially occur at any time of the year, it is assumed that mortality would be highest during the pupping season when bats are pregnant and pupping and during the Winter Torpor season.. However, the forest habitat analysis indicates that the majority of the suitable habitat is foraging habitat, limiting the potential for roosting bats during the daytime. We would expect that TCB would be more likely to be present in the SDZ area during nighttime foraging. The MPMG range will mostly be used during daylight hours, which will lessen the potential of a TCB being directly hit from a munition. We expect the chance of mortality from munition to be insignificant.

3.3.3 Summary

The Action may cause injury and mortality to TCB through individual bats roosting in trees that are removed; loss of foraging, commuting, and roosting habitat; and increased predation due to fleeing during the daytime. TCBs are small and occupy forested habitat where they are difficult to find. They are mostly nocturnal and form small, widely dispersed maternity colonies. Some species occur under loose bark or in the cavities of trees, and males and non-reproductive females may roost individually. For these reasons, effects to survival, reproduction, or distribution will be difficult to observe and it is not practicable to quantify the potential level of take with reasonable certainty. Accordingly, the use of acreage as a surrogate will be used to quantify take for TCB. To minimize those effects, the DoD has committed to avoid vegetation removal and UXO clearance during the sensitive timeframes, minimize light disturbances, avoid snag harvesting, follow culvert guidance and installation to minimize harm to bats, and follow best management practices for the 1,642 acres of wetlands and nearby invertebrates and pollinators. Therefore, we considered the removal of 210.8 acres of suitable habitat to be the primary stressor.

Forested land throughout South Carolina has remained relatively stable. Overall, the bat's suitable habitat in the Action Area represents less than a thousandth of a percent of South Carolina forested lands. This portion of South Carolina represents a small portion within the TCB Southern RPU. The proposed Action would not result in measurable declines in the resilience, redundancy, and representation of the TCB Southern RPU. While impacts could occur to individuals or populations, we do not consider these impacts to affect the survival or recovery of TCB in the RPUs or range-wide.

Table 3-2: Summary table of stressor effects to TCB

Stressor	Loss of Habitat acreage Outside of Sensitive Seasons (Roost trees and foraging trees)
Impact to TCB	• Injury or mortality of individuals roosting in trees. • Loss of foraging, commuting, and roosting habitat. • Increased predation due to fleeing during daytime. • Loss of connectivity between roosting and foraging habitat. • Disruption of feeding.
Conservation Measures	• Removal of vegetation and UXO clearance will occur outside of the sensitive timeframes. • Avoid operating loud machinery from ½ hour before sunset time until ½ hour after sunrise. • Use of artificial lighting within 1000 ft of confirmed roosting habitat from ½ hour before sunset until ½ hour after sunrise will be avoided. • When feasible, tree snags or dying trees will be left. • Best management practices for wetlands to maintain associated habitat and water quality to the maximum extent practicable will be utilized. • Habitat management strategies to protect invertebrates and food sources will be utilized. These include plant propagations, pollinator plots, and limited usage of pesticides. • The addition of two roost towers on MTC. • When feasible, regular maintenance of known supplemental roosts • The continuation of quarterly already established monitoring of supplemental roosts.
Surrogate Impacts (# of acres)	210.8 acres total (208-acres MPMG range + 2.8-acres transmission line)

3.4 Cumulative Effects

For purposes of consultation under ESA §7(a)(2), cumulative effects are those caused by future state, tribal, local, or private actions that are reasonably certain to occur in the Action Area. Future Federal actions that are unrelated to the proposed action are not considered, because they require separate consultation under §7 of the ESA. The DoD did not describe, and the Service is not aware of any cumulative effects in the Action Area at this time; therefore, cumulative effects are not relevant to formulating our opinion for the Action.

3.5 Conclusion

The Service concludes that the proposed action is likely to have adverse effects to some individual TCBs. We anticipate the following effects to the TCB: (1) lethal take, harm, and/or harassment as a result of 210.8 acres of suitable habitat removal conducted outside of the sensitive timeframes.

Although the proposed Action is expected to result in adverse effects to TCBs, we have determined that the species' reproduction, numbers, and distribution will not be appreciably reduced as a result of the proposed Action.

After reviewing the current status of the TCB, the environmental baseline, and the effects of the Construction and Operation of the Multipurpose Machine Gun Range, McCrady Training Center Project, it is the Service's Opinion that the proposed Action is not likely to jeopardize the continued existence of the TCB. No critical habitat has been designated for TCB; therefore, none will be affected.

Our conclusion considered the following information:

1. The portion of the habitat removal in the proposed Action constitutes a relatively small portion of the overall habitat available range wide for TCB. In South Carolina, forested land is estimated to be approximately 12.86 million acres making the 208-acres for the MPMG range and 2.8-acres for the transmission line removed a very small portion available habitat in the state.
2. WNS is the primary factor causing declines for the TCB range-wide. Our analysis of the effects of this proposed Action indicates that the additional loss of individuals bats resulting from these activities would not exacerbate the effects of WNS at the scale of the RPUs or range-wide.
3. Take of TCBs will be minimized by implementation of the Conservation Measures outlined in section 2.6. These measures have been shown to help minimize adverse impacts to these species.

The Service's conclusion is based on, but not limited to, the information presented in the Assessment (Assessment, entire); correspondence during this consultation process; information in the Service's files; and informal discussions between the Service, DoD, and other personnel.

4. Incidental Take Statement

ESA §9(a)(1) and regulations issued under §4(d) prohibit the take of endangered and threatened fish and wildlife species without special exemption. The term "take" in the ESA means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (ESA §3(19)). In regulations, the Service further defines:

- "harm" as "an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering;" (50 CFR §17.3) and
- "incidental take" as "takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant" (50 CFR §402.02).

Under the terms of ESA §7(b)(4) and §7(o)(2), taking that is incidental to a federal agency action that would not violate ESA §7(a)(2) is not considered prohibited, provided that such taking is in compliance with the terms and conditions of an incidental take statement (ITS).

The prohibitions against taking endangered species under section 9 of the ESA or under a section 4(d) rule for threatened species do not apply until the species are listed. If the Conference Opinion is adopted as a Biological Opinion following a listing or designation under section 4 of the ESA, the Reasonable and Prudent Measures (RPMs), with their implementing T&Cs, will be nondiscretionary for these species. T&Cs must be undertaken, for the exemption in section 7(o)(2) to apply.

The ITS provided in this Conference Opinion does not become effective until the species is listed, and the Conference Opinion is adopted as the Biological Opinion issued through formal consultation. At that time, the Action will be reviewed to determine whether any take of the species or its critical habitat has occurred. Modifications of the opinion and incidental take statement may be appropriate to better reflect take. No take of the species or its critical habitat may occur between the listing of a species and the adoption of the Conference Opinion through formal consultation, or the completion of a subsequent formal consultation. Section 6 of this document contains the instructions on adopting the Conservation Opinion as a Biological Opinion.

4.1 Amount or Extent of Take

This section specifies the amount or extent of take of TCB that the Action is reasonably certain to cause, which we estimated in the "Effects of the Action" section(s) of this CO.

The Service anticipates that the Action is reasonably certain to cause incidental take of individual TCB consistent with the definition of harm or harass resulting from the action. It is anticipated that most of this take would be in the form of temporary non-lethal effects. The Service anticipates incidental take of TCB will be difficult to detect for the following reasons:

- Bats are mostly nocturnal and individuals are small and occupy forested habitats where they are difficult to find;
- Bats form small, widely dispersed maternity colonies, some species occur under loose bark or in the cavities of trees, and males and non-reproductive females may roost individually, which makes finding the species or occupied habitats difficult;
- Finding dead or injured specimens during or following Action implementation is unlikely;
- Most incidental take will be non-lethal and undetectable (e.g., bats fleeing disturbances caused by proposed activities, which creates the likelihood of death or injury due to predation and reduced fitness).

When it is not practical to monitor take in terms of individuals of the listed species, the regulations at 50 CFR §402.14(i)(1)(i) indicate that an ITS may express the amount or extent of

take using a surrogate (e.g., a similarly affected species, habitat, or ecological conditions), provided that the Service also:

- describes the causal link between the surrogate and take of the listed species; and
- sets a clear standard for determining when the level of anticipated take has been exceeded.

We have identified surrogate measures in our analyses of effects that satisfy these criteria for monitoring take of the species named above during Action implementation. **Table 4-1** lists the species, life stage, surrogate measure, and the section of the CO that explains the causal link between the surrogate and the anticipated taking.

Table 4-1. Surrogate measures for monitoring take of TCB caused by the Action, based on the cited CO effects analyses.

Common Name	Life Stage	Activity	Form of Take	Surrogate (units)	Quantity	CO Effects Analysis Section
Tricolored Bat	Adult, Volant Juvenile, and Non-volant juvenile	Habitat Removal	Harm, harass	Acreage of trees removed	210.8	3.4

4.2 Reasonable and Prudent Measures

The Service believes that no reasonable and prudent measures are necessary or appropriate to minimize the impact, *i.e.*, the amount or extent, of incidental take of TCB caused by the Action. Minor changes that do not alter the basic design, location, scope, duration, or timing of the Action would not reduce incidental take below the amount or extent anticipated for the Action as proposed. Therefore, this ITS does not provide RPMs for these species. The DoD is reminded of the commitments made to the conservation measures listed in Section 2.6.

4.3 Terms and Conditions

No reasonable and prudent measures to minimize the impacts of incidental take caused by the Action are provided in this ITS; therefore, no terms and conditions for carrying out such measures are necessary.

4.4 Monitoring and Reporting Requirements

In order to monitor the impacts of incidental take, the DoD must report the progress of the Action and its impact on the species to the Service as specified in the ITS (50 CFR §402.14(i)(3)). This section provides the specific instructions for such monitoring and reporting (M&R), including procedures for handling and disposing of any individuals of a species actually killed or injured. These M&R requirements are mandatory.

As necessary and appropriate to fulfill this responsibility, the DoD must require any permittee, contractor, or grantee to accomplish the M&R through enforceable terms that the DoD includes in the permit, contract, or grant document. Such enforceable terms must include a requirement to immediately notify the DoD and the Service if the amount or extent of incidental take specified in this ITS is exceeded during Action implementation.

M&R #1. Monitoring of Bat Roosts

Currently, SCARNG conducts quarterly monitoring of its already established supplemental roosts for bat use. The SCARNG will continue to conduct long-term monitoring of both supplemental and natural (if/when discovered) roosts to track and inventory bats and other wildlife that utilize them via Habitat Use Surveys and/or Emergence Counts (active and/or passive).

M&R #2. Disposition of Dead or Injured TCB.

Upon locating a dead individual, preserve the specimen(s) and notify the Service at the phone number and email below for further instructions on where to send it. The Service may ask for the specimen(s) to be sent to the Charleston office, below, to the repository at the Smithsonian Museum, or another appropriate repository. Care must be taken in handling any dead specimens of proposed or listed species to preserve biological material in the best possible state. In conjunction with the preservation of any dead specimens, the finder has the responsibility to ensure that evidence intrinsic to determining the cause of death of the specimen is not unnecessarily disturbed. The reporting of dead specimens is required to enable the Service to determine if take is reached or exceeded and to ensure that the T&Cs are appropriate and effective.

Initial notification must be made to the Service's Law Enforcement Office below. Additional notification must be made by email to the Service's Ecological Services Field Office. Care should be taken in handling sick or injured individuals and in the preservation of specimens in the best possible state for later analysis of cause of death or injury.

Tracey Woodruff
Special Agent
U.S. Fish & Wildlife Service - Law Enforcement
176 Croghan Spur, Suite 200
Charleston, SC 29407

(843) 300-0412
(864) 323-4991 (cell)
tracey_woodruff@fws.gov

Notification to the Charleston Ecological Services Field Office may be emailed to charleston_regulatory@fws.gov and/or Lindsey_Troutman@fws.gov.

Information required in these Reporting Requirements should be submitted to the following email addresses by January 31 of the year following data collection unless otherwise stated: charleston_regulatory@fws.gov

5. Conservation Recommendations

§7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by conducting conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary activities that an action agency may undertake to avoid or minimize the adverse effects of a proposed action, implement recovery plans, or develop information that is useful for the conservation of listed species. The Service offers the following recommendations that are relevant to the listed species addressed in this CO and that we believe are consistent with the authorities of the DoD.

- Conduct further research on supplemental bat roosts as part of a Section 7(a)(1) INRMP project.
- Monitor the health and status of bat colonies on DoD lands.
- Submit all species occurrence records to the South Carolina Natural Heritage Program located at the following website https://schtportal.dnr.sc.gov/portal/apps/sites/#/naturalheritage-program.

6. Reinitiation Notice

This concludes the formal conference for the Action considered in this Conference Opinion. The DOD may ask the Service to confirm the Conference Opinion as a Biological Opinion issued through formal consultation if the TCB is listed. The request must be in writing. If the Service reviews the proposed Action and finds that there have been no significant changes in the Action as planned or in the information used during the conference, the Service will confirm the Conference Opinion as the Biological Opinion for the Action and no further section 7 consultation will be necessary.

After listing of the TCB as endangered/threatened and/or designation of critical habitat and any subsequent adoption of this Conference Opinion, the federal agency shall request reinitiation of consultation if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency Action that may affect the species or critical habitat in a manner or to an extent not considered in this Conference Opinion; (3) the agency Action is subsequently modified in a manner that causes an effect to the species or critical habitat that was not considered in this Conference Opinion; or (4) a new species is listed or critical habitat designated

that may be affected by the Action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease until reinitiation.

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McCrady Training Center
Integrated Natural Resources Management Plan
September 2023

South Carolina Military Department
and South Carolina Army National Guard
1 National Guard Road
Columbia, SC 29201

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UPDATED
INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN
MCCRADY TRAINING CENTER
SOUTH CAROLINA

SIGNATURE PAGES

This Integrated Natural Resources Management Plan (INRMP) is an update of the 2002-2006 McCrady Training Center (MTC) INRMP that has been reviewed for operation and effect and recommended for update and continued implementation (in 2013 and again in 2019). It meets the requirements for INRMPs as specified in the Sikes Act, as amended (16 US Code [USC] §670a *et seq.*). It has set appropriate and adequate guidelines for conserving and protecting the natural resources of MTC.

Approving Officials:

MCCARTY.ROY.VAN.1058856807 Digitally signed by MCCARTY.ROY.VAN.1058856807 Date: 2023.09.01 11:25:29 -04'00'

Date: _____

R. Van McCarty
Major General, SCNG
The Adjutant General

Approving Officials:

HAMMETT.ANTHONY.SCOTT.1116575562

Digitally signed by HAMMETT.ANTHONY.SCOTT.1116575562
Date: 2023.02.23 13:51:43 -05'00'

Date: 23-Feb-2023

Anthony Hammett
Colonel, US Army
Chief, G-9 Army National Guard

Approving Officials:

GIBSON.ALEX.ALFUNZA.1276363855 Digitally signed by GIBSON.ALEX.ALFUNZA.1276363855 Date: 2023.08.29 14:47:26 -04'00'

Date: _____

MAJ Alex Gibson
Environmental Program Manager
South Carolina Military Department

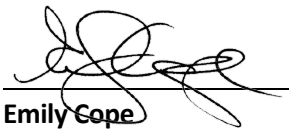
Approving Officials:

Thomas D. McCoy

Date: October 20, 2022

Tom McCoy
State Supervisor for Ecological Services
Department of the Interior – US Fish and Wildlife Service
South Carolina Ecological Services Field Office

Approving Officials:



Date: 2/2/23

Emily Cope
Deputy Director
South Carolina Department of Natural Resources

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EXECUTIVE SUMMARY

McCrady Training Center (MTC) is a National Guard training facility located in the Midlands region of South Carolina. While the primary purpose is military training, natural resources are managed for conservation and to support the military mission across the approximately 15,200-acre site in Richland County. MTC provides habitat for multiple breeding pairs of federally endangered red-cockaded woodpecker (*Leuconotopicus borealis*). The intent of the INRMP is to support the military mission at MTC using scientifically-proven land management practices in compliance with relevant laws, regulations, and applicable state and federal guidance, while ensuring no net loss in the capability to support the military mission of the installation. The INRMP is based on an adaptive, ecosystem management approach and integrates natural resources management with the military mission and other stakeholders associated with MTC.

An INRMP was first developed for MTC in 2001, and a review for operation and effect for MTC was completed in 2011. This updated INRMP is the result of a review for operation and effect done by the US Fish and Wildlife Service (USFWS), the South Carolina Army National Guard (SCARNG), and the South Carolina Department of Natural Resources (SCDNR). The review resulted in agreement to update and continue implementing the existing INRMP. No substantive changes were made to the management programs and philosophies or the goals, objectives, and implementation projects. An INRMP is required for MTC by the Department of Defense (DoD) and Army National Guard Policy because the military training requires conservation measures to minimize impacts (e.g. federally listed species management, prescribed burning, invasive species control) and to provide conditions suitable for military training.

MTC is contained within Fort Jackson and there is a cooperative relationship between the two organizations. The MTC INRMP reflects the natural resource management goals for Fort Jackson. Fort Jackson currently assists the SCARNG in the management of natural resources on MTC and participates in the development and implementation of this INRMP. The goals in the INRMP are supported by objectives, projects, and tasks to achieve these goals. Implementation tables are maintained in a database but summarized in Appendix C.

As required by National Environmental Policy Act (NEPA), an Environmental Assessment (EA) was completed in conjunction with the 2001 INRMP. The previously completed EA concluded with the issuance of a Finding of No Significant Impact (FNSI; signed in 2005) and found implementation to result in net positive effects by sustaining and enhancing the natural resources, while providing for no net loss in training lands and having no significant adverse environmental or socioeconomic impacts.

The updated INRMP reflects changes in current guidance on INRMP structure and recent data relating to natural resources, but there have been no substantive changes to the overall scope or priorities of natural resources management. Implementation of the updated INRMP will be a continuation of the Preferred Action Alternative identified in the EA for the 2001 INRMP. As such, the EA for the 2001 INRMP and the FNSI are valid for the updated INRMP and a new detailed NEPA analysis is not necessary. An Environmental Checklist and Record of Environmental Consideration (REC) have been included as Appendix I.

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1 INRMP OVERVIEW

1.1 PURPOSE AND SCOPE

The purpose of this updated Integrated Natural Resources Management Plan (INRMP) is to guide natural resources management at McCrady Training Center (MTC) for the South Carolina Army National Guard (SCARNG), based on the original INRMP approved in 2001. MTC consists of approximately 15,200 acres in Richland County in South Carolina. Land ownership is federal property licensed to the South Carolina Military Department (SCMD) through the US Department of Army (DA). General management responsibilities are specified within this license. Elements of the natural resources management are done cooperatively with Fort Jackson (US Army).

This INRMP is consistent with the *Sikes Act* (16 US Code [USC] § 670a et seq.), Army Regulation (AR) 200-1 *(Environmental Protection and Enhancement*), Department of Defense (DoD) Instruction 4715.03 (*Natural Resources Conservation Program*).

Goals and objectives provide the framework for the natural resources management programs. Goals reflect SCARNG's vision for managing MTC's natural resources. Each goal is supported by objectives that identify a management initiative or action for achieving the stated goal. The objectives then drive the development of projects and tasks to achieve those objectives. The goals and objectives in this updated INRMP are a consolidation and continuation of the goals and objectives in the 2001 INRMP and the 2011 review for operation and effect for MTC. The primary purpose of the MTC INRMP is to:

a) Support the mission,
b) Ensure good stewardship, and
c) Enhance quality of life for Army Guard personnel, and the citizens of South Carolina.

1.2 AUTHORITY AND REGULATORY COMPLIANCE

The most relevant laws, regulations, and policies with respect to natural resources management at MTC are listed below.

The **Sikes Act** (and the Sikes Act Improvement Act) requires an INRMP be written and implemented for all DoD installations having significant natural resources and developed cooperatively with USFWS and the state wildlife agency. **AR 200-1,** *Environmental Protection and Enhancement,* addresses the environmental responsibilities of all Army organizations and agencies and provides a framework for the Army Environmental Management System (EMS). This regulation provides guidance on when to develop and implement an INRMP and discusses associated coordination requirements.

The **National Environmental Policy Act** of 1969 (NEPA; 42 USC §4321 *et seq*.) requires that federal agencies consider potential environmental consequences of proposed actions. New INRMPs and major revisions of INRMPs require an Environmental Assessment (EA) to meet NEPA requirements per Army National Guard Environmental Branch (ARNG-ILE) Memorandum, 9 April 2012 and DA Memorandum, 25 May 2006. Minor updates and continued implementation of an existing INRMP do not require an EA or opportunity for public comment.

As required by NEPA and the policies described above, an EA was completed for the original 2001 INRMP to evaluate the impacts of the actions proposed in the plan on the "human environment" and the installation's natural resources. This updated INRMP is not expected to result in biophysical consequences materially different from those anticipated in the 2001 INRMP. Thus, an Environmental Checklist and a Record of Environmental Consideration (REC) were completed that tier off the EA for the 2001 INRMP. The Environmental Checklist describes the Proposed Action (update and continued implementation of the 2001 INRMP), confirms that the activities in the updated INRMP are addressed in the 2001 INRMP EA, identifies potential impacts to various environmental media, and concludes that a REC is the appropriate level of NEPA documentation. A copy of the REC is included in Appendix I.

MTC is included within the boundaries of Fort Jackson Military Reservation (FJMR), which is managed by the US Army and has its own INRMP. The MTC's INRMP is consistent with Fort Jackson's INRMP. The intent is to ensure that all natural resources management is integrated with the SCARNG's military mission and that all personnel understand their roles and responsibilities and understand Fort Jackson's responsibilities at the MTC.

1.3 RESPONSIBILITIES

Implementation of the INRMP at MTC is a shared responsibility between multiple departments within the SCMD and outside organizations.

1.3.1 SCMD

The Adjutant General

The Adjutant General is responsible for the establishment of facilities engineering and environmental services for the state and its supported installations, including implementation and enforcement of this INRMP. All department heads and their subordinates will be charged with following the standards and guidelines outlined in the plan.

Environmental/ Conservation

The Conservation section is directly responsible to ensure that the INRMP is implemented, remains current and achieves the stated management goals. This includes coordination, tracking and funding. The Conservation section is responsible for the writing and reporting of the Integrated Pest Management Plan (IPMP). The staff includes the following positions:

- Training Site Environmental Program Manager
- Conservation Manager
- Compliance Coordinator
- Geographic Information Systems (GIS) Manager
- Field Technician

Training & Operations/ Integrated Training Area Management (ITAM)

The ITAM program is responsible for ensuring the integration of training within the INRMP. They are also responsible for management of training assets across the installation. This includes the development, implementation and integration of the Range Development Plan. They are responsible for the maintenance of ranges, trails and other training assets in the training areas.

Facilities

The Construction & Facilities Management Office is responsible for the management and maintenance of all real property assets at MTC. This includes, the Site Development Plan, Master Plans, and for the implementation of the IPMP. Facilities are responsible for the management of real property, utilities, and roads at MTC.

1.3.2 Fort Jackson

The Fort Jackson Directorate of Reserve Support assists the MTC for scheduling training activities and in assigning training locations for visiting units. Natural resources specialists from Fort Jackson currently assist the SCARNG in the management of natural resources on MTC and participated in the development and implementation of this INRMP. Fort Jackson provides support to MTC in the following natural resource areas.

- Forest Management
- Fire Management
- Wildland Fire Suppression
- Wildlife Management
- T&E Management
- Law Enforcement
- Hunting and Fishing

1.3.3 Federal & State Agencies

Several agencies are involved with assisting MTC and Fort Jackson in the management of their natural resources. In addition to the ones listed below that have regulatory requirements to assist our management efforts, we also work closely with other agencies and universities to implement the INRMP and meet our management goals (See Section 4.2). Listed below are our partners that provide direct assistance during INRMP review and/or implementation.

- US Fish and Wildlife Service: The USFWS is a signatory agency to this INRMP and the Fort Jackson INRMP. USFWS cooperates with MTC on fish and wildlife management, threatened and endangered (T&E) species management, fish stocking, and waterfowl management.
- South Carolina Department of Natural Resources: The SCDNR is the primary state agency that assists MTC personnel in natural resource management and fish and wildlife management.
- US Army Corps of Engineers: USACE is the primary agency that assists MTC personnel with wetland and stream issues and management.

1.4 Review and Revision Process

In accordance with the Sikes Act, DoDI 4715.03, and AR 200-1, there are two components to the INRMP review process. An annual review process occurs so all cooperating entities receive an update regarding what has been accomplished in the last year and what is planned for the next year. The review for operation and effect (ROE) must occur at least every five years and is a more comprehensive review process involving the USFWS and SCDNR to determine whether the INRMP goals and objectives are being achieved and whether anything needs to be modified. If the natural resources management on MTC changes significantly, a major revision to the INRMP may be required.

1.4.1 Conservation Tracker Database (C-Tracker)

After the Review for Operation and Effect in 2011, SCARNG determined that the two INRMPs (MTC and Clarks Hill Training Center [CHTC]) were not truly "integrated" into the management program. The INRMPs were documents that sat on a shelf and were periodically referenced as needed. To solve this issue, SCARNG undertook an overhaul of the INRMPs and their day-to-day business practices. Part of this process also involved integrating all the programmatic elements for both MTC and CHTC.

To do this we first built an Access database around our INRMP document structure, which is referred to as the C-Tracker. The C-Tracker has four primary functions. The first function is to store and track all of our INRMP goals, objectives, projects and tasks (See Appendix C).

The second function is to incorporate this information into our daily business practices. We do this by using the C-tracker to automatically number projects and generate our server file structure. Everything saved on the server must fit into this file structure. The result is that everything we do or work on is tied to a project within our INRMP. Each of these projects are also linked to an existing STEP project, which connects the project and associated tasks to a funding source.

The third function of the C-tracker is to track and manage the Conservation budget and procurement. All proposed procurement actions are entered into the C-Tracker. All procurements must be tied to an existing project within the INRMP. The system automatically generates a tracking number, creates a file structure on the server, and generates appropriate procurement request documents based on the procurement type. Using the C-Tracker to initiate our procurement has further integrated the INRMP into our daily business practices.

The fourth function of the C-tracker is reporting. We use it to generate our annual reports and the reports for our ROE and 5-year updates. Through the C-Tracker, we are able to generate multi-year reports to look at our program from a Goals and Objective level down to individual project reports that can track time, material, and procurements for individual tasks.

The C-Tracker was developed and implemented in-house, not contracted out. The C-Tracker has met its intended purpose; the INRMP is now solidly part of our day-to-day business practice and it is updated every time we initiate a procurement action or begin a new project.

1.4.2 Annual Review and Coordination

The INRMP is reviewed annually to ensure the achievement of mission goals, verify the implementation of projects, and establish any necessary new management requirements. The SCARNG Conservation Manager will communicate annually with USFWS, SCDNR, and internal stakeholders to review the previous year's INRMP implementation and discuss implementation of upcoming programs and projects. Coordination will be done through a meeting or by letter or email. The SCARNG Conservation Manager is responsible for ensuring that annual INRMP reviews are completed, tracked, and reported. A memorandum of record detailing the annual review will be prepared and appended in Appendix I.

As part of the annual review and as a function of the INRMP, SCARNG will specifically:

1. Invite feedback from USFWS and SCDNR on the effectiveness of the INRMP;
2. Document specific INRMP action accomplishments from the previous year and discuss upcoming projects and activities.

Natural resources data and program and project information are available to cooperating agencies. They may request to see project folders or to have a site visit to view natural resources projects in progress at any time.

1.4.3 Review for Operation and Effect

Not less than every five years, the INRMP will be reviewed for operation and effect by all cooperating agencies and internal stakeholders to determine if the INRMP is being implemented, if the goals and objectives are being met, and if natural resources management is achieving necessary outcomes. The result of the review for operation and effect is a determination to continue implementation of the existing INRMP with minor updates or to proceed with a revision. The review for operation and effect may be done as part of every annual review or as a separate, more in-depth process, depending upon the parties involved and their concerns. The conclusion of the review will be documented in a jointly executed memorandum, meeting minutes, or in some other way that reflects mutual agreement.

If minor updates are needed, they will be completed by SCARNG and reviewed and approved by all parties. If it is determined that major changes are needed (i.e., sufficient to trigger a full revision), all parties will provide input and an INRMP revision and associated NEPA review.

If a review of operation and effect concludes that an INRMP must be updated or revised, there is no set time to complete the updates or revision. The existing INRMP remains in effect until the updates or revision is complete and all concurrences are received. Revisions to the INRMP will go through a more detailed review process similar to development of the initial INRMP.

1.5 Integration with Other Plans

Integration is central to the MTC INRMP. This integration takes two basic forms. The first is integration of key components of other plans into the INRMP. This is primarily accomplished through the use of the C-Tracker (described above). The second form of integration is to ensure that Natural Resources are considered in other plans and projects beyond the Conservation division (see Appendix H for a complete list). This is accomplished through the SCARNG Environmental Review program. All SCARNG projects are subject to Environmental Review Process at which time the potential effects on natural resources are evaluated.

Due to the unique co-managed nature of MTC, there are other natural resources plans that have particular relevance to the management goals and objectives identified in the MTC INRMP:

Fort Jackson

- Fort Jackson INRMP
- Red Cockaded Woodpecker (RCW) Management Plan
- Smooth Coneflower Management Plan
- Integrated Wildland Fire Management Plan for Fort Jackson
- FJMR Range Regulation 350-14 (Environmental restrictions related to range use including on MTC)

MTC/SCARNG

- Integrated Pest Management Plan

2 INSTALLATION OVERVIEW

2.1 GENERAL DESCRIPTION

The SCMD is comprised of approximately 11,000 part and fulltime service members and civilian employees including nearly 9,200 Soldiers, 930 State Guard and Joint Service Detachment members, and 500 state employees. It is headquartered at 1 National Guard Road in downtown Columbia, South Carolina and has more than 60 operational facilities throughout the state in 39 of 46 counties. The MTC provides the primary training area for these soldiers (SCMD *Fact Sheet* Feb 2019).

MTC is located within the state of South Carolina in Richland County. MTC comprises approximately 15,200 acres within the boundaries of the Fort Jackson (Figure 1 in Appendix B). MTC is located in the south eastern portion of Fort Jackson. Fort Jackson is located approximately five miles east of the business district within the city limits of Columbia, the state capital. Columbia is one of the state's largest cities, with a metropolitan area population of more than 800,000.

MTC is bounded by Leesburg Road to the south, Highway 601 to the east, Highway 268 to the northeast, and Division Road within the Fort Jackson to the northwest. Other than Fort Jackson, private land surrounds MTC.

2.2 HISTORY

MTC's history is intertwined with Fort Jackson's history. Fort Jackson was established on June 17, 1917 as Camp Jackson in anticipation of the US entering World War I. The land (1,156 acres) was purchased in part from the Wade Hampton estate by the City of Columbia and then donated to the Federal Government. The camp was completed in eight months and was established primarily as an infantry training facility, but during the war also trained an aero squadron, balloon company, telegraph battalion, 17a regiment of heavy artillery, and support units (SCARNG ICRMP 2017).

Although heavily used during the World War I, the camp was abandoned during the summer of 1922 and much of the camp either torn down or repurposed. From 1925 until 1939, the camp was turned over to the SCARNG for summer training and the Guard had to rebuild facilities.

In 1939, Camp Jackson was revived as a result of the mobilization for World War II. The camp was expanded to 53,000 acres and the cantonment area was rebuilt including construction of some 569 buildings. On August 15, 1940, Camp Jackson became Fort Jackson and it was designated as a permanent camp. Fort Jackson was heavily used during World War II, but use declined until the Korean War. Since the 1950s, Fort Jackson has maintained its primary mission of basic infantry training and specialized training. Specialized training has included radio operation, administration and supply, and a WAC basic training program. In 1968, Fort Jackson was incorporated into the City of Columbia.

Starting in approximately 1979, the 15,200 acres of Fort Jackson that comprise MTC (formerly the Leesburg Training Center) has been licensed to SCARNG from the Department of the Army. MTC is the largest of the SCARNG training centers and approximately 108 SCARNG facilities spread throughout the state. This INRMP pertains only to MTC; a separate INRMP governs CHTC.

2.3 MILITARY MISSION

The stated mission of MTC is to "*SCARNG Training Center supports readiness by providing a wide range of services and infrastructure to tenant and transient units and organizations, to include maintaining facilities, training areas, and live fire ranges, at training sites across the state to enable effective training in a safe and sustainable environment.*

Provides a wide range of Soldier and Family care and support commensurate with Active Component capabilities to foster resiliency.

O/O Conducts Joint Reception, Staging, Onward Movement and Integration (JRSOI) to rapidly support continuous state emergency operations ISO federal or state declared emergencies." (MTC Command Brief 2019)

MTC is the primary training area for the SCARNG and as such it plays an important role in meeting the dual mission of SCARNG. MTC provides training opportunities in support of the federal mission and serves as a staging site for state missions. MTC is the home of the 218th Regiment (Leadership) Total Army School. The 218th Regiment serves as the schoolhouse for the southeastern region. A Unit Training Equipment Site (UTES) is also located on MTC. MTC provides a training ground for the following equipment: M1-A1 Abrams tanks, Multiple Launch Rocket Systems, M2 Bradley fighting vehicles, and AH-64 Apache attack helicopters.

The South Carolina National Guard has deployed more than 25,000 service members since Sept. 11, 2001 in support of Operations Nobel Eagle, Iraqi Freedom, New Dawn, Enduring Freedom, Freedom's Sentinel, Inherent Resolve, Spartan Shield, Kosovo Force, and the European Deterrence Initiative, as well as other contingency training and mobilizations in support of combatant commands US Africa Command, US Central Command, US European Command, US Northern Command, US Southern Command, US Pacific Command, and US Cyber Command.

MTC Soldier-Days Trained
(provided by Range Control)

Component	FY 19	FY 20 (as of 07/13/20)
Active Component	60,438	42,132
National Guard/Reserve	73,059	84,883
Other DOD	114,483	47,537
Non-DOD	42,479	26,448
Totals	**290,459**	**201,000**

Deployment/Federal Mission: The South Carolina National Guard has deployed more than 25,000 Soldiers and Airmen in support of overseas contingency operations since September 11, 2001. As of February 2019, approximately 300 service members are mobilized in support of homeland defense and overseas missions, including rotational support of the National Capital Region and ongoing support along the Southwest Border:

- In June 2018, nearly 300 South Carolina National Guard Airmen and a dozen F-16 fighter jets deployed under the 407th Air Expeditionary Group in Southwest Asia in support of an Air Expeditionary Force rotation
- In July 2018, South Carolina National Guard Security Forces Squadron Airmen returned home from a six-month deployment to Southwest Asia

- Approximately 90 Soldiers with the 125th Cyber Protection Battalion mobilized March 2018 for a yearlong deployment to the National Capital Region under operational control of US Army Cyber Command
- Six Soldiers with 2nd Battalion, 641st Aviation Regiment mobilized November 2018 for a nine-month deployment to Afghanistan in support of Operation Freedom's Sentinel
- More than 40 Soldiers with the 678th Air Defense Artillery Brigade mobilized January 2019 for a yearlong deployment to the National Capital Region in support of Operation Noble Eagle
- Approximately 140 Soldiers with the 1221st Engineer Clearance Company mobilized January 2019 for a nine-month deployment in support of Operation Inherent Resolve
- The South Carolina National Guard provides continued support to the Southwest Border under Operation Guardian Support. Currently, approximately 15 Soldiers are mobilized to provide personnel and aviation assets in support of the Department of Homeland Security
- In September, 2019 the SCNG responded to Hurricane Dorian with more than 1,600 Soldiers and Airmen providing support to civil authorities in preparation, during, and in the aftermath of the storm. The Soldiers and Airmen provided evacuation and security support, transportation and communication assets, and provided debris clearing support.
- In Fiscal Year (FY) 2020, the South Carolina National Guard is expected to mobilize more than 1,000 service members in support of homeland defense and overseas missions. Projected deployments include aviation support to the Kosovo Force; sustainment, signal, and combined arms support to Operation Spartan Shield; engineer support to Operation Inherent Resolve and the European Deterrence Initiative; aviation medevac support to Operation Freedom's Sentinel; engineer and personnel support to Eager Lion in Jordan; as well as continued air defense artillery rotational support of the National Capital Region and ongoing aviation support along the Southwest Border
- Sixteen Soldiers in the South Carolina National Guard have paid the ultimate price in support of combat operations since September 11, 2001

State Emergency and Management Assistance Compact mission support (SCEMD Fact Sheet Feb 2019):

- The SCEMD serves as the primary point of contact, signatory, and coordinating element for the mission
- The South Carolina Air National Guard sent a contingent of support personnel to assist in command and control for Tyndall Air Force Base after Hurricane Michael, a category 4 hurricane, devastated the pan handle of Florida after making landfall Oct. 10, 2018
- At the peak of operations, more than 3,400 South Carolina National Guard Soldiers, Airmen, state employees, and members were mobilized to assist South Carolina after Hurricane Florence made landfall September 14, 2018. While Hurricane Florence had grown to a category 4 storm, the winds rated it as a category 1 when it came ashore in the southern portion of North Carolina. The slow speed of the storm brought trillions of gallons of rain to the Carolinas and caused devastating flooding in the Pee Dee region of South Carolina. Response missions included assisting with coastal evacuations, engineer support of infrastructure to include sandbag operations and aqua barriers along main coastal routes. Post-storm missions included high water evacuations, aerial reconnaissance, and road repairs
- In May 2018, SCEMD deployed two mitigation specialists in response to severe flooding in Hawaii to assist in planning and developing mitigation actions and projects

- The South Carolina National Guard responded to snow and ice that impacted York County area and Rock Hill Jan. 17, 2018 sending two Vehicle Recovery Teams (VRTs) to assist the South Carolina Highway Patrol
- The South Carolina National Guard responded to snow and ice that impacted the low country of the state, Jan. 3, 2018. Soldiers activated for three VRTs with support personnel and liaison. VRTs performed 6 missions in support of South Carolina Highway Patrol. They recovered a total of 6 vehicles at mile markers 8, 18 and 57 on I-95
- 169th Fighter Wing supported the Aerospace Control Alert mission; defends east coast air space in support of North American Aerospace Defense Command
- In September, 2019 the SCNG responded to Hurricane Dorian with more than 1,600 Soldiers and Airmen providing support to civil authorities in preparation, during, and in the aftermath of the storm. The Soldiers and Airmen provided evacuation and security support, transportation and communication assets, and provided debris clearing support.

2.4 CURRENT LAND USE

MTC is devoted to providing training lands for the men and women of the SCARNG. MTC also provides limited access to the public for outdoor recreation on the Palmetto Trail along the southern border. Within the 15,200-acre training center, there are 7,658 acres designated for maneuver training; 3,211 acres designated for heavy maneuver training; 3,819 acres limited to certain types of training; and 292 acres for cantonment.

The cantonment area contains parade grounds, the 218th Regiment (Leadership) facilities, and MTC administrative facilities, McCrady Billeting, McCrady Fire Station, fuel and wash-rack facilities, Unit Training and Equipment Site, United States Marine Corps Reserve facilities, and the Battle Simulation Complex. All maneuver-training areas on MTC are regarded as suitable for light maneuver.

There are 210 miles of roads, trails, and firebreaks. Of this total, there are 6 miles of primary roads, 87 miles of secondary roads, and 117 miles of tank trails and firebreaks (MTC GIS Data 2016). The SCARNG has the following training facilities at MTC:

- Basic weapons marksmanship ranges: 6
- Indirect fire points: 18 (17 artillery/ mortar)
- Light maneuver areas: 43
- Heavy maneuver areas: 11
- Forward Operating Bases: 2
- Mobile Operations in Urban Terrain site: 1
- Landing zones: 18
- Direct fire range: 1
- Tank/Bradley range

2.5 REGIONAL LAND USE AND REGIONAL PLANNING

2.5.1 Regional Land Use

The central Midlands of South Carolina is home to five military installations totaling 70,650 acres: Fort Jackson, MTC, Shaw Air Force Base (AFB), McEntire Joint National Guard Base, and Poinsett Range. These installations are used by personnel from the Army, Navy, Air Force and Marines. These installations have over 12,000 full time military personnel in addition to over 7,000 civilian employees. They provide training opportunities for over 65,000 soldiers, sailors, airmen, and marines annually. Our installations annually support over 2,000,000 training man-days and over 10,000 training flights. The replacement cost of these facilities is more than $6,000,000,000. This hub of high-density military training is contained within area approximately the size of Joint Base Lewis McChord.

In addition to the concentration of military training, this area has been referred to as "The Green Heart" of South Carolina. The area has some of the best agricultural, timber and recreational lands and waters in the state. The area has cultural history that dates back over 12,000 years. Post-Civil War, the region was a center for African-American settlement and remains an area of strong cultural attachment.

At the center of the Region is the confluence of the Wateree, the Congaree and Santee rivers (COWASEE Basin). The COWASEE Basin Focus Area covers over 315,000 acres in the midlands of South Carolina and includes the Congaree, Wateree and Upper Santee Rivers. This has created a unique natural area that is anchored by the Congaree National Park and Manchester State Forest.

The 26,000-acre Congaree National Park is the heart of the basin and is home to the largest old growth bottomland hardwood forest remaining in the eastern United States. The focus area is a priority waterfowl restoration area where many partners are implementing research and management to improve waterfowl habitat and populations. Staff from SCDNR and USFWS band ducks as part of a waterfowl monitoring project. To date, 45% of the COWASEE Basin Focus Area is protected either as public conservation land or through private conservation easements.

The Congaree National Park and surrounding region has been designated a United Nations Educational, Scientific and Cultural Organization (UNESCO) Man and Biosphere Reserve (MAB). The MAB program combines natural and social science with economics and education to improve human livelihoods and safeguard natural and managed ecosystems. MAB promotes innovative approaches to economic development that are socially and culturally appropriate, and environmentally sustainable. The MAB program provides a unique platform for cooperation on research and development, capacity-building and networking to share information, knowledge and experience on biodiversity, climate adaptation and sustainable development. It contributes not only to better understanding of the environment, but also promotes greater involvement of science and scientists in policy development concerning the wise use of biological diversity.

There are over a dozen public access areas dedicated to outdoor recreation, not including blue trails, hunt clubs and fish camps. Outdoor recreation within the region is significant, both economically and in quality of life. There are hiking trails along the boundary of MTC and Fort Jackson installations to provide recreational benefits to our service members, their families, school groups, and the general public. These recreational activities have not resulted in any restrictions or impacted our ability to train. In fact, they have increased public awareness and created a better understanding of our activities. Private

industry has donated labor and materials to build boardwalks and improve parking areas along these trails. Our Recreational lands face the same threats from unfocused development as our military installations, farms, timberlands and green spaces.

2.5.2 Army Compatible Use Buffer

The military installations in the Midlands, along with several partners, have been working together since 2007 forming the Midlands Area Joint Installation Consortium (MAJIC). Working together under MAJIC, the partners identified a 650-square mile focus area that incorporated all five military installations, a national park and a SCDNR focus area. Until the Eastern North Carolina Sentinel Landscape that was designated in 2016, MAJIC was the only Program that was focused on multiple installations, across multiple services.

The purpose of MAJIC is to facilitate a region–wide approach to compatible use of resources to strengthen military mission, community well-being, economic development, and to conserve the environment and natural resources. The primary goal of MAJIC is to reduce encroachment pressures on the installations through the use of conservation easements and fee-simple purchases.

To date within our focus area, we have worked with 30 separate landowners on 47 separate Protection Projects. We have encumbered over 25,000 acres at estimated fair market value of over $36.6 million.

2.5.3 Sentinel Landscape

We are currently working our way through the Readiness and Environmental Protection Integration (REPI) Sentinel Landscape application process. The MAJIC Sentinel Landscape is uniquely positioned at the nexus of several federal interests, and conservation concerns. We have a very supportive and military-friendly local government and population. This provides us with opportunities to maximize any federal investment in the region. The installations of MAJIC are taking a multi-tiered approach to protecting our training lands. To accomplish this, the different aspects of encroachment are addressed within individual

THE CENTRAL MIDLANDS SNAPSHOT

(from MAJIC Sentinel Landscape Proposal 2016)

- **Economics**
  - Low cost of living (% of national average)
    - Overall Cost: 91 %
    - Housing/Property Value: 68 %
    - Energy: 114 %
  - Thirty cents of every dollar spent is connected to military installations
- **A Supportive Community**
  - Operational military installations in the area since prior to World War I
  - 26 separate agencies and NGOs participated
- **Transportation**
  - Less than 100 miles to Port of Charleston
  - Multiple railheads
  - Intersection of major North-South & East-West transportation corridors
- **Climate Resiliency**
  - Not impacted by flooding from sea level rise
  - Quickly recovered after regional 1000-year flood event in 2015
- **Urban Centers**
  - Over 800,000 people in the metro region
  - Opportunities for servicemen and families
  - Available Installation support services
- **Outdoor Recreation**
  - Congaree National Park
  - Sesquicentennial State Park
  - Poinsett State Park
  - Wateree River Heritage Preserve
  - Congaree Bluffs Heritage Preserve
  - Manchester State Forest Palmetto Trail
  - Mill Creek Nature Center
  - Congaree and Wateree Rivers
  - Sparkleberry Landing
  - Mill Creek County Park
  - SCDNR Cooks Mountain WMA
- **Universities**
  - Technical assistance and research
  - Continuing Education opportunities
- **Conservation**
  - Congaree National Park
  - UNESCO Congaree Man and Biosphere Reserve
  - NRCS Longleaf Pine Initiative
  - Atlantic Coast Joint Venture COWASEE Basin

installation plans. They all reference back to MAJIC and its efforts to ensure regional consistency of message and goals. MAJIC is working closely with several regional partners to ensure that our goals are consistent with theirs. This includes working with the Stronger Economies Together initiative, a USDA Rural Development program. This program has identified Defense & Security as one of three key economic development clusters. The Central Midlands Council of Governments is developing an agricultural plan to help local farmers provide food to institutions in the region, like the military bases. This will provide economic incentives to maintain farmland around our installations. The goals of the MAJIC program matches well with our partners' goals to promote a Compact Urban Core and Multi-Center growth pattern that allows economic growth across the region while maintaining the rural character of our natural and cultural history.

2.5.4 State Wildlife Action Plan

Every military installation should evaluate and incorporate any applicable information from the State Wildlife Action Plan (SWAP) into their natural resources management plans and agreements (per DoDI 4715.03). Every state has one of these comprehensive plans that address species that have been determined to have the greatest conservation need. SWAPs serve as a framework for management of wildlife habitat, especially for those species that are in decline. During the INRMP update process, the SCARNG consulted the South Carolina SWAP (SCDNR 2015) to ensure INRMP goals, objectives and strategies are consistent with South Carolina's overall statewide and site-specific plans. The South Carolina SWAP is available at http://dnr.sc.gov/swap/index.html.

The South Carolina SWAP provides guidance for addressing limiting factors that negatively impact the species of greatest conservation need, or "priority species". The SWAP also includes strategies and tools that can be implemented by SCDNR and its partners and is intended to be a cooperative and proactive management plan that emphasizes partnerships in maintaining wildlife and plant resources. There are nine Conservation Action Areas (CAAs) identified in the 2015 SWAP, and these CAAs affect all priority species. MTC shares many overlapping conservation actions with these CAAs, as can be seen in **Table 1**.

Table 1. South Carolina SWAP Conservation Action Areas and MTC INRMP Management Areas

Conservation Action Areas	MTC Management Areas	INRMP Section
Education and Outreach	Outreach, Awareness, and Education	3.3
Habitat Protection	Fish and Wildlife; Threatened, Endangered and Special Status Species	3.9 & 3.10
Invasive and Non-Native Species Control	Pests	3.11
Private Land Cooperation	-	-
Public Land Management	Entire INRMP	All
Regulatory Actions	Authority and Regulatory Compliance	1.2
Survey and Research Needs	Various Natural Resource Management Topics	Chapter 3
Urban and Developing Lands	Regional Land Use and Regional Opportunities & Climate Change and Regional Growth	2.5.1 & 3.12
Climate Change (added in 2013)	Climate Change and Regional Growth	3.12

Source: SCDNR 2015

MTC lies in the Sandhills Ecoregion, which contains the fire-depended longleaf pine community. Conservation-oriented management in this region was boosted by the listing of the RCW and restoring

the longleaf pine-wiregrass community followed as a future conditions goal – this is also true for management of longleaf pine forests at MTC, as reflected in the goals and objectives in Section 3.6.

Two relatively new pressures that South Carolina is grappling with as a state, and shared by MTC, are encroachment caused by regional growth and climate change (Section 3.12). CCA number 8 – Urban and Developing Lands – is a major concern for South Carolina in the Sandhills Ecoregion where MTC lies. MTC has been working in recent years with other military installations in South Carolina to address and prevent impacts of encroachment. Climate change – CAA number 9 – will impact factors throughout South Carolina such as drought, temperature extremes, severe weather, water quantity, and sea level rise.

There are 493 animal species and 332 plant species listed as priority species in the SWAP. Several of these species have been documented on MTC. For a complete list of priority species in South Carolina, refer to Chapter 2 of the 2015 South Carolina SWAP. For a complete list of rare species documented on MTC, see Appendix E.

2.6 CONSTRAINTS AND OPPORTUNITIES

There are several constraints at MTC that may present environmental issues or constraints for existing or potential training requirements. These includes limitations due to noise, fire risk, T&E species, cultural resources, and wetlands.

2.6.1 Current Constraints

RANGE RESTRICTIONS

To minimize effects in the surrounding civilian communities, Fort Jackson has implemented the following voluntary restrictions as part of FJ Reg 350-14, which MTC follows:

- Mass fires will be limited to the minimum deemed "absolutely essential" to ensure successful attainment of the field training exercise objective.
- There will be no mass fire by units larger than a single battery between the hours of 2200 –2400 daily.
- Artillery firing will not be permitted between 2400-0630 daily and from 1000 - 1300 Sunday (Exceptions will be considered)
- Units planning to conduct mass training of more than one battalion of artillery (all calibers) must coordinate 90 days in advance of the exercise with the Installation Range Officer and Directorate of Plans, Training, Mobilization and Security, so that appropriate advance publicity of the firing can be made by the Installation Public Affairs Office.
- During extreme weather conditions, such as heavy overcast, Range Control may impose additional restrictions to reduce noise levels.
- Tank cannon live fire is restricted from 2400 to 0630 daily and between 1000-1300, Sunday.
- M28A1's will be limited to minimum deemed essential for successful attainment of training objectives and insurances of safety.
- MLRS RRPR firing is not authorized for live fire from 2400 to 0630 daily and Sunday from 1000 to 1300. Exceptions will be considered.
- Mortar firing will not be permitted between 2400-0630 daily and between 1000-1300, Sunday.

- Smoke producing materials will not be used under conditions that are dangerous to life or property outside of the training area(s). Smoke will not be released within 500 meters of the installation boundaries
- Do not conduct any smoke generator operations closer than 3,000 meters of any installation boundaries, if the wind direction is not in the opposite direction of the closest installation boundary.
- Post smoke control points no closer than 1000 meters from the installation boundaries.

THREATENED AND ENDANGERED SPECIES

MTC is home to a variety of federal and state listed species. These species, as well as others known to reside in Richland County, are listed in Table 6.4. Three federally endangered listed species, RCW, the smooth coneflower, and the rough-leaved loosestrife, have populations on MTC.

There are a total of sixty one (61) active clusters of the RCW; thirty six (36) of these are located on MTC and the remainder on the Fort Jackson. A cluster is defined as the total area encompassing cavity trees occupied or formerly occupied by a RCW group, plus a 200-foot buffer zone. There is also a 0.5-mile restrictive foraging area around each cluster. While T&E species do not impact the availability of training lands, restrictions placed on training near/around these clusters can inhibit maneuver training. Weapons firing is prohibited in the clusters and maneuver training is limited to established roads.

The habitat of the smooth coneflower is along roadsides, cleared openings, and open wooded areas. It is usually characterized by abundant sunlight and little competition by other plant life. One known occurrence of this plant is located in a fenced-in area along the Statue of Liberty Tank Trail. The rough-leaved loosestrife is located between training area 20C and Buffalo Creek. Both the smooth coneflower and rough-leaved loosestrife have minimal impact on the type of training by the SCARNG.

Through an Interagency Agreement between Fort Jackson and the USFWS, a management plan for the RCW has been developed for the Fort Jackson and MTC lands. The implementation of the MTC INRMP is consistent with the RCW management plan and other endangered species management plans.

WETLANDS

The installation has a total of 1,642 acres of wetlands (Figure 4 in Appendix B). Vehicles and mechanized equipment are only allowed to traverse wetlands on established roads and trails. Foot traffic through wetlands is not generally allowed during training periods because of its undesirable nature. A majority of training occurs in the upland environment.

CULTURAL RESOURCES

The ICRMP incorporates all SCARNG sites including MTC. Archaeological surveys have identified 242 archaeological sites and six cemeteries at MTC. Of the archaeological sites evaluated 41 have been recommended as eligible for listing in the National Register of Historic Places. Digging, excavating, removing, altering, or otherwise disturbing or damaging the area within a 50 meter radius of eligible archaeological sites and cemeteries is prohibited at MTC.

NOISE

Military installations tend to attract activity from the civilian sector. For example, sizeable new communities may grow up near an installation or existing communities may expand toward or around an installation's boundaries. This growth process can place severe limitations upon the ability of a military installation to support training and for assigned units to maintain an adequate level of readiness. As noise impacts from military activities increase upon the civilian communities, both litigation and/or political pressures, which could result in degradation of the installation's mission, also increase. Not only does the number of complaints to installation commanders increase dramatically, but also so does the number of complaints to elected officials.

Since 1993, Army Environmental Policy Institute studies have documented the potential threat that noise poses to readiness training. A survey reported that 43% of the installations surveyed experienced noise problems that required either rescheduling or moving training ranges to resolve. A reflection of this survey's results can be found in the ranking of environmental noise in the Army Environmental Compliance Pillars. In 1999, training and testing range noise control was ranked second, falling only behind particulate matter/dust control.

2.6.2 Potential Future Constraints

ENVIRONMENTAL RESOURCE MANAGEMENT ACTIVITIES

Environmental management at MTC is aimed at sustaining and maintaining range and training lands as a prime training resource. In general, management activities on MTC do not significantly hinder training activities. However, field activities to restore or rehabilitate areas may limit certain training activities temporarily.

CLIMACTIC CONDITIONS

Climate models for this area predict a general increase in extreme weather events. Specifically, there will be more intense storm and rainfall events followed by long periods of draught. Increased average summer temperatures are also predicted, which will exacerbate periods of draught. See Appendix F, Section F.4 for more details.

These conditions could result in three significant constraints:

- Reduced access to training areas, resulting from damage to the road and trail network resulting from storm water run-off and flooding.
- Loss of training time due to excessive high temperatures and thunder storms
- Increased risk of soldier death and injury resulting from extreme weather

EROSIVE SOILS

As mentioned above current climatic models predict an increase of extreme weather events in the region, specifically intense/ heavy rainfall events followed by long periods of draught. This will increase the likelihood of issues resulting from soil erosion. The primary soil association at MTC is the Vaucluse-Ailey-Pelion Association (sand/loam) which has low erodibility potential, unless disturbed or located on a steep grade subject to plentiful rainfall (Figure 3 in Appendix B). All three of these erodibility factors are common at MTC. Based on climate models, we anticipate an increase in heavy rainfall events (both frequency and intensity).

Figure 1: COL Creek Bridge after 2015 Storm (22" of rain in 48 Hours)

It can be reasonably anticipated that we will see an increase in erosion issues, specifically associated with our road and trail network. This would impact both our ability to perform management activities and impact our training capability.

Constraints could include restricted access to areas during repair, restoration and rehabilitation. MTC's small size severely limits its ability to rotate heavy maneuver areas for natural reclamation, contributing further to the soil erosion problem. These potential constraints could be mitigated by improvements to the road and trail network to allow for improved handling of storm water run-off.

2.7 ENVIRONMENT OVERVIEW

MTC is within the Sandhills Ecoregion of South Carolina, an inland habitat type characterized by rolling hills capped by deep, coarse sands. This region is wedged between the Coastal Plain and Piedmont regions. Scientists believe sand hills were formed by ice age oceans that rose and receded in response to melting and freezing of polar ice caps. Beaches formed wherever the water met the land, and the sand hills were left behind when the ocean receded.

Dominant plants in the forests on the installation are long-leaf pine (*Pinus palustrus*) and scrub oak (*Quercus laevis*), with other mixed hardwoods and pines. Disturbance and land use changes have contributed to the establishment of introduced vegetation, most notably slash pine (*Pinus elliottii*). Woodland and forests on the MTC are abundant, including major forest community types found at the installation are longleaf pine/turkey oak, scrub oak, upland hardwood, and bottomland hardwoods. There are no remaining open grasslands on the installation. Fauna are typical of the region, benefitting from the undeveloped nature of the installation.

Sandhills Plant Life

Because the sandhills contain dry, nutrient-poor soil, this habitat contains only hearty, well-adapted plants. Turkey oak and longleaf pine trees are typical because their rooting systems allow them to extract water from various soil depths. These species are also adapted to the frequent, lightning-induced fires that strike the sandhills. Longleaf pines have a thick, fire-resistant bark, and turkey oaks burned by fire will regenerate because the fire does not damage their root systems. Several fire-resistant grass species inhabit the sandhills, including sorghastrum, broomsedge and three-awn grass. Several plants on the federal and state lists of *threatened or endangered species* are found on the installations.

Sandhills Wildlife

The sandhills support many reptile and amphibian species adapted to the habitat's dry, sandy conditions. These include broad-headed skinks, oak toads, six-lined racerunner lizards, glass lizards and hog-nosed snakes. Mammals that inhabit the sandhills include white-tailed deer, opossum, gray fox, bobcat, fox squirrel and cottontail rabbit. Birds that inhabit the sandhills include the mourning dove, sparrow hawk, red-tailed hawk and wild turkey. The RCW, a federally endangered bird, is found on MTC and Fort Jackson.

The physical environment at MTC is summarized in more detail Appendix F, while the biological environment is summarized in Appendix G. Rare, threatened, and endangered species at MTC are summarized in Appendix E. There are three federally endangered species at the MTC: RCW (*Picoides borealis*), smooth coneflower (*Echinacea laevigata*), and rough-leaved loosestrife (*Lysimachia asperulaefolia*).

3 NATURAL RESOURCES MANAGEMENT

This section summarizes each technical area of natural resources management. In each section, relevant management recommendations, objectives, policies, and actions are presented. The main issues and concerns pertaining to natural resources management on MTC include managing for the various federally-listed species, control of invasive species, and soil erosion. A complete summary of all relevant laws, regulations, executive orders (EOs) and policies is provided in Appendix J.

The goals and objectives in this updated INRMP are a continuation of the goals and objectives in the 2001 INRMP, with some minor updating of language and the addition of success criteria. These goals and objectives are achieved by undertaking projects and tasks, which are summarized in the Implementation Tables in Appendix C. These supporting actions can include in-house actions undertaken by SCARNG staff or larger actions working with other state and federal partners like Fort Jackson or SCDNR, working with universities, or working with non-governmental organizations (NGOs). Other actions may be completed by working with vendors through the state contracting procedures. In addition, actions can be performed using non-DoD funds or by volunteers.

The following sections are not included in this INRMP because they do not apply to MTC:

- Bird/Wildlife Aircraft Strike Hazard (BASH) – There is no BASH program at MTC.
- Coastal/Marine Management – There is no coastal or marine habitat at MTC.

Natural resources management at MTC occurs in collaboration with Fort Jackson. Generally, Fort Jackson takes the lead on wildland fire management, hunting and fishing programs, RCW management, and timber harvesting. SCARNG and SCMD either take the lead or share implementation with Fort Jackson on all other natural resources management on MTC.

3.1 PROGRAM MANAGEMENT

Program management captures those elements that arch across the entire Conservation Program at MTC, not just for one resource topic. Consistency and coordination are essential to maximize project benefit, and programmatic success. The C-Tracker is a critical part of the program management.

Guidelines for Program Management

- Managing the ecosystem to maintain biological diversity.
- Improving the quality of wildlife habitat for game and nongame species.
- Providing special protection and management leading to endangered species recovery as identified.
- Restoring damaged training areas and maintaining training areas for optimum use.
- Cooperating with Ft. Jackson in meeting their objectives in forest management activities and endangered species management.

GOAL: OUR GOAL IS TO BE A PROACTIVE PROGRAM THAT ANTICIPATES AND MEETS THE NEEDS OF THE NATIONAL GUARD. WE STRIVE TO BE A NATIONAL LEADER IN EFFICIENCY, INNOVATION AND DIVERSITY, WHILE PROVIDING OUR STAFF AN ENVIRONMENT THAT EMPOWERS AND SUPPORTS THEIR CREATIVITY AND INITIATIVE.

Success Criteria

- **Green:** Maintain staffing levels above 80% of manning model, maintain above a 95% obligation rate, and maintain database and tracking systems.
- **Amber**: Maintain staffing levels above 60% of manning model, maintain above a 60% obligation rate, and maintain database and tracking systems.
- **Red**: Maintain staffing levels below 60% of manning model, obligation rate below 60%, and failure to maintain database and tracking systems.

Objective 1. Facilitate program implementation through the use of seasonal staff.

The Columbia Metro Area has a large population of students seeking under graduate and post graduate degrees in conservation related fields. This provides us with a unique opportunity to supplement our staff to work on seasonal projects.

Success Criteria

- **Green**: Have hiring plans and announcement paperwork completed before March. Have candidates hired by May 16th
- **Amber**: Have hiring plans and announcement paperwork completed after March. Have candidates hired after May 16th
- **Red**: Needed seasonal staff, but not hired

Objective 2. Ensure That All Planning Documents are Relevant & Current

Keep all planning documents current through annual reviews, and updates. This project also includes document revisions, and other administrative tasks to improve document management and document relevance in day to day business practices.

Success Criteria

- **Green:** 100-90% of documents filed and archived
- **Amber*:*** 80-90 of documents filed and archived
- **Red:** <80% of documents filed and archived

Objective 3. Maintain current and accurate species lists

The purpose of this objective is to have an accurate species information that is both current and in easily accessible and usable format. In the past individual surveys were in different formats and stored in in multiple locations making it difficult to access the information. Our species data has been transferred to central species tracking database. This database contains both individual occurrences recorded from Planning Level Surveys, and general presence/ absence for each of our installations. This includes both verified records and potential occurrences.

Success Criteria

- **Green:** 100-90% up time availability of database. New data entered within 90 days of survey completion
- **Amber:** 89-75% up time availability of database. New data entered within 180 days of survey completion

- **Red:** <75% up time availability of database. New data entered within >180 days of survey completion.

OBJECTIVE 4. MAINTAIN EASY AND UP TO DATE ACCESS TO ALL RELEVANT DOCUMENTS.

Maintain easy and up to date access to all records, surveys, reports, reviews and other relevant documents. This is accomplished through the use of both a document tracking database and our file management system.

SUCCESS CRITERIA

- **Green:** 100-90% up time availability of Servers. New documents entered within 90 days of survey completion
- **Amber*:*** 89-75% up time availability of Servers. New documents entered within 180 days of survey completion
- **Red:** <75% up time availability of Servers. New documents entered within >180 days of survey completion.

OBJECTIVE 5. CONTRIBUTE TO THE NATIONAL GUARD ENVIRONMENTAL PROGRAM AT A NATIONAL LEVEL

The success of the local Environmental Program is directly linked to the success of the National Program. To facilitate that success, SCARNG Conservation staff will participate in committees, review policy documents and reports, and provide general feedback and support to the National Guard Bureau (NGB) to facilitate a strong overall environmental program.

SUCCESS CRITERIA

- **Green**: All actions are recorded and tracked
- **Amber**: 50%-99% of actions are recorded and tracked
- **Red**: <50% of actions are recorded and tracked

OBJECTIVE 6. ENSURE FISCAL SUSTAINABILITY FOR THE CONSERVATION PROGRAM

In order for the SCARNG Conservation Program to be successful, it requires sound and sustainable fiscal management. This includes programming out year requirements, managing budgets and tracking procurements.

SUCCESS CRITERIA

A consistently funded program that maintains an obligation rate above 95%, while maintaining 100% compliance with fiscal law and best management practices (BMPs).

- **Green*:*** 100-95% Obligation Rate
- **Amber*:*** 94-60% Obligation Rate
- **Red:** <60% Obligation Rate

OBJECTIVE 7. TO EMPLOY A STAFF OF SUBJECT MATTER EXPERTS THAT ARE INNOVATIVE LEADERS AND CURRENT IN THEIR FIELD.

To employ a staff of subject matter experts that are innovative leaders and current in their field. That are able to use their knowledge and experience to implement program management plans and support the mission of the SCARNG.

SUCCESS CRITERIA

Each staff member attends at least one refresher training per year and one training session that expands their current knowledge base. They also teach or present at least one class, seminar, or event each year.

- **Green**: 100-75% of Full Time Staff Meets Both Goals
- **Amber**: 74-50% of Full Time Staff Meets Only One of the Goals
- **Red**: <50% of the Full Time Staff Meets the Goals

OBJECTIVE 8. MAINTAIN STATE OF THE ART TECHNOLOGY

Conservation Management requires the analysis of complex and diverse systems. Understanding these systems is often a very data intensive undertaking that requires repackaging to communicate the information. As a result, Conservation projects often require and utilize the most current technology.

SUCCESS CRITERIA

This Success Criteria is based on the completion, implementation and maintenance of a 5-year automation plan with annual updates and the tracking of down days due to equipment failure or unavailable equipment.

- **Green**: Current and updated plans, and 100% - 75% equipment not more than 1 year past planned life
- **Amber**: Plans not updated or current, or >75% of equipment more than 1 year past planned life cycle
- **Red**: "Down Days" due to IT failure exceed 15%

OBJECTIVE 9. SUPPORT PROGRAM IMPLEMENTATION THROUGH PROVIDING STAFF THE TOOLS, EQUIPMENT, AND SUPPLIES NEEDED TO PERFORM THEIR DAY TO DAY WORK ACTIVITIES.

In order to effectively perform their duties, the staff needs the proper supplies and equipment. This objective is to ensure that they are provided these materials.

SUCCESS CRITERIA

Properly supplied and equipped staff. Valid request are filled within 30 days of submission.

- **Green**: < 30 day turn around on procurement
- **Amber:** 31-60 day turn around on procurement
- **Red:** Over 60 Day Turn around on procurement

3.2 GIS (CONSERVATION)

The Conservation GIS program maintains and updates GIS data related to natural and cultural resources, but it is shared with other groups within SCARNG and with Fort Jackson.

Guidelines for Conservation GIS

- Select suitable areas for specialized training exercises.
- Plan land rehabilitation projects.
- Provide special maps for Environmental Awareness materials.
- Ensure avoidance of cultural resources during ground disturbing projects.
- Ensure avoidance of rare species habitats and other areas of special concern during construction projects or training.
- Ensure avoidance or consideration of wetlands when planning construction projects.
- Monitor effects of wildfires and prescribed burning activities.
- Identify site options for use during NEPA evaluation of alternative sites.

GOAL: SUPPORT THE MISSION OF THE SOUTH CAROLINA MILITARY DEPARTMENT, AND SPECIFICALLY THE SCMD ENVIRONMENTAL DIVISION, THROUGH THE DEVELOPMENT AND MAINTENANCE OF AN INTEGRATED GIS PROGRAM.

SUCCESS CRITERIA

The use of GIS within the agency and specifically within the Environmental Section continues to increase and become an integrated part the SCMD business practices.

- **Green:** > 80% of the Environmental staff are fully aware of GIS and look to apply it when necessary/advantageous and the Environmental GIS program continues to expand
- **Amber:** 50-80% of the Environmental staff are aware of GIS and look to apply it when necessary/advantageous and the Environmental GIS program is sufficiently maintained
- **Red:** 0-49% of the Environmental staff are aware of GIS and look to apply it when necessary/advantageous and the Environmental GIS program regresses

OBJECTIVE 1: PROVIDE UPDATED AND ACCURATE SPATIAL DATA SETS.

The SCMD GIS program supports a diverse and complex agency with spatial interest over a large geographic range. Despite the large scale of the area of interest, analysis is often required at a minute scale. The result is the need for an extensive data collection that is accurate and up to date.

SUCCESS CRITERIA

It is vital that a strategy is in place to continually update and maintain these holdings, keeping them as current and accurate as possible.

- **Green:** 100% of vital data is updated annually or as determined necessary
- **Amber:** 80-99% of vital data is updated annually or as determined necessary
- **Red:** A detailed data maintenance plan fails to be implemented and vital data is arbitrarily updated

OBJECTIVE 2. MAINTAIN A STATE-OF-THE-ART GIS INFRASTRUCTURE.

The power of GIS comes from its ability to analyze increasingly diverse and complicated datasets through a spatial lens. This requires state of the art computer systems and software. As with all IT programs the speed of change is high, and the risk of obsolescence is even higher. To mitigate these

risks and costs the GIS infrastructure must be updated and maintained in a planned and systemic fashion.

SUCCESS CRITERIA

This Success Criteria is based on the completion, implementation and maintenance of a GIS Infrastructure plan for hardware and software.

- **Green:** A detailed hardware/software maintenance plan is implemented and 100% of vital hardware/software is updated as determined necessary
- **Amber:** A detailed hardware/software maintenance plan is implemented and 80-99% of vital hardware/software is updated as determined necessary
- **Red:** A detailed hardware/software maintenance plan fails to be implemented and vital hardware/software is arbitrarily updated

OBJECTIVE 3. PROVIDE SPATIAL ANALYSIS, DATA CREATION, AND GIS SERVICES FOR DECISION-MAKING.

The power of GIS comes from its ability to analyze diverse and complicated datasets through a spatial lens. This analysis then enables decision makers to make more an informed choice. Improved analytical capability increases our return on our GIS investment.

SUCCESS CRITERIA

The continued integration and improvement of data creation and analysis through models, web applications, or other GIS services within the Environmental department business practice.

- **Green:** Remain fully staffed and provide timely data analysis, data creation, and GIS services for Environmental staff
- **Amber:** Remain reasonably staffed and provide timely data analysis, data creation, and GIS services for Environmental staff when possible
- **Red:** Consistently under staffed and fail to provide timely data analysis, data creation, and GIS services for Environmental staff

OBJECTIVE 4. EXPLORE/RESEARCH NEW GIS TECHNOLOGIES AND PROMOTE GIS CAPABILITIES.

GIS is a quickly expanding technology that requires a knowledge of geography, computer programing, data management, web development, IT infrastructure, graphic design, and a passing knowledge of the fields your end-users plan to use the GIS system to analyze. To meet these needs and keep the program relevant staff members must be subject matter experts that are innovative leaders and current in their field. They must use their knowledge and experience to implement program management plans and support the mission of the SCARNG.

SUCCESS CRITERIA

Attend conferences, webinars, pertinent GIS classes, and research new or improved techniques to expand the Environmental GIS program and promote new capabilities within the department.

- **Green:** Continuously advance and promote Environmental GIS capabilities through attending conferences, webinars, and classes or researching various knowledge bases
- **Amber**: Periodically advance and promote Environmental GIS capabilities through attending conferences, webinars, and classes or researching various knowledge bases
- **Red:** Fail to advance and promote Environmental GIS capabilities

3.3 OUTREACH, AWARENESS AND EDUCATION

The Outreach, Awareness, and Education program has both an internal (military/SCARNG) audience and an external (public) audience. The internal training is primarily conducted through our State-Wide Environmental Compliance Officer/NCO Course.

Opportunities to provide outreach and environmental education to the public not only helps inform interested parties about what the SCARNG is doing as good stewards of the land, but also helps educate the public about issues in their 'backyard' and can create a network of people who support the National Guard and its Mission.

Guidelines for Environmental Awareness

- Make available and easily accessible all Environmental Awareness material to military personnel and interested public.
- Design and produce material professionally.
- Post material on endangered species and sensitive habitats where appropriate.
- When requested, make staff available to interested military personnel, organizations, and the public who are in need of natural resources information.
- Train staff to provide excellent customer service skills.

GOAL: PROTECT THE TRAINING MISSION OF THE SCARNG BY FOSTERING A PUBLIC UNDERSTANDING OF CONSERVATION STEWARDSHIP ON MTC AND THE CRITICAL NATURE OF THE SCARNG MISSION.

SUCCESS CRITERIA

An active program that is proactively engaging the targeted audiences.

- **Green**: 100% Entry of Engagements/Outreach Events into Tracking System
- **Amber**: 50%-99% Entry of Engagements/Outreach Events into Tracking System
- **Red**: < 50% Entry of Engagements/Outreach Events into Tracking System

OBJECTIVE 1. RAISE COMMUNITY AWARENESS.

In order to maintain the current favorable opinion that the public holds for the military mission, the SCARNG needs to actively work to inform the public of our efforts to maintain the resources that have been entrusted to us.

SUCCESS CRITERIA

To meet this Objective, SCARNG needs to consistently record/track all Outreach Activities. After 5 years of tracking, the data should be analyzed to refine this success criteria to focus more on the number and quality of the Outreach Activity.

- **Green:** All outreach efforts are recorded and tracked
- **Amber:** 50%-99% of outreach efforts are recorded and tracked
- **Red:** < 50% of outreach efforts are recorded and tracked

OBJECTIVE 2. CONTINUE EDUCATION AND TRAINING PROGRAM

Continue the implementation of the State-Wide Environmental Education & Training program.

SUCCESS CRITERIA

- **Green:** Completion of 4 State-Wide Environmental Education & Training Classes.
- **Amber:** Completion 2-3 State-Wide Environmental Education & Training Classes.
- **Red:** Completion 1 or less State-Wide Environmental Education & Training Classes.

3.4 SOIL AND WATER

The management of soil and water on MTC is driven by compliance with various laws and regulations, but also to prevent erosion and loss of soil that would impede training and impact aquatic species.

Guidelines for Protecting Soil and Water Resources

- Manage erosion control in accordance with several plans and permits including the Stormwater Pollution Prevention Plan (SWPPP), Special Use Permits, United States Forest Service (USFS) Soil and Water Conservation Handbook, and State BMPs.
- Use the specific guidance for selecting BMPs as provided by your state sources, such as Construction Site BMPs Manuals, and other proven techniques.
- Ensure incorporation of BMPs in the preliminary engineering, design, and construction of facilities involving ground disturbance.
- Prevent or minimize erosion to the maximum extent possible, utilize native plants for erosion control where possible.

GOAL: TO MAINTAIN TRAINING LANDS WHILE PROTECTING AND ENHANCING SOIL AND WATER QUALITY AND ENSURING COMPLIANCE WITH ALL APPLICABLE LAWS AND REGULATIONS.

SUCCESS CRITERIA

Acres of training lands excluded from use due to erosion or water quality issues, and numbers of regulatory enforcement actions. Acres data will be derived from range use and ITAM data while enforcement data derived from SCARNG compliance records.

- **Green:** 0-5% total acreage excluded from training (temporarily) and zero enforcement actions
- **Amber:** < 5% of total acreage excluded from training (temporarily) or 1 enforcement action
- **Red:** > 5% total acreage excluded from training (temporarily), or more than 1 enforcement action

OBJECTIVE 1. DEVELOP A SYSTEMATIC APPROACH FOR SOIL AND WATER MANAGEMENT.

The three biggest obstacles to a successful Soil and Water Management program are; communication, coordination, and resourcing (funding). The intent of this objective is to provide a structured system to facilitate coordination and communication. This in turn would allow for more targeted use of available resources. The intent is to hold a quarterly meeting between all stakeholders (Facilities Management Office, Training/ ITAM, Natural Resources and pertinent Training Center Staff). The 1st and 4th Quarter meeting would focus on review of completed work, identification and prioritization of work still needed, and the development of available budget and resourcing to execute the work. The 2nd and 3rd Quarter meeting would be to track on going work and note any problems or changes in the execution plan.

SUCCESS CRITERIA

- **Green:** All four meetings were conducted, with overall attendance from 2/3rds of the interested

parties.

- **Amber:** 2-3 Meetings were conducted, or less than 2/3rds of the interested parties attended the meetings
- **Red:** 1 meeting or less was held, less than 1/3rd of the interested parties attended.

OBJECTIVE 2. REPAIR IDENTIFIED EROSION SITES.

The purpose of this objective is to implement the Soil Management Implementation Plan & Inventory (SMPI) developed under Objective ID #6 in this database.

SUCCESS CRITERIA

- **Green:** 100%-75% Execution of the yearly plans developed during the SMPI Coordination Meeting.
- **Amber:** 74%-50% Execution of the yearly plans developed during the SMPI Coordination Meeting.
- **Red:** < 50% Execution of the yearly plans developed during the SMPI Coordination Meeting, or no execution plan is developed.

OBJECTIVE 3. EROSION REPAIR SITE MONITORING & EVALUATION.

The intent of this objective is to determine if the activities in Section 3.4, Objective 2 produce the desired results. Monitoring and project evaluation helps:

- identify what works, what did not work, and what should continue
- improves actions where they are less effective
- change actions if they are ineffective

SUCCESS CRITERIA

- **Green:** 100%-75% of repaired site are evaluated and documented annually
- **Amber:** 74% - 50% of repaired site are evaluated and documented annually
- **Red:** <50% of repaired site are evaluated and documented annually

3.5 WETLANDS

There are approximately 5,560 acres of wetlands on Fort Jackson, with 1,642 acres on MTC. The majority of these wetlands are bottomland hardwoods that occur adjacent to stream systems on the installation. A small percentage of wetlands on MTC are comprised of small bogs created by seeps.

MTC manages for wetlands by preventing impacts in these areas through soil management and ensuring proper compliance with Section 404 of the Clean Water Act. All activities must adhere to established buffer zones and caution areas unless otherwise stated in environmental documentation.

Guidelines for Wetland Management

- Follow applicable BMPs for all activities occurring in or near wetlands.
- Ensure activities adhere to established buffer zones and caution areas regulations.

- Do not apply pesticides directly to wetlands or open waters (follow all label restrictions and environmental documentation).

GOAL: A WETLANDS MANAGEMENT PROGRAM THAT PROTECTS AND ENHANCES ALL WETLAND SYSTEMS AND ENSURES COMPLIANCE WITH ALL APPLICABLE LAWS AND REGULATIONS.

SUCCESS CRITERIA

No net loss of wetland habitat, regulatory enforcement actions, training mission capability, or delays to projects.

- **Green:** No net loss of wetland habitat, regulatory enforcement actions, training mission capability, or delays to projects.
- **Amber**: No more than 1 regulatory enforcement action.
- **Red**: More than 1 regulatory enforcement action or any net loss of regulatory wetlands, training mission capability, or significant delays to projects.

OBJECTIVE 1: COLLECTION OF DATA TO SUPPORT PLANNING AND MONITORING INITIATIVES.

This objective supports the planning and check stages of our adaptive management strategy.

SUCCESS CRITERIA

The collection of a continuous data set that provides insight into the relative health of the wetland systems at MTC.

- **Green:** A complete and continues data set that easily accessible and used by resource managers and subject matter experts.
- **Amber**: Incomplete datasets, or dataset that are not curated, or checked for quality assurance & control, or dataset that are not readily accessible.
- **Red**: Nonexistent datasets, or datasets that are in such a state as to be unusable or irretrievable.

OBJECTIVE 2. SUSTAIN OR ENHANCE WETLAND SYSTEMS AT MTC.

This objective addresses the action and the analysis phases of our adaptive management strategy. It focuses on implementing projects derived from our planning process and analyzing the success of the implemented projects.

SUCCESS CRITERIA

Success criteria based on the creation of wetland health report.

- **Green:** A complete and continues data set that easily accessible and used by resource managers and subject matter experts.
- **Amber**: Incomplete datasets, or dataset that are not curated, or checked for quality assurance & control, or dataset that are not readily accessible.
- **Red**: Nonexistent datasets, or datasets that are in such a state as to be unusable or irretrievable.

3.6 FOREST MANAGEMENT

While Fort Jackson has the primary responsibility for all timber harvesting on MTC, SCARNG serves in a coordinating role in most instances and undertakes some forest management activities.

Guidelines for Forest Management on MTC

- Practice BMP's while conducting management activities
- Follow the silvicultural guidelines of the revised 2003 RCW Recovery Plan, 2007 Management Guidelines for managing RCW on Army installations, 2013 Fort Jackson RCW Management Plan, and Section 4-3 of AR 200-1.

GOAL: A FOREST THAT SUPPORTS THE MILITARY MISSION AND MAINTAINS ECOSYSTEM INTEGRITY. THIS IS A FOREST THAT IS CHARACTERIZED BY HIGH HABITAT DIVERSITY AND MANAGED FOR TARGETED TRAINING OPPORTUNITIES. TARGETED TRAINING OPPORTUNITIES REFERS TO MATCHING TRAINING MISSIONS TO LAND MANAGEMENT PRACTICES.

SUCCESS CRITERIA

No net loss of opportunities, and no overall degradation of the ecosystem health.

- **Green:** 90-100% project integration within the Conservation Tracker and periodic meetings with ITAM.
- **Amber**: 80-89% project integration within the Conservation Tracker and sporadic meetings with ITAM.
- **Red**: Less than 79% project integration within the Conservation Tracker and no meetings with ITAM.

OBJECTIVE 1. MAINTAIN OPEN FOREST MIDSTORY.

All historic accounts of longleaf pine forests described them as "open and park like" with a conspicuous lack of midstory trees and shrubs. They were also described with a high diversity plant in the ground layer. This sub-climax condition is the result of a well-established fire regime.

This open park-like condition is beneficial to both the training community and the overall health of the eco-system. The intent of this objective is to aid the wild land fire management program, to accelerate habitat restoration in targeted areas, and provide a more usable training space to meet the military mission.

SUCCESS CRITERIA

- **Green:** 100% development of a strategy for ensuring an open forest midstory.
- **Amber**: 1-99% development of a strategy for ensuring an open forest midstory.
- **Red**: No development of a strategy for ensuring an open forest midstory.

OBJECTIVE 2. LONG-TERM MONITORING OF VEGETATIVE COMMUNITIES.

Monitoring conditions and species composition of vegetative communities at MTC.

SUCCESS CRITERIA

- **Green:** 75 -100% of vegetative communities monitoring completed for that FY.
- **Amber:** 50-74% of vegetative communities monitoring completed for that FY.
- **Red:** Less than 49% of vegetative communities monitoring completed for that FY.

3.7 WILDLAND FIRE

Fort Jackson takes the lead on wildland fire, including both prescribed fire and wildfire response. SCARNG staff provides assistance on a limited basis. SCARNG reviews and provides input on annual prescribed fire plans.

3.8 GROUNDS

This section contains objectives for both buildings and grounds maintenance, and new construction activities. The SCARNG has primary responsibility for grounds maintenance and construction on MTC.

Guidelines for Grounds Maintenance

- Use regionally native plants for landscaping.
- Use construction practices that minimize adverse effects on the natural habitat.
- Reduce pollution by reducing the use of fertilizer and pesticides, using integrated pest management, recycling green waste, and minimizing runoff.
- Implement water-efficient practices.
- Minimize the use of fertilizers near water resources.

GOAL: TO MAINTAIN THE GROUNDS AT THE MTC IN A SAFE, ATTRACTIVE AND PROFESSIONAL STATE, WHILE INCORPORATING SUSTAINABILITY PRINCIPLES.

SUCCESS CRITERIA

No overall degradation of the ecosystem health and no red findings in the ISR.

- **Green:** 1 or less findings by the ISR.
- **Amber**: 2-4 Findings by the ISR.
- **Red**: More than 4 findings of the ISR.

OBJECTIVE 1. A SUSTAINABLE GROUNDS MAINTENANCE PROGRAM.

In accordance to the requirements in EO 13693: to establish a method for reducing water, energy, and vehicle fuel usages each FY via developing a comprehensive Sustainable Grounds Management Strategy.

SUCCESS CRITERIA

- **Green:** Completion of a Sustainable Grounds Management Strategy prior to the next ROE.
- **Amber**: 1-99% Completion of a Sustainable Grounds Management Strategy prior to the next ROE.
- **Red**: No comprehensive Sustainable Grounds Management Strategy prior to the next ROE completed.

3.9 FISH AND WILDLIFE

Wildlife management on Fort Jackson and MTC is designed to conserve and enhance indigenous wildlife populations and their associated habitat at optimum levels. Optimum levels are determined by considering such factors as statutory requirements and restrictions, military training needs, public health and safety, morale support needs (hunting, fishing and other outdoor recreation), aesthetics, public

relations, and public trust/stewardship responsibilities. An example of this can be found in MTC's work performed on our bird populations. Our yearly surveys such as Migratory Avian Productivity and Survivorship (MAPS) station, Breeding Bird Survey, Nightjar Survey, Raptor Survey, etc., in support of the Migratory Bird Treaty Act (MBTA) and Bald and Golden Eagle Protection Act (BGEPA), which dictates our management efforts. Using data collected with these surveys, management decisions such as timber thinnings, habitat restorations, installation of nesting boxes, etc. are performed in order to maintain a healthy population of birds both migratory and resident.

Currently, habitat quality and species diversity are high. MTC is generally forested with large contiguous blocks of forest. Overall health is good despite human activities over time. Colonel's Creek and associated wetlands provide a corridor through MTC and Fort Jackson. Corridors and other important connections are a high priority as wildlife habitat to maintain species diversity and fragmentation.

Guidelines for Fish and Wildlife Management

- Maintain habitat connectivity and management consistency with contiguous areas outside the installation, particularly for riparian zones and ridgelines.
- Minimize habitat fragmentation within the training area.
- Manage landscape areas where few mature forests persist to retain late-succession patches.
- Provide for retention of any old-growth fragments that remain in watersheds.
- Allow salvage only for safety reasons along roads, near developed and recreation facilities, and to relieve the effects of catastrophic events such as fire, insects and diseases, should this occur.

GOAL: CONSERVE AND ENHANCE WILDLIFE POPULATIONS AND THEIR ASSOCIATED HABITAT FOR OPTIMUM LEVELS OF BIODIVERSITY AND ECOSYSTEM HEALTH, WHILE MAINTAINING A REALISTIC TRAINING ENVIRONMENT.

SUCCESS CRITERIA

No overall degradation of the ecosystem health.

- **Green:** 0 to 1 NOV for habitat degradation.
- **Amber**: 2 to 4 NOV for habitat degradation.
- **Red**: > 4 NOV for habitat degradation.

OBJECTIVE 1. LONG-TERM MONITORING OF FISH AND WILDLIFE.

Initiate PLS and continue ongoing PLS to develop trend data of fish and wildlife.

SUCCESS CRITERIA

- **Green:** 76-100% of planned PLS completed.
- **Amber**: 50-75% of planned PLS completed.
- **Red**: 0-49% of planned PLS completed.

OBJECTIVE 2. MANAGE WILDLAND HABITAT TO PROMOTE SPECIES DIVERSITY.

Modification of existing wildland habitat to increase biodiversity of native flora and fauna.

SUCCESS CRITERIA

- **Green:** 76> 41 acres of modified habitat.
- **Amber**: 20-40 acres of modified habitat.

- **Red**: 0-14 acres of modified habitat.

3.10 THREATENED, ENDANGERED AND SPECIAL STATUS SPECIES

SCARNG takes the management and protection of Threatened, Endangered and Species of Concern very seriously. SCARNG strives to manage and protect both federal and state listed species, as well as special status species that have the potential to be listed in the future. Appendix E provides a description of all Threatened, Endangered and Species of Concern known or with potential to occur on MTC, including species-specific management recommendations. Tables E-1 and E-2 summarize potential and documented species status animals and plants, respectively. At present, there are two (2) federally listed plant species, rough-leaved loosestrife (*Lysimachia asperulaefolia),* and smooth coneflower *(Echinacea laevigata),* and one (1) federally listed bird species, RCW (*Picoides borealis*) documented on MTC, along with the bald eagle which is protected under the BGEPA.

Guidelines for T&E Management

- Coordinate with Fort Jackson on management activities.
- Comply with all applicable laws and regulations.
- Use prescribed fire to maintain or increase habitats as applicable.

GOAL: CONSERVE AND ENHANCE THREATENED, ENDANGERED AND SPECIAL STATUS SPECIES (SSS) POPULATIONS AND THEIR ASSOCIATED HABITAT FOR OPTIMUM LEVELS OF BIODIVERSITY AND ECOSYSTEM HEALTH.

The goal of the Threatened, Endangered and Special Status Species program is to support the military mission, while complying with all State and Federal Laws concerning these species.

SUCCESS CRITERIA

No net loss of training opportunities, and no overall degradation of the ecosystem health. No USFWS enforcement actions.

- **Green:** No net loss of training days/ activities and no USFWS findings.
- **Amber**: Less than 2 days net loss of training and 1 USFWS finding.
- **Red**: Net loss of 2 or more days of training and more than 2 USFWS findings.

OBJECTIVE 1. THREATENED, ENDANGERED AND SPECIAL STATUS SPECIES HABITAT MANAGEMENT.

Maintain and/or modify existing habitat to increase biodiversity of Threatened, Endangered and Special Status Species.

SUCCESS CRITERIA

- **Green:** Maintain staffing levels above 80% of manning model, maintain above a 95% obligation rate, and maintain database and tracking systems.
- **Amber**: Net loss of 11-20% of Threatened, Endangered and Special Status Species habitat.
- **Red**: Net loss greater than 20% of Threatened, Endangered and Special Status Species habitat.

OBJECTIVE 2. THREATENED, ENDANGERED AND SPECIAL STATUS SPECIES MONITORING.

Develop a protocol for Threatened, Endangered and Special Status Species monitoring, which will create a species list and monitoring period.

SUCCESS CRITERIA

- **Green:** 76 -100% of Threatened, Endangered and Special Status Species monitoring completed for that FY.
- **Amber**: 50-75% of Threatened, Endangered and Special Status Species monitoring completed for that FY.
- **Red**: Less than 49% of Threatened, Endangered and Special Status Species monitoring completed for that FY.

OBJECTIVE 3. THREATENED AND ENDANGERED ECOSYSTEM MANAGEMENT.

Manage ecosystems level factors that support T&E species population health and survivorship.

SUCCESS CRITERIA

- **Green:** Annual increase in T&E species populations.
- **Amber**: Annual Sustainment of T&E species populations.
- **Red**: Annual decrease in T&E species population.

3.11 PESTS

All pest management activities are performed in compliance with the Integrated Pest Management Plan (IPMP). This includes management of invasive plants and animals outside of the Cantonment Area and other buildings.

Guidelines for Pest Management

- Use only proven biological control methods whenever feasible and economical.
- Establish buffers zone adjacent to water resources.
- Apply no pest management procedures that are likely to have a negative impact on endangered, threatened or special status species, or their habitats.

GOAL: ENSURE COMPLIANCE WITH DOD INSTRUCTION 4150.07, "DOD PEST MANAGEMENT PROGRAM".

SUCCESS CRITERIA

Implementation of comprehensive pest management plan.

- **Green:** Yearly update of IPMP and subsequent reports within IPMP.
- **Amber**: N/A.
- **Red**: IPMP and subsequent reports within not updated annually.

OBJECTIVE 1. REDUCE IMPACTS TO TRAINING AND THE ENVIRONMENT FROM NUISANCE WILDLIFE.

SUCCESS CRITERIA

Reduce impacts from nuisance wildlife.

- **Green:** Successful removal of nuisance wildlife with no net loss of training days/ activities.
- **Amber**: Removal of nuisance wildlife with a net loss of less than 2 days of training.
- **Red**: Removal of nuisance wildlife with a net loss of 2 or more days of training.

OBJECTIVE 2. REDUCE THE QUANTITY OF PESTICIDES APPLIED.

This objective is intended to meet the Presidential EOs and the DOD Measure of Merit #2: to reduce the total amount of pesticide applied each year to federal military installments.

SUCCESS CRITERIA

Show reduction of annual pesticide use via tracking and analysis of pesticide application data.

- **Green:** Reduction in annual net pesticide use by 5% or more.
- **Amber**: Less than 2-4% reduction in annual net pesticide use.
- **Red**: Increase in annual net pesticide use.

OBJECTIVE 3. MANAGE INVASIVE/NOXIOUS PLANT SPECIES.

This objective is to develop a proactive program in accordance to EO 13112, to facilitate the management and control of Invasive/Noxious plants and animals. This program is managed as part of our IPMP. SCARNG will monitor both the overall health of the system as well as the success or failure of individual projects as part of this objective.

SUCCESS CRITERIA

Completion of a comprehensive Invasive strategy prior to the next ROE.

- **Green:** 100% completion of a comprehensive invasive species management strategy.
- **Amber**: 1-99% development of a comprehensive invasive species management strategy.
- **Red**: No development of a comprehensive invasive species management strategy.

3.12 RECREATION

Recreational use of the developed area and facilities are available to active and retired military and civilian employees of MTC (and their guests) provided the activities do not interfere with the military mission. MTC is home to the Harry J. Vann Trail, a one-mile interpretive loop trail that connects to the Palmetto Trail. This trail is open to the public and meanders through the black water flood plain of Colonels Creek and upland pine forest. The Environmental Office constructed this trail in part due to a grant received from National Environmental Education Foundation for National Public Lands Day. Signs posted along the trail address topics from the history of the Sandhills region to recycling. Located at the mid-point of the trail is an outdoor classroom which is used for hands-on displays and lectures during guided walking tours, but which also makes for a nice resting spot.

GOAL: PROVIDE FOR SAFE OUTDOOR RECREATION AND FITNESS OPPORTUNITIES THAT EDUCATE USERS ABOUT STEWARDSHIP ON MILITARY LANDS AND THE MISSION OF THE SCARNG.

SUCCESS CRITERIA

An active recreation program with staff engagement opportunities.

- **Green:** Recreational opportunities available <90% of the year.
- **Amber**: Recreational opportunities available 50% -89% of the year.
- **Red**: Recreational opportunities available >50% of the year.

OBJECTIVE 1. OPERATE AND MAINTAIN AN INTERPRETIVE PUBLIC TRAIL.

Working in conjunction with partnering NGOs SCARNG is maintaining and operating a section of the Palmetto Trail that runs along the south boundary of the installation. In addition, SCARNG is also maintaining a spur trail, the BG Harry J Vann Interpretive Trail.

SUCCESS CRITERIA

Maintain the trail and promote usage with zero impact to the training mission.

- **Green:** Trail open >75% of the year with no net loss of training days/ activities.
- **Amber**: Trail open 75%-%50 of the year with no net loss of training days/ activities.
- **Red**: Trail open >50% of the year or a negative impact to the training mission.

3.13 CLIMATE CHANGE AND REGIONAL GROWTH

Over the past decade, two issues have taken a more prominent role in the Conservation discussion: Climate Change and Regional Growth. Both issues are addressed in this section because they share the same goals: protecting mission capability through planning, adaptive management, and proactive innovative solutions. The scope of both of these issues are complicated and go beyond the boundaries of our installation. They require innovation, planning and a level of collaboration that exceeds any of our past efforts.

CLIMATE CHANGE

In January 2019, DoD published *Report on Effects of a Changing Climate to the Department of Defense.* The report provides an assessment of the significant vulnerabilities from climate-related events in order to identify high risks to mission effectiveness on installations and to operations. While Fort Jackson and MTC were not specifically addressed in the document, Shaw AFB was included. Shaw AFB is located approximately 13 miles from MTC. The climatic impacts anticipated at Shaw can also reasonably anticipated at MTC.

The report anticipates recurrent flooding, drought, and wildfires as the greatest impacts. These impacts are consistent with climatic model predictions of a general increase in extreme weather events. Specifically, intense storm & rainfall events followed by long periods of draught and increased average summer temperatures.

REGIONAL DEVELOPMENT

From 1970 to 2019, the population of the Central Midlands Region grew from 372,000 to over 800,000. By comparison, statewide growth during the same period was only 35%. Since the 2000 US Census, the Central Midlands region has seen notable increases in its housing stock, as well as in its commercial and industrial sectors. Overall growth for the Central Midlands region between 2020 and 2035 will follow this established trend. The region will experience an estimated 35%-65% increase in population depending on area. Several of the areas around the installations are predicted to possibly exceed the regional average.

Anticipated Effects of Future Climate Scenarios
Increased Black Flag Days
Increased Fire Hazard Days
Increased Wildfires
Reduced Number of Prescribed Burn Days
Increased Number of Endangered Species
Increased Management Requirements
Species Movement & Habitat Shifts
Increased Dust/ Decrease in Air Quality
Increased Erosion
Increased Need for Natural infrastructure Management

In 2007 we formed the MAJIC to protect our installations from threats of encroachments. From its inception, MAJIC has been a regional holistic approach to dealing with the encroachment facing the military installations in the Midlands of South Carolina. From the outset, we have understood this was an issue that we could not address individually and that it needed to be a region wide partner driven approach. In many ways, we were a precursor to many of the Sentinel Landscape ideals.

We are currently working our way through the REPI Sentinel Landscape application process. The MAJIC Sentinel Landscape is uniquely positioned at the nexus of several federal interests, and conservation concerns. We have a very supportive and military friendly local government and population.

GOAL: PROTECT THE MISSION CAPABILITY OF THE SCARNG THROUGH PLANNING, ADAPTIVE MANAGEMENT, AND PROACTIVE, INNOVATIVE SOLUTIONS.

An active program that proactively seeks to integrate innovative solutions and adaptive management strategies into our planning documents.

SUCCESS CRITERIA

- **Green:** All plans current and up to date
- **Amber**: 50% of Plans current and up to date or under revision
- **Red:** <50% of plans current and up to date or under revision

OBJECTIVE 1: INTEGRATE CLIMATE RESILIENCY INTO THE SCARNG PLANNING PROCESS.

As stated above, our primary goal is to protect the mission capability of the SCARNG. The first step in doing that is to identify and plan for potential impacts.

SUCCESS CRITERIA

- **Green:** All plans are current and address potential climatic impacts.
- **Amber**: 50% of plans are current and address potential climatic impacts.
- **Red**: < 50% of plans are current and address potential climatic impacts.

OBJECTIVE 2: ENSURE CLIMATE RESILIENCY ADAPTION AND MITIGATION OF ADVERSE IMPACTS

This Objective will be accomplished through the scientifically and data driven decision making, the establishment of achievable targets, collaborative planning, and adaptive management.

SUCCESS CRITERIA

- **Green:** Completion or adoption of a Climate Resiliency Strategy.
- **Amber**: Ad-Hoc implementation of resiliency and adaptation measures.
- **Red**: No action on Climate Resiliency & Adaptation.

OBJECTIVE 3: DEVELOP AND MAINTAIN PARTNERSHIPS.

The DoD's presence in the Midlands of South Carolina is significant. There are five military installations; three active duties and two National Guard. Active and reserve components of the Army, Navy, Air Force and Marines utilize these bases. To reduce development-related pressure, the installations are working together to leverage our presence in regional decision making. Specifically, the South Carolina Military

Department, Fort Jackson, and Shaw Air Force Base have joined together with local governments and NGOs to form the MAJIC. The purpose of the Consortium is to facilitate collaboration on projects including a region-wide Joint Land Use Study (JLUS) or the implementation of Joint Compatible Use Buffers (JCUB) program. To further leverage our local partnerships, we are also pursuing a Sentential Landscape designation.

SUCCESS CRITERIA

- **Green:** Hold biannual meetings with local and regional partners.
- **Amber**: Hold annual meetings with local and regional partners.
- **Red**: No partner meetings are held.

4 PLAN IMPLEMENTATION

4.1 PROJECT DEVELOPMENT AND PRIORITIZATION

Preparation and implementation of this INRMP is required by DoD Instruction 4715.03 and AR 200-1 and is a high funding priority. There are several programs within this INRMP that are required for compliance with other laws, especially laws related to endangered species and waters of the US/wetlands. However, it is unlikely that all programs within this INRMP will be funded immediately. Therefore, projects and programs are listed in relative importance. Estimated time schedules are provided by fiscal year.

4.2 PARTNERSHIPS

Since the inception of the program in 1992, partnerships have played a significant role to accomplish our primary goal of protecting the training mission. These partnerships have taken many forms, both formal and informal. They have been with other installations, other government agencies, and NGOs. Below are a few of the more significant and longest lasting partnerships. The entities below have been our most consistent partners, but there have been other ephemeral partnerships that provided important outcomes.

4.2.1 University Of South Carolina (USC)

Our partnership with USC was the first that we established and served as the model for several others. Our relationship with USC is a two way street, they provide us assistance on individual projects. We provide research opportunities for students. We also frequently make our staff available at classes at the University to share our experiences and expertise.

4.2.2 Midlands Area Joint Installation Consortium (MAJIC)

In 2007 we formed the MAJIC to protect our installations from threats of encroachments. From its inception, MAJIC has been a regional holistic approach to dealing with the encroachment facing the military installations in the Midlands of South Carolina. MAJIC is composed of the five installations in the Central Midlands along with twenty-one (21) other partners. From the outset, we have understood this was an issue that we could not address individually and that it needed to be a region wide partner driven approach. In many ways, we were a precursor to many of the Sentinel Landscape ideals.

4.2.3 SCDNR

SCDNR is our second longest running partnership. Over the years we have worked with them for a variety of projects and surveys. Projects with SCDNR have ranged from planning levels surveys to Summer Camp outreach programs.

4.2.4 Palmetto Conservation Foundation (PCF)

PCF is a statewide NGO that is responsible for the creation and maintenance of the Palmetto Trail. The Palmetto Trail is planned to span the entirety of the state. Its path will run from the coast to the mountains. Currently a passage of the trail runs along our southern boundary. We have worked with PCF to maintain and improve the trail, as well as hosting several public outreach events.

4.3 FUNDING

Funding for INRMP implementation can come through a variety of sources depending on the implementation task, available funding, current funding guidance, and SCARNG and MTC priorities. In addition, forestry, wildlife, prescribed burning, and recreation projects managed by Fort Jackson staff are paid for through their funding sources, separate from SCARNG and MTC funding sources.

The potential funding sources through SCARNG include ITAM, environmental, facilities management, and other Army-funded programs. In addition, some activities may be funded through grants or cost-sharing with other entities, including ACUB and Sentinel Landscape projects.

Implementation of this INRMP is subject to the availability of annual funding. MTC will make the best effort to request funding through appropriate channels and implement the INRMP based on the highest priorities using the available funding.

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A. ACRONYMS

AFB	Air Force Base
AR	Army Regulation
ARNG-ILE	Army National Guard Environmental Branch
BASH	Bird Aircraft/Wildlife Strike Hazard
BGEPA	Bald and Golden Eagle Protection Act
BMPs	Best Management Practices
CAA	Conservation Action Area
CHTC	Clarks Hill Training Center
C-Tracker	Conservation Tracker Database
COWASEE Basin	Congaree, Wateree, and Santee Rivers
DA	Department of the Army
DoD	Department of Defense
EA	Environmental Assessment
EO	Executive Order
FJMR	Fort Jackson Military Reservation
FY	Fiscal Year
GIS	Geographic Information System
HUC	Hydrologic Unit Code
ICRMP	Integrated Cultural Resources Management Plan
INRMP	Integrated Natural Resources Management Plan
JRSOI	Joint Reception, Staging, Onward Movement and Integration
ITAM	Integrated Training Area Management
IPMP	Integrated Pest Management Plan
ISR	Installation Status Report
JCUB	Joint Compatible Use Buffer
JLUS	Joint Land Use Study
MAB	Man and Biosphere
MAJIC	Midlands Area Joint Installation Consortium
MAPS	Migratory Avian Productivity and Survivorship
MBTA	Migratory Bird Treaty Act
MTC	McCrady Training Center
NCO	Non-Commissioned Officer
NEPA	National Environmental Policy Act
NGB	National Guard Bureau
NGO	Non-governmental Organization
NRCS	Natural Resources Conservation Service

NWI	National Wetlands Inventory
OMS	Organizational Maintenance Shop
RCW	Red-cockaded Woodpecker
REC	Record of Environmental Consideration
REPI	Readiness and Environmental Protection Integration
ROE	Review of Operation and Effect
SCARNG	South Carolina Army National Guard
SCMD	South Carolina Military Department
SCEMD	State Emergency and Management Assistance Compact
SCDNR	South Carolina Department of Natural Resources
SMPI	Soil Management Implementation Plan and Inventory
SSS	Special Status Species
SWAP	State Wildlife Action Plan
SWPPP	Stormwater Pollution Prevention Plan
T&E	Threatened and Endangered
UNESCO	United Nations Educational, Scientific and Cultural Organization
USACE	US Army Corps of Engineers
USC	United States Code
USC	University of South Carolina
USEPA	US Environmental Protection Agency
USFS	US Forest Service
USFWS	US Fish and Wildlife Service
UXO	Unexploded Ordinance
VRT	Vehicle Recovery Team

B. MAPS

Figure 1. General Location and Layout

Figure 2. Soils

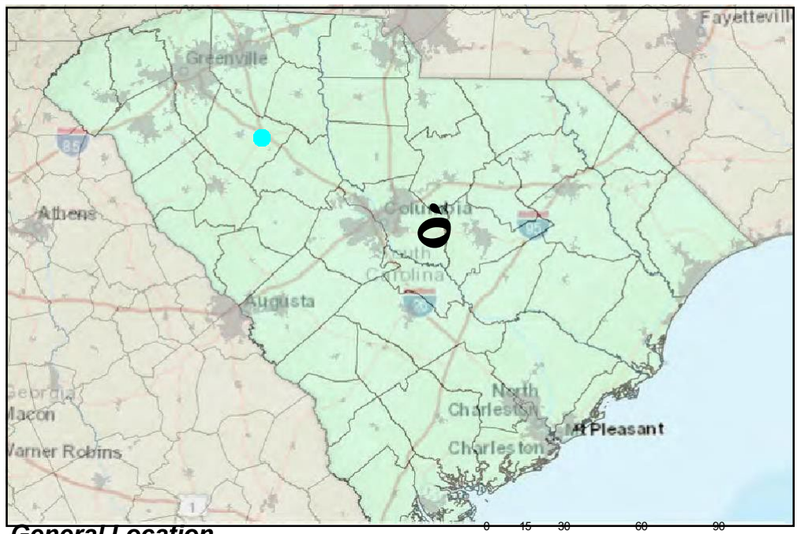
Figure 3. Water and Wetlands

Figure 4. Vegetation Communities

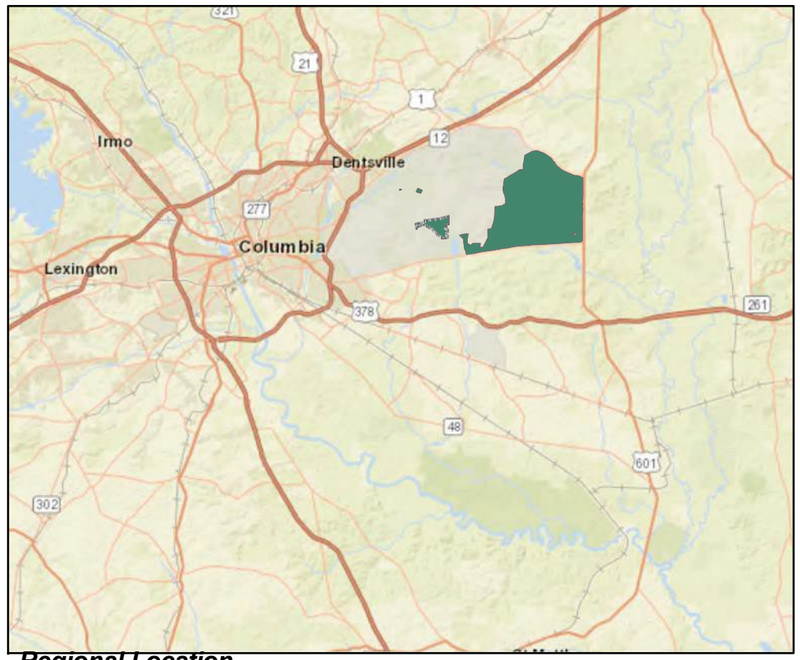
Figure 5. Caution Areas

Figure 6. Fauna Special Ststus Species

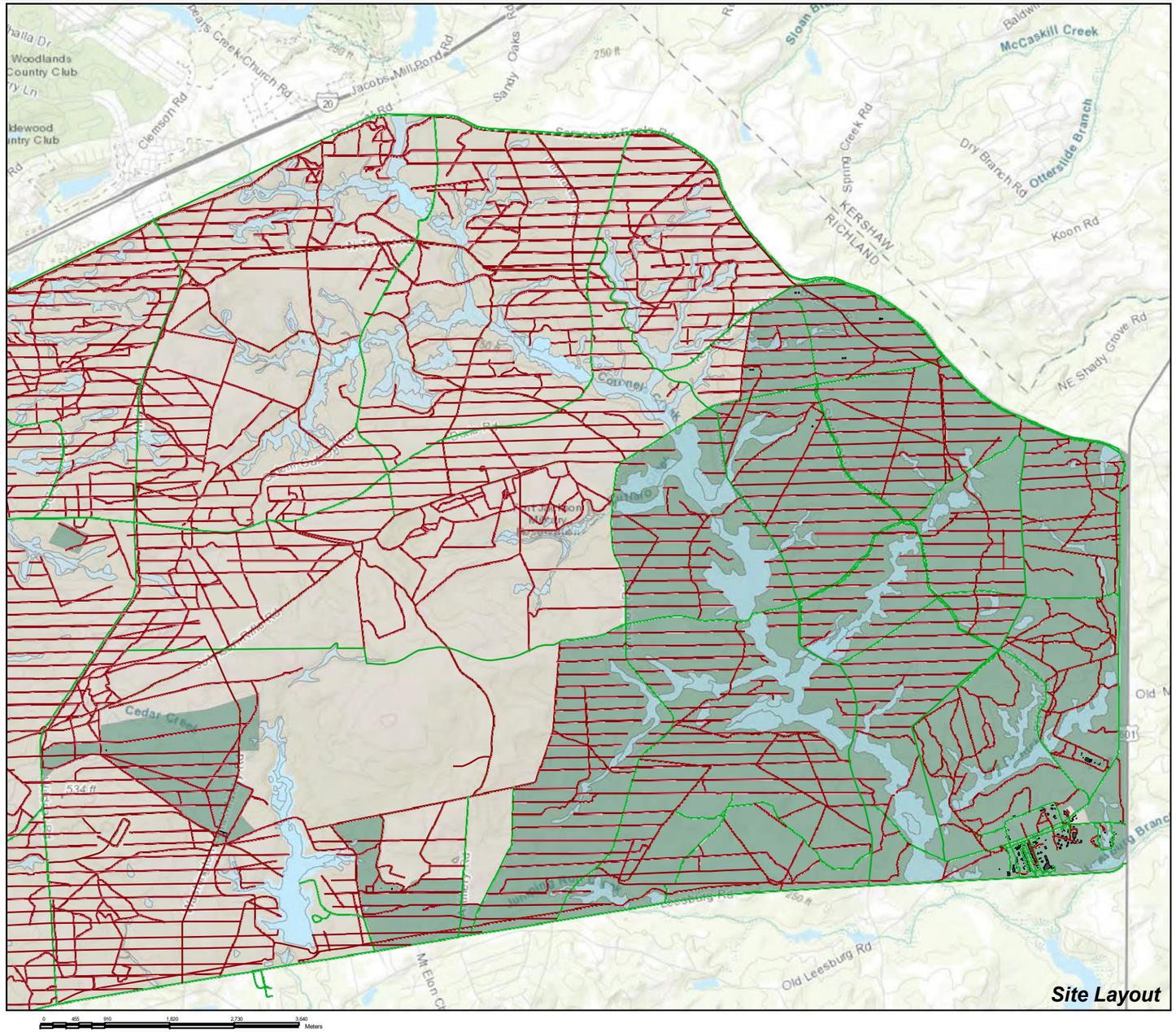
Figure 7. Floral Special Status Species



General Location



Regional Location



Site Layout

McCradyTraining Center

General Location and Layout

Legend

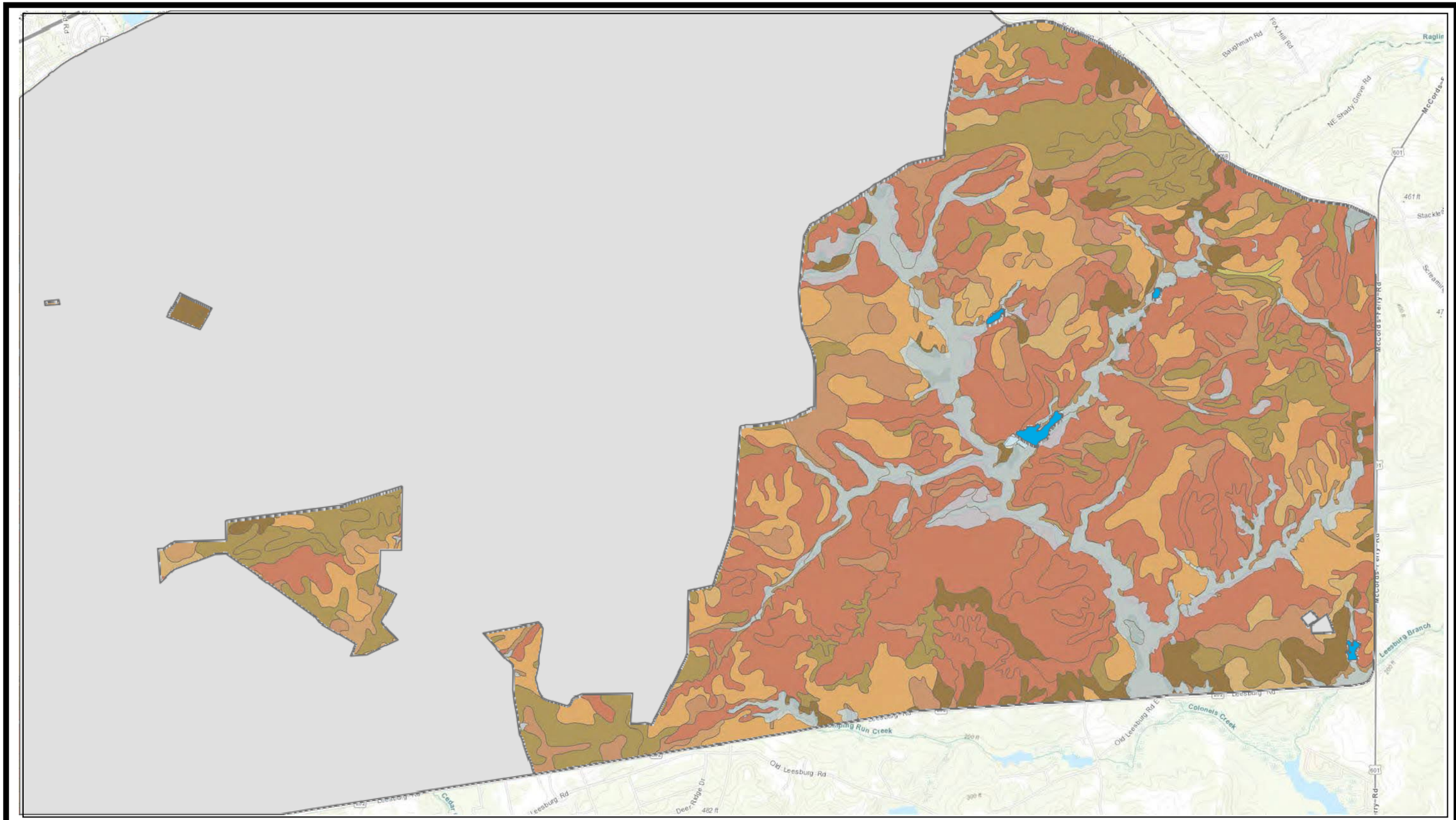
Structures Installation

Structures
McCrady Training Center
Wetlands

O	Created For MTCC INRMP
Figure Number 1	Checked by:SCARNG Conservation
	Date: 4/5/2019

McCRADY

McCRADY



Legend

- Open Water on SCARNG Property
- Wetlands

Unit Name

- Ailey coarse sand
- Blanton sand
- Dothan loamy sand
- Fuquay sand
- Johnston fine sandy loam
- Lakeland sand
- Lucy loamy sand
- Pelion coarse sand
- Pelion-Urban land complex
- Rains loamy fine sand
- Troup sand
- Vaucluse loamy sand

0 337.5 675 1,350 2,025 2,700 Meters

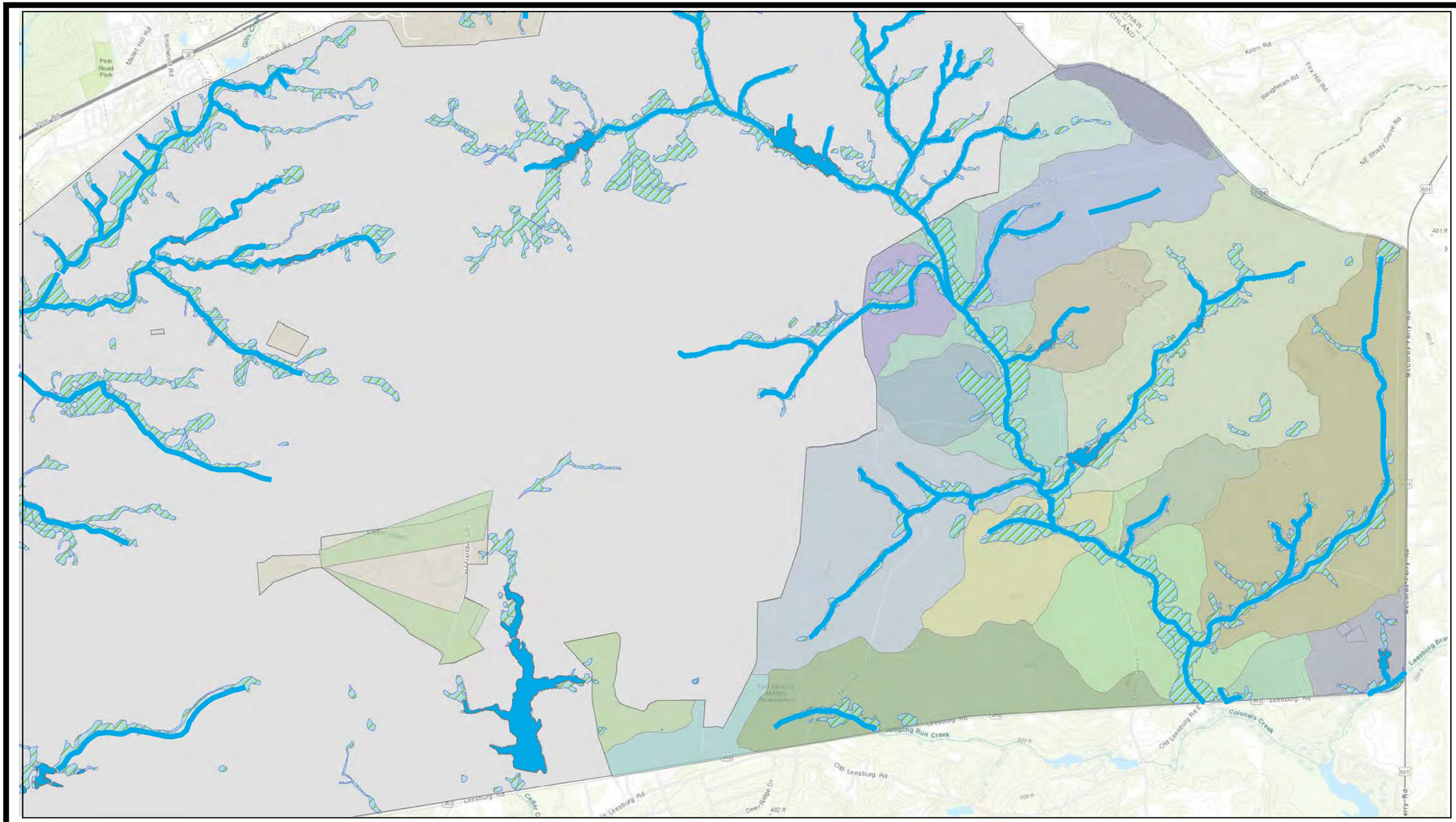
Soils

Figure Number 2

Created For MTCC INRMP

Checked by:SCARNG Conservation

Date: 4/23/2019



Legend

- Streams
- Open Water on SCARNG Property
- Wetlands

Drainage

- Bee Branch
- Buffalo Creek
- Cedar Creek
- Compound-Colonel's Creek
- Compound-Leesburg Branch
- Davis Pond
- English Pond
- Jumping Run Creek
- Lower Colonel's Creek
- McCaskill Creek
- Noah's Marsh
- North Division
- Odom Pond
- South Division
- Training 28 B & C
- Training 31 A & B
- Upper Colonel's Creek
- West Red Diamond
- Weston Lake

0 360 720 1,440 2,160 2,880 Meters

Water & Wetlands

Figure Number

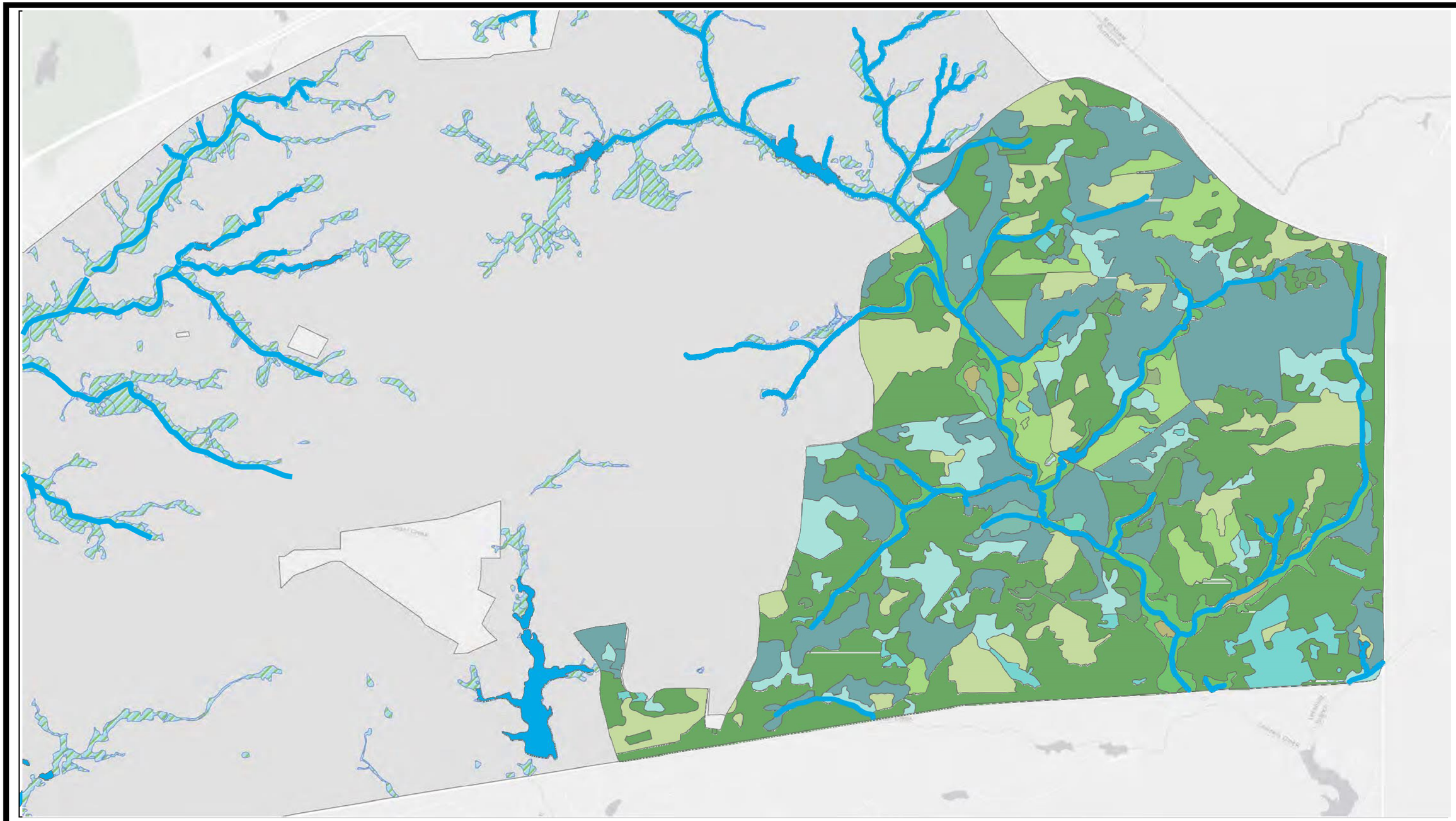
3

Created For MTC INRMP

Checked by:SCARNG Conservation

Date: 4/23/2019

McCrady



Legend

Community Type

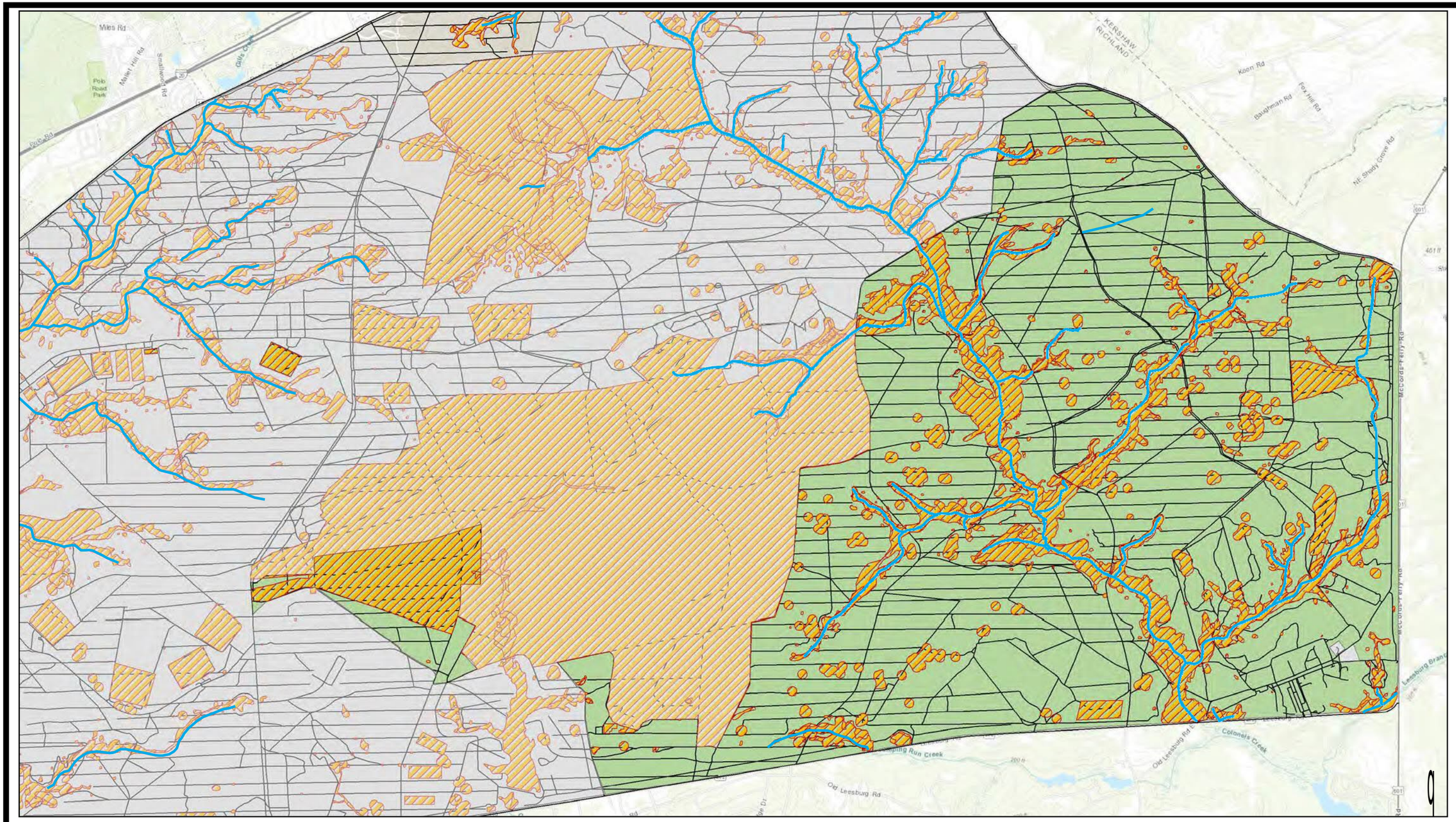
- Emergent Non-Forested Wetlands
- Mixed Hardwood-Pine
- Pine Dominated Canopy- Dense, Young Crowns
- Pine Dominated Canopy- Moderately Dense, Middle-Ag
- Pine Dominated Canopy- Open, Mature Crowns
- Pine Evergreen Shrub
- Pine-Mixed Hardwoods
- Pine-Wetland Mixed Hardwoods
- Upland Mixed Hardwoods
- Upland Non-Forested
- Wetland Mixed Hardwood- Shrub
- Wetland Mixed Hardwoods
- Wetland Mixed Hardwoods - Pine

0 375 750 1,500 2,250 3,000
Meters

Vegetation Community	**Created For MTC INRMP**
Figure Number 4	**Checked by:SCARNG Conservation**
	Date: 4/23/2019

McCrady

McCrady



Legend

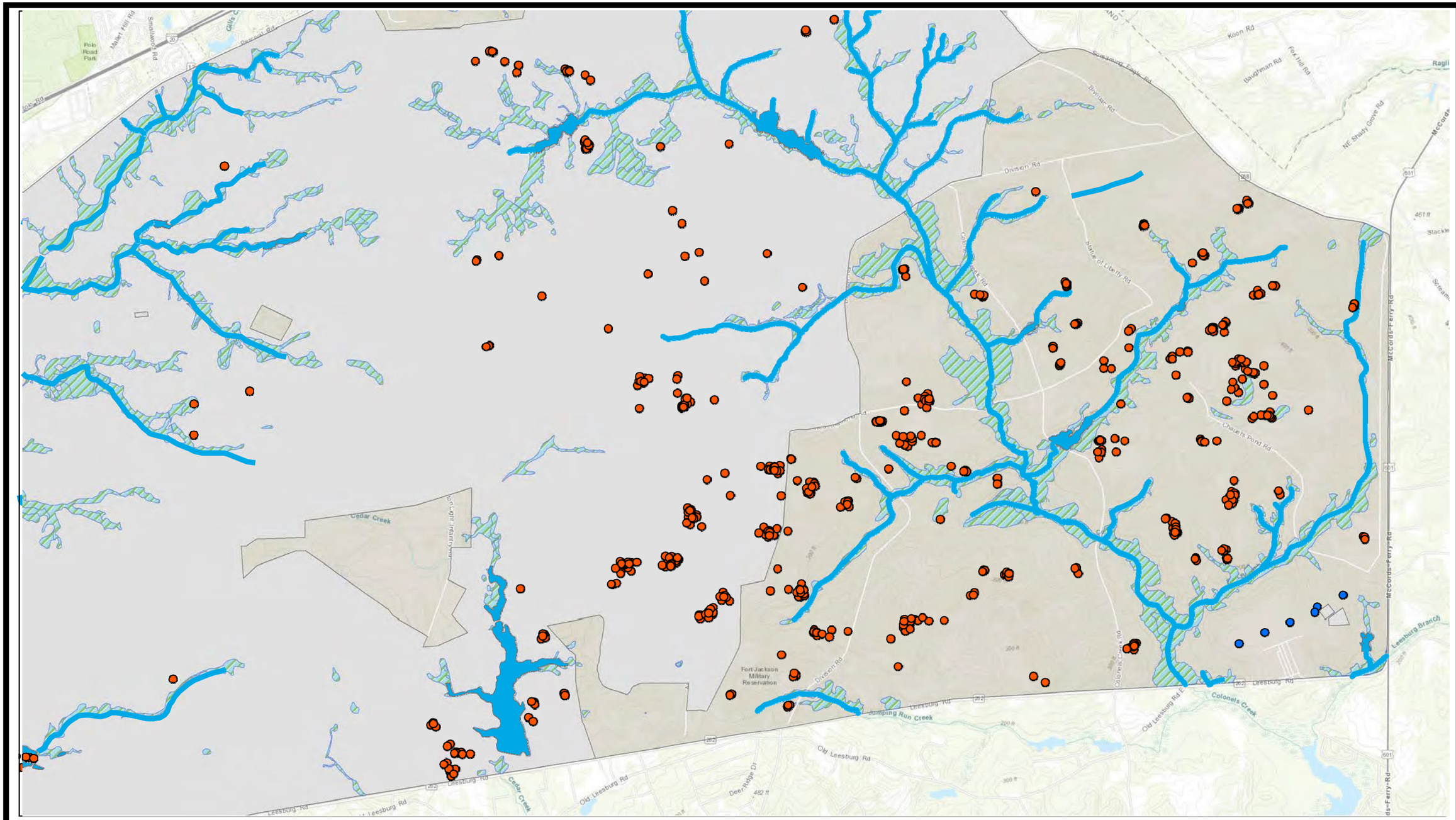
Installation

- McCrady Training Center
- Fort Jackson
- Caution Areas
- Streams
- Road

0 360 720 1,440 2,160 2,880
Meters

Note: Caution Areas are a conglomeration of limited use areas that training and access restrictions

Caution Areas	Created For MTC INRMP
Figure Number 5	Checked by:SCARNG Conservation
	Date: 4/23/2019



McCrady

Legend

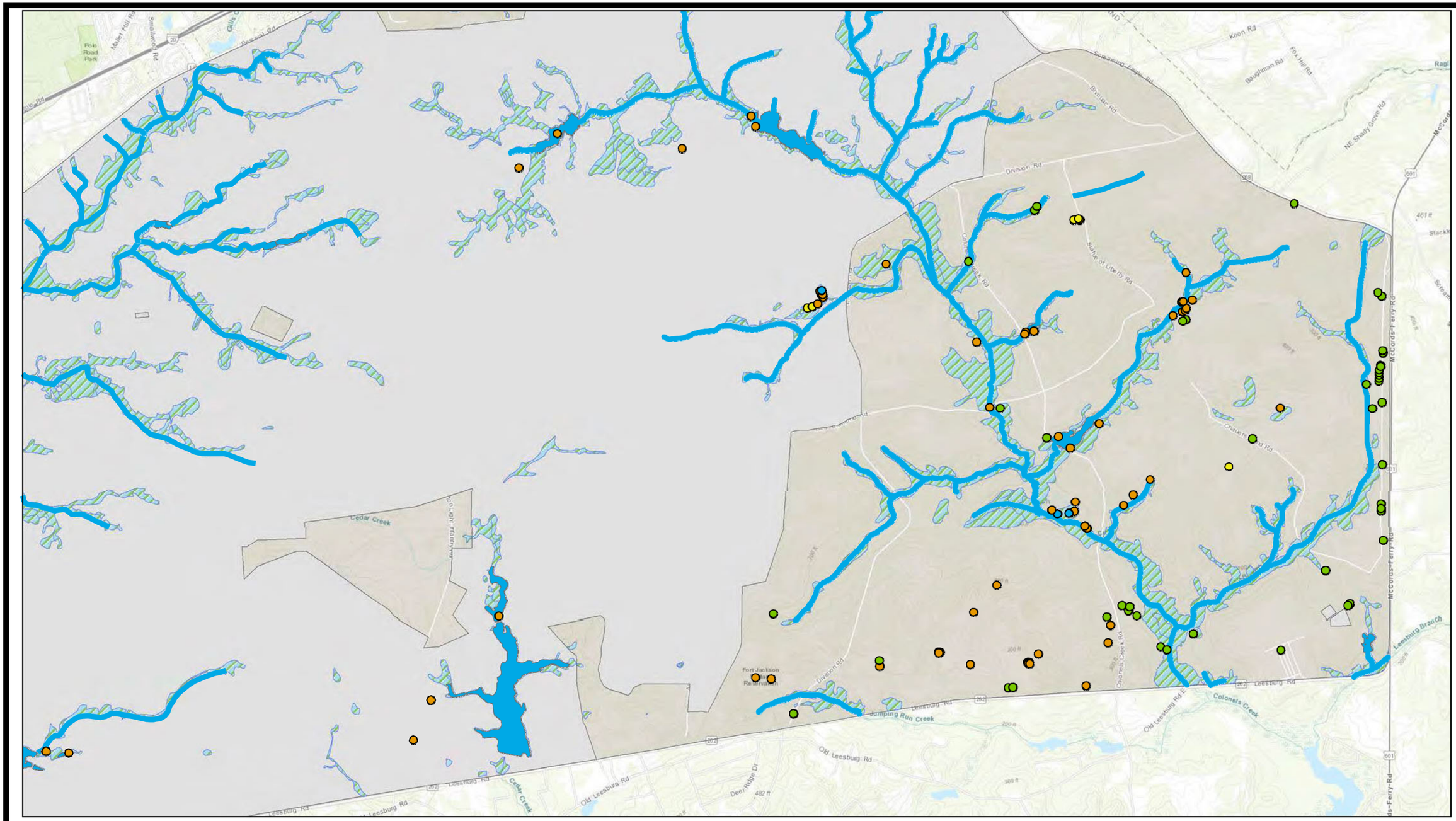
Fauna Special Status Species

Status

- Federal Listed
- State Listed

Fauna Special Status Species	**Created For MTC INRMP**
Figure Number 6	**Checked by:SCARNG Conservation**
	Date: 4/25/2019

McCrady



Legend

Flora Special Status Species

Status

- Endangered.
- Invasive
- Rare.
- Sensitive.

0 360 720 1,440 2,160 2,880 Meters

Flora Special Status Species	**Created For MTC INRMP**
Figure Number 7	**Checked by:SCARNG Conservation**
	Date: 08/04/2020

C. IMPLEMENTATION TABLES

The Goals and Objectives Summary and the Project List include program-wide, as well as items specific to MTC and Clarks Hill Training Center (CHTC).

C.1 GOALS AND OBJECTIVES SUMMARY

Climate Change and Regional Growth

Goal: Protect the Mission capability of the SCARNG through planning, adaptive management, and proactive innovative solutions.

Objective: Ensure climate resiliency adaption and mitigation of adverse impacts.
This Objective will be accomplished through the scientifically and data driven decision making, the establishment of achievable targets, collaborative planning, and adaptive management.

Objective: Integrate climate resiliency into the SCARNG planning process.
Our primary goal is to protect the mission capability of the SCARNG. The first step in doing that is to identify and plan for potential impacts.

Objective: Develop and maintain partnerships
The Department of Defense's presence in the Midlands of South Carolina is significant. There are five military installations; three active duties and two National Guard. Active and reserve components of the Army, Navy, Air Force and Marines utilize these bases. To reduce development related pressure, the installations are working together to leverage our presence in regional decision-making. Specifically, the South Carolina Military Department, Fort Jackson, and Shaw Air Force Base have joined together with local governments and Non-Governmental Organizations (NGO) to form the Midlands Area Joint Installation Consortium. The purpose of the Consortium is to facilitate collaboration on projects including a region-wide Joint Land Use Study (JLUS) or the implementation of Joint Compatible Use Buffers (JCUB) program. To further leverage our local partnership, we are also pursuing a Sentential Landscape designation.

Cultural Resources Management

Goal: Our goal is to protect and preserve the cultural and historic resources entrusted to us, while maintaining and supporting the mission of the National Guard.

Objective: ICRMP update and revision
Five-year update and revision of the Integrated Cultural Resource Management Plan to ensure the SCARNG CRM continues to operate under provisions conducive to mission goals.

Objective: Public engagement
Develop and participate in community engagement initiatives to foster public understanding of the SCARNG's commitment to cultural preservation.

Objective: ARPA compliance
Conduct annual review of eligible sites and all cemeteries located on the McCrady Training Center. Ensure appropriate preservation measures are enforced at eligible sites and cemeteries.

Objective: Protect cultural resources
Routinely assess the condition of all eligible sites located on the McCrady Training Center. Ensure appropriate signage and protection of all cultural sites.

Objective: Comply with section 106 of the NHPA
Ensure that all SCARNG undertakings are reviewed by the SHPO, THPOs, and all interested parties in compliance with Section 106 of the National Historic Preservation Act.

Fish and Wildlife

Goal: Conserve and enhance wildlife populations and their associated habitat for optimum levels of biodiversity and ecosystem health, while maintaining a realistic training environment.

Objective: Manage wildland habitat to promote species diversity
Modification of existing wildland habitat to increase biodiversity of native flora and fauna.

Objective: Long term monitoring of fish and wildlife
Initiate PLS and continue ongoing PLS to develop trend data of fish and wildlife.

Forest and Vegetation

Goal: A forest that supports the military mission and maintains ecosystem integrity. This is a forest that is characterized by high habitat diversity and managed for targeted training opportunities. Targeted Training Opportunities refers to matching training missions to land management practices.

Objective: Maintain diversity of forest habitats
Historically, the forested lands at CHTS ranged from open areas of southern yellow pines with little midstory but a high diversity of plant life in the ground layer, as well as, open upland hardwoods to hardwood drainage ways with healthy midstory/ground layer of vegetation. The intent of this objective is to accelerate habitat restoration in targeted areas, assist in the fire management program and have beneficial conditions for both the training community and the overall health of the eco- system.

Objective: Maintain open forest midstory
All historic accounts of long-leaf pine forests described them as “open and park like” with a conspicuous lack of midstory trees and shrubs. They were also described with a high diversity plant in the ground layer. This sub-climax condition is the result of a well-established fire regime. This open park-like condition is beneficial to both the training community and the overall health of the eco- system. The intent of this objective is to aid the wild land fire management program, to accelerate habitat restoration in targeted areas, and provide a more usable training space to meet the military mission.

Objective: Long term monitoring of vegetative communities
Monitor condition and species composition of vegetative communities across SCARNG Training Centers.

GIS Data

Goal: Support the mission of the South Carolina Military Department, and specifically the SCMD Environmental division, through the development and maintenance of an integrated GIS program.

Objective: Provide spatial analysis and GIS services for decision-making.

The power of GIS comes from its ability to analyze diverse and complicated datasets through a spatial lens. This analysis then enables decision makers to make more an informed choice. Improved analytical capability increases our return on our GIS investment.

Objective: GIS model creation
The power of GIS comes from its ability to analyze diverse and complicated datasets through a spatial lens. This analysis then enables decision makers to make more an informed choice. The development and use of models aids in this analysis. Improved analytical capability increases our return on our GIS investment.

Objective: Develop a data maintenance/update strategy
The SCMD has an extensive collection of training and natural resources data. It is vital that a strategy is in place to continually update and maintain these holdings, keeping them as current and accurate as possible.

Grounds

Goal: To maintain the grounds at the McCrady Training Center in a safe, attractive and professional state, while incorporating sustainable principals.

Objective: Develop a sustainable ground maintenance program.
In accordance to the requirements in EO 13693: to establish a method for reducing water, energy, and vehicle fuel usages each FY via developing a comprehensive Sustainable Grounds Management Strategy.

Outreach, Awareness and Education

Goal: Protect the Training Mission of the South Carolina Army National Guard, by fostering a public understanding of the Guards efforts at conservation stewardship, and the critical nature of the Guards mission.

Objective: Develop and maintain partnerships
The Department of Defense's presence in the Midlands of South Carolina is significant. There are five military installations; three active duties and two National Guard. Active and reserve components of the Army, Navy, Air Force and Marines utilize these bases. To reduce development related pressure, the installations are working together to leverage our presence in regional decision-making. Specifically, the South Carolina Military Department, Fort Jackson, and Shaw Air Force Base have joined together with local governments and Non-Governmental Organizations (NGO) to form the Midlands Area Joint Installation Consortium. The purpose of the Consortium is to facilitate collaboration on projects including a region-wide Joint Land Use Study (JLUS) or the implementation of Joint Compatible Use Buffers (JCUB) program. To further leverage our local partnership, we are also pursuing a Sentential Landscape designation.

Objective: Raise community awareness
In order to maintain the current favorable opinion that the public holds for the military mission, the SCARNG needs to actively work to inform the public of our efforts to maintain the resources that have been entrusted to us.

Objective: Continue education & training program
Continue the implementation of the State-Wide Environmental Education & Training program

Pest

Goal: Ensure compliance with DoD Instruction 4150.07, "DoD Pest Management Program"

Objective: Reduction of pesticide use
This objective is intended to meet the Presidential Executive Order and the DOD Measure of Merit #2: to reduce the total amount of pesticide applied each year to federal military installments.

Objective: Reduce impacts to training and the environment from nuisance wildlife.
Reduce impacts of nuisance wildlife on training activities.

Objective: Manage invasive/ noxious plant species
This objective is to develop a proactive program in accordance to EO 13112, to facilitate the management and control of Invasive/Noxious plants and animals. This program is managed as part of our Integrated Pest Management Plan. SCARNG will monitor both the overall health of the system as well as the success or failure of individual projects as part of this objective.

Program Management

Goal: Our Goal is to be a proactive program that anticipates and meets the needs of the National Guard. We strive to be a national leader in efficiency, innovation and diversity, while providing our staff an environment that empowers and supports their creativity and initiative.

Objective: Facilitate program implementation through the use of seasonal staff.
The Columbia Metro Area has a large population of students seeking under graduate and post graduate degrees in conservation related fields. This provides us with a unique opportunity to supplement our staff to work on seasonal projects.

Objective: Maintain current and accurate species lists
The purpose of this objective is to have an accurate species information that is both current and in easily accessible and usable format. In the past individual surveys were in different formats and stored in in multiple locations making it difficult to access the information. Our species data has been transferred to central species tracking database. This database contains both individual occurrences recorded from Planning Level Surveys, and general presence/ absence for each of our installations. This includes both verified records and potential occurrences.

Objective: Maintain easy and up to date access to all relevant documents.
Maintain easy and up to date access to all records, surveys, reports, reviews and other relevant documents. This accomplished through the use of both a document tracking database and our file management system.

Objective: Contribute to the National Guard Environmental Program at a national level
The success of the local Environmental Program is directly linked to the success of the National Program. To facilitate that success SCARNG Conservation staff will participate in Committees, review policy documents and reports, and provide general feedback and support to NGB to facilitate a strong overall environmental program.

Objective: Ensure fiscal sustainability for the Conservation Program
In order for the SCARNG Conservation Program to be successful, it requires sound and sustainable fiscal management. This includes program out year requirements, managing budgets and tracking procurements.

Objective: To employ a staff of subject matter experts that are innovative leaders and current in their field.
To employ a staff of subject matter experts that are innovative leaders and current in their field. That are able to use their knowledge and experience to implement program management plans and support the mission of the SCARNG

Objective: Facilitate program support and implementation through state-of-the-art technology
Conservation Management requires the analysis of complex and diverse systems. Understanding these systems is often a very data intensive undertaking that then require repackaging to communicate the information. As a result, Conservation projects often require and utilize the most current technology.

Objective: Ensure that all planning documents are relevant & current
Keep all planning documents current though annual reviews, and updates. This project also includes document revisions, and other administrative task to improve document management and document relevance in day to day business practices.

Objective: Support program implementation through providing staff the tools, equipment, and supplies needed to perform their day to day work activities.
In order to effectively perform their duties, the staff needs the proper supplies and equipment. This objective is to ensure that they are provided these materials.

Soil and Water

Goal: To maintain training lands, while protecting and enhancing soil and water quality, and ensuring compliance with all applicable laws and regulations.

Objective: Erosion repair site monitoring & evaluation
The intent of this objective is to determine if the activities in Section 2.3.2 Objective 2 of the McCrady INRMP produce the desired results. Monitoring and project evaluation helps:

- Identify what works, what did not work, and what should continue
- Improves actions where they are less effective
- Change actions if they are ineffective

Objective: Facilitate the coordination, repair and identification of eroded areas across the training site.
The purpose of this objective is to aid in the execution of the Soil Management Implementation Plan & Inventory (SMPI) developed under Objective ID #6 in this database. This is done through coordination of interested parties to develop budgets, identify resourcing and aid in planning and execution.

Objective: Develop a systematic approach for Soil & Water Management
The three biggest obstacles to a successful Soil and Water Management program are; communication, coordination, and resourcing (funding). The intent of this objective is to provide a structured system to facilitate coordination and communication. This in turn would allow for more targeted use of available resources. The intent is to hold a quarterly meeting between all stakeholders (Facilities Management

Office, Training/ ITAM, Natural Resources and pertinent Training Site Staff). The 1st and 4th Quarter meeting would focus on review of completed work, identification and prioritization of work still needed, and the development of available budget and resourcing to execute the work. The 2nd and 3rd Quarter meeting would be to track on going work and note any problems or changes in the execution plan.

Objective: Repair identified erosion sites
The purpose of this objective is to implement the Soil Management Implementation Plan & Inventory (SMPI) developed under Objective ID #6 in this database

Special Status Species

Goal: Conserve and enhance Threatened, Endangered and Special Status Species (SSS) populations and their associated habitat for optimum levels of biodiversity and ecosystem health.

Objective: Special status species monitoring
Develop a protocol for monitoring SSS, which will create a species list and monitoring period.

Objective: Special status species habitat management
Maintain and/or modify existing habitat to increase biodiversity of SSS.

Objective: Threatened and endangered ecosystem management
Manage ecosystems level factors that support threatened and endangered (T&E) species population health and survivorship.

Wetlands

Goal: A Wetlands Management Program that protects and enhances all wetland systems and ensures compliance with all applicable laws and regulations.

Objective: Collection of data to support planning and monitoring initiatives.
This objective supports the planning and check stages of our adaptive management strategy.

Objective: Sustain or enhance wetland systems at MTC & CHT
This objective addresses the action and the analysis phases of our adaptive management strategy. It focuses on implementing projects derived from our planning process and analyzing the success of the implemented projects.

C.2 CURRENT PROJECT LIST

Climate Change and Regional Growth: Develop and Maintain Partnerships

Update and Maintain JCUB Program (Project # 96)

The SCARNG, in cooperation with several partners was successful in obtaining funding for a Joint Compatible Use Buffer plan in FY 08. Updating and managing this plan is an ongoing effort. This includes updating GIS data layers, developing annual funding requests, and reports. Refining parcel scoring models, attending public meetings and meeting and coordinating with our partners.

Facility:	MTC
Status:	Active
Frequency:	C-Annual
STEP Project Number:	SCONG10001
Estimated Cost:	$15,000.00/year
Proponent:	Joint
Year Proposed:	Current

SERPPAS Steering Committee (Project # 294)

Participate in the SERPPAS Steering Committee.

Facility:	Statewide / Program-wide
Status:	Active
Frequency:	C-Annual
STEP Project Number:	SC0NG150001
Estimated Cost:	$2,500.00/year
Proponent:	-
Year Proposed:	Current

Sentinel Landscape Program (Project # 319)

Development and implementation of a MAJIC Sentinel Landscape.

Facility:	Statewide / Program-wide
Status:	Active
Frequency:	C-Annual
STEP Project Number:	TBD
Estimated Cost:	$0
Proponent:	ENV
Year Proposed:	Current

Implement Climate Resiliency Plan (Project # 350)

Implement a strategy to review existing plans for climate resiliency integration and identify opportunities.

Facility:	Statewide / Program-wide
Status:	Planning
Frequency:	D-Annual
STEP Project Number:	SCC70060010

Estimated Cost: $10,000.00/year
Proponent: -
Year Proposed: 20

Climate Change and Regional Growth: Integrate climate resiliency into the SCARNG planning process

Develop a Climate Resiliency Integration Plan (Project # 349)

Develop a strategy to review existing plans for climate resiliency integration and identify opportunities.

Facility: Statewide / Program-wide
Status: Planning
Frequency: Defined
STEP Project Number: SCC70060010
Estimated Cost: $10,000.00/year
Proponent: -
Year Proposed: 20

Native American Consultation (Project # 134)

Conduct Consultation with Native American Tribes.

Facility: Statewide / Program-wide
Status: Active
Frequency: C-Annual
STEP Project Number: SC000060008
Estimated Cost: $ 25,750.00/year
Proponent: ENV
Year Proposed: 20

Cultural Resources Management: Comply with Section 106 of the NHPA

Mitigation for Armories (Project # 146)

Develop a program for armory mitigation that will address future adverse effects. This mitigation for an adverse effect is outlined in the signed NHPA Nationwide PA for armories, and the follow-on letter to the SHPO notifying them of the adverse effect & the proposed mitigation, as prescribed by the PA.

The SCARNG is planning a federal undertaking funded with Sustainment, Restoration and Modernization (SRM) funds. The SCARNG has determined that the project will affect historic properties and buildings that are eligible for listing in the National Register of Historic Places and that the affects will be adverse as defined in 36 CFR 800.5(a)(1). The SCARNG has developed agreement document (i.e. a Memorandum of Agreement or Programmatic Agreement) in consultation with the SHPO and other consulting parties to mitigate this adverse effect.

Facility: Statewide / Program-wide
Status: Active
Frequency: Defined
STEP Project Number: SC000060014
Estimated Cost: $ 20,000.00/year

Proponent:	ENV
Year Proposed:	Current

Historic Armory Research Project (Project # 244)

This project is designed to identify and scan relevant materials on historic armories and other SCARNG facilities. This research will include blueprints, construction documents, photographs and unit histories.

Facility:	Statewide / Program-wide
Status:	Active
Frequency:	Multi-year
STEP Project Number:	SC000060014
Estimated Cost:	$15,000.00/year
Proponent:	-
Year Proposed:	Current

NEPA and Section 106 Review (Project # 307)

This project is for regular reoccurring aspects of NHPA and Section 106 and NEPA Review.

Facility:	Statewide / Program-wide
Status:	Active
Frequency:	C-Annual
STEP Project Number:	SC0NG160001
Estimated Cost:	$300.00/year
Proponent:	-
Year Proposed:	Current

Cultural Resources Management: Protect Cultural Resources

Monitor Cultural Sites (Project # 166)

Bringing the Integrated Cultural Resource Management Plan (ICRMP) up to date for 2014-2019.

Facility:	Statewide / Program-wide
Status:	Active
Frequency:	D-Annual
STEP Project Number:	SCC70140002
Estimated Cost:	$ 5,000.00/year
Proponent:	ENV
Year Proposed:	Current

Cultural Resource Historic GIS Mapping Project (Project # 227)

This GIS project is a long-term project designed to acquire, digitize, analyze historic cartographic sources to locate previously unidentified archaeological resources, identify the history of the various military disturbances at the MTC. Also related to this idea, is the possibility of using this locational model as part of the development of a PA with the SC SHPO that uses location of a project as one variable to determine whether the project would require external review.

Facility:	Statewide / Program-wide
Status:	Active
Frequency:	Multi-year
STEP Project Number:	SC000060014
Estimated Cost:	$ 5,000.00/year
Proponent:	-
Year Proposed:	Current

Cultural Program Management (Project # 317)

This project provides overarching support to the Cultural resources program. It supports tasks that cross project lines within the Cultural program.

Facility:	Statewide / Program-wide
Status:	Active
Frequency:	C-Annual
STEP Project Number:	SCC70140002
Estimated Cost:	$ 35,000.00/year
Proponent:	ENV
Year Proposed:	Current

Fish and Wildlife: Long-term Monitoring of Fish and Wildlife

Herpetological Monitoring (Project # 76)

Herpetological Monitoring project assess the distribution, ecology and habitat of the herpetofauna associated at MTC and CHT. Also provides table showing habitat preferences of all species native to the base. This project also generates an on-going reptile/amphibian species list.

Facility:	Statewide / Program-wide
Status:	Active
Frequency:	C-Annual
STEP Project Number:	SCC70060014
Estimated Cost:	$ 7,500.00/year
Proponent:	ENV
Year Proposed:	Current

Monitoring Neotropical Migrants (Project # 74)

The Monitoring Avian Productivity and Survivorship (MAPS) Program is a national program created by The Institute for Bird Populations to assess and monitor the vital rates and population dynamics of over 120 species of North American land birds in order to provide critical conservation and management information on their populations. The SCARNG is partnered with the SC Department of Natural Resources (SCDNR) to conduct surveys of neo-tropical migratory birds on the training lands in order to make sound biological management decisions. Other bird surveys on MTC provided by SCDNR are: The Breeding Bird Survey and Fall Bird Banding Event.

Facility:	MTC
Status:	Active

Frequency:	D-Annual
STEP Project Number:	SCC70140001
Estimated Cost:	$ 10,000.00/year
Proponent:	ENV
Year Proposed:	Current

Analyze and Plan for Pollinator Survey (Project # 78)

During this phase, the survey will be reviewed, and current status of the pollinator population discussed. If it is decided that the population requires management strategies to be implemented, then a plan will be developed.

Facility:	Statewide / Program-wide
Status:	Planning
Frequency:	Multi-year
STEP Project Number:	SCC70060014
Estimated Cost:	$ 7,500.00/total
Proponent:	ENV
Year Proposed:	21

Study on Propagation of Listed Plant Species (Project # 79)

Some state and federally listed plant species that occur on MTC do not have thriving population. This study will check on the feasibility of propagating state and federally listed plant species as well as species of cultural interest to federally recognized Native American populations.

Facility:	Statewide / Program-wide
Status:	Planning
Frequency:	Defined
STEP Project Number:	SCC70060008
Estimated Cost:	$ 20,000.00/total
Proponent:	ENV
Year Proposed:	21

PLS Birds at Clarks Hill (Project # 111)

Planning Level Survey for Birds at Clarks Hill Training Center. Includes breeding Bird Surveys and point counts. This is a multiyear project that will run from FY12-FY14.

Facility:	Clarks Hill Training Center
Status:	Active
Frequency:	Multi-year
STEP Project Number:	SC96A060003
Estimated Cost:	$ 10,433.00/Annually
Proponent:	ENV
Year Proposed:	Current

Bat Population Monitoring (Project # 129)

This project is for the long-term monitoring of Chiropteran on SCARNG managed property. This project will primarily use acoustic means to collect information about bat populations. This data will be shared with SCDNR and DoD Bat population specialists.

Facility:	Statewide / Program-wide
Status:	Active
Frequency:	D-Annual
STEP Project Number:	SCC70060008
Estimated Cost:	$ 30,000.00/Annually
Proponent:	ENV
Year Proposed:	Current

Weather Station (Project # 162)

Maintain and collect data from FTS weather station as part of the MTC Wetland Monitoring program.

Facility:	MTC
Status:	Active
Frequency:	C-Annual
STEP Project Number:	SCC70060005
Estimated Cost:	$ 1,000.00/Annually
Proponent:	ENV
Year Proposed:	Current

Large and Medium Wildlife PLS (Project # 348)

Provide baseline information concerning the abundance and diversity of medium and large mammals at the Clarks Hill Training Center near Plum Branch, SC, that will be used for management purposes at this site. Of particular interest is the presence and abundance of medium and large mammal species across the site and how these are influenced by human activities.

Facility:	Statewide / Program-wide
Status:	Active
Frequency:	Defined
STEP Project Number:	SC96A160001
Estimated Cost:	$ 55,000.00 Total
Proponent:	ENV
Year Proposed:	Current

Food Plots (Project # 139)

Planting of Food Plots to help enhance wildlife habitat.

Facility:	Statewide / Program-wide
Status:	Active
Frequency:	D-Annual
STEP Project Number:	SC96A160001
Estimated Cost:	$ 40,000.00/Year
Proponent:	ENV

Year Proposed: Current

Fish and Wildlife: Manage Wildlife Habitat to Promote Species Diversity

Herpetological PLS at CHTC (Project # 309)

This project is to conduct a PLS at CHTC in accordance with the SIKES requirements. The PLS will look at both reptile and amphibian populations across the installation. To include both terrestrial and aquatic habitats with the CHTC.

Facility:	Clarks Hill Training Center
Status:	Active
Frequency:	Defined
STEP Project Number:	SC96A160001
Estimated Cost:	$ 25,000.00 Total
Proponent:	ENV -Conservation
Year Proposed:	Current

Develop a Fire Management Plan (Project # 157)

Create a comprehensive plan that will establish firebreaks and burning regimes for the forested areas at CHTC. This will be accomplished by using data from the forest management plan and consulting with the USACE.

Facility:	Statewide / Program-wide
Status:	Planning
Frequency:	Defined
STEP Project Number:	SC96A060002
Estimated Cost:	$ 20,000.00 Total
Proponent:	ENV
Year Proposed:	21

Forest and Vegetation: Maintain Diversity of Forest Habitats

CHTC Floral PLS and Monitoring (Project # 340)

The purpose of this project is monitor and catalog floral species of concern at CHTC. This includes, wetlands species, at risk species, invasive, and threatened and endangered species. This is accomplished through the use of seasonal staff and contracted surveys.

Facility:	Clarks Hill Training Center
Status:	Planning
Frequency:	Multi-year
STEP Project Number:	SC96A060004
Estimated Cost:	$ 15,000.00/Year
Proponent:	-
Year Proposed:	21

Scrub Oak Management Plan (Project # 91)

Through use of data collected in the Hardwoods mapping project, a plan for the removal and maintenance of dense hardwood areas will be developed. This plan will describe specific stands in need of treatment and determine proponent and cost of each activity. This plan should be coordinated with Ft Jackson Forestry and the USACE Strom Thurmond Project to ensure management objectives follow their forestry objectives and should be updated every 5 years.

Facility:	Statewide / Program-wide
Status:	Planning
Frequency:	Multi-year
STEP Project Number:	SCC70060008
Estimated Cost:	$ 20,000.00 Total
Proponent:	TBD
Year Proposed:	21

Forest and Vegetation: Maintain Open Forest Inventory

Mid Story Removal (Project # 92)

Implementation of the Scrub oak management plan will consist of putting into practice the management practices described in the SOMP. This work will include mechanical thinning of sites, prescribed burning assistance, and chemical control in accordance with the recommendations of the Ft Jackson forest management plan and the USACE at the Strom Thurmond Project on Lake Clarks Hill.

Facility:	Statewide / Program-wide
Status:	Planning
Frequency:	C-Annual
STEP Project Number:	SCC70060008
Estimated Cost:	$ 10,000.00/Year
Proponent:	TBD
Year Proposed:	Current

CHT Forestry Management Plan implementation (Project # 329)

Execute projects/ task from the CHT Forestry Management Plan.

Facility:	Clarks Hill Training Center
Status:	Active
Frequency:	Multi-year
STEP Project Number:	SC96A060007
Estimated Cost:	$ 25,000.00/Year
Proponent:	ENV
Year Proposed:	Current

GIS Data: Develop a Data Maintenance/Update Strategy

Create a 5-year Data Management Plan (Project # 6)

Develop a management plan that will address the following areas plan to keep track of and schedule updates for existing data, and creation of new data. All environmental GIS data layers will have a specified schedule for updates and routine maintenance.

Facility:	Statewide / Program-wide
Status:	Active
Frequency:	Multi-year
STEP Project Number:	SC000060010
Estimated Cost:	$ 5,000.00 Total
Proponent:	ENV
Year Proposed:	21

Implement 5-year Data Plan (Project # 7)

Implement and update 5-year Data plan. This includes performing both managerial/ administrative task and actual data creation, updating and maintenance.

Facility:	Statewide / Program-wide
Status:	Active
Frequency:	Multi-year
STEP Project Number:	SC000060010
Estimated Cost:	$ 15,000.00/Year
Proponent:	ENV
Year Proposed:	22

Create SOPs for data handling (Project # 8)

Develop and implement standard operating procedures for the organization, maintenance, sharing, distribution and updating of all environmental GIS data, and ensure that all environmental staff follows these procedures.

Facility:	Statewide / Program-wide
Status:	Active
Frequency:	Multi-year
STEP Project Number:	SC000060010
Estimated Cost:	$ 5,000.00 Total
Proponent:	ENV
Year Proposed:	21

Update 5-year IT equipment plan (Project # 9)

Create and implement a plan to specify hardware and equipment maintenance and updates.

Facility:	Statewide / Program-wide
Status:	Active
Frequency:	Multi-year
STEP Project Number:	SC000060012
Estimated Cost:	$ 5,000.00 Total
Proponent:	ENV

Year Proposed: Current

SDE Management & Maintenance (Project # 257)

Create and implement a plan to specify hardware and equipment maintenance and update Manage the SCARNG enterprise GIS. Includes any common/routine/needed management of data layers, database schema/design, SQL server, services etc.…

Facility: Statewide / Program-wide
Status: Active
Frequency: C-Annual
STEP Project Number: SC000060010
Estimated Cost: $ 20,000.00/Year
Proponent: ENV
Year Proposed: Current

Create & Manage a Document Management GIS Layer (Project # 259)

Create, manage, and maintain a GIS Document Management layer linking important environmental documentation to a physical/geographic area viewable in GIS.

Facility: Statewide / Program-wide
Status: Active
Frequency: C-Annual
STEP Project Number: SC000060010
Estimated Cost: $ 5,000.00/Year
Proponent: ENV
Year Proposed: Current

Manage SCARNG ArcGIS Online Account (Project # 260)

Facility: Statewide / Program-wide
Status: Active
Frequency: C-Annual
STEP Project Number: SC000060010
Estimated Cost: $ 0
Proponent: -
Year Proposed: Current

Update and improve JCUB parcel priority model (Project # 10)

Continue to develop and fine-tune the suitability model created for the JCUB (Joint Compatible Use Buffer) program. Find new and relevant data layers to incorporate into the model.

Facility: Statewide / Program-wide
Status: Active
Frequency: Multi-year
STEP Project Number: SCONG10001
Estimated Cost: $ 10,000.00 Total
Proponent: ENV
Year Proposed: Current

Update and improve JCUB parcel priority model (Project # 10)

Continue to develop and fine-tune the suitability model created for the JCUB (Joint Compatible Use Buffer) program. Find new and relevant data layers to incorporate into the model.

Facility:	Statewide / Program-wide
Status:	Active
Frequency:	Multi-year
STEP Project Number:	SCONG10001
Estimated Cost:	$ 10,000.00 Total
Proponent:	ENV
Year Proposed:	Current

GIS Data: GIS Model Creation

Create and maintain soil erosion models (Project #11)

Create models of soil erosion for the training areas of McCrady Training center, to highlight areas that are current concerns, as well as to predict future areas of interest.

Facility:	Statewide/ Program Wide
Status:	Active
Frequency:	Multi-Year
STEP Project Number:	SCC70060009
Estimated Cost:	$10,000.00 Total
Proponent:	ENV
Year Proposed:	21

Provide cartographic products as needed (Project # 28)

Provide access to the environmental GIS data holdings in the form of maps, aerial photography, and other cartographic products, in order to assist soldiers and staff in project development, resource management, training, and decision making.

Facility:	Statewide/ Program Wide
Status:	Active
Frequency:	Multi-Year
STEP Project Number:	SCB18060001
Estimated Cost:	$5,000.00 Annual
Proponent:	ENV
Year Proposed:	Current

GIS Data: Provide Spatial Analysis and GIS Services for Decision-Making

Provide spatial analysis (Project #29)

Utilize GIS and ancillary data in spatial analysis to assist with resource management, project development, and decision making.

Facility:	Statewide/ Program Wide
Status:	Active

Frequency:	Multi-Year
STEP Project Number:	SC000060010
Estimated Cost:	$10,000.00 Annual
Proponent:	ENV
Year Proposed:	Current

Migrate Species data to GIS (Project #241)

Incorporate data from the Species Database into GIS.

Facility:	Statewide/ Program Wide
Status:	Planning
Frequency:	C-Annual
STEP Project Number:	SC000060010
Estimated Cost:	$5,000.00
Proponent:	
Year Proposed:	21

GI-STAR Support (Project # 261)

General management and maintenance for GI-STAR. Includes managing, updating, and maintaining services for GI-STAR; creating Help documentation for using GI-STAR; assisting with GI-STAR design, layout, etc.…

Facility:	Statewide/ Program Wide
Status:	Active
Frequency:	C-Annual
STEP Project Number:	SC000060010
Estimated Cost:	$5,000.00 Annual
Proponent:	-
Year Proposed:	Current

Outreach, Awareness and Education: Continue Education and Training Program

Develop ECO Training Materials (Project # 103)

Currently the SCARNG has limited materials for unit ECO's to use in their training programs. This project is for the development of a DVD that ECO's could use to train Unit Personnel

Facility:	Statewide/ Program Wide Status Planning
Frequency:	C-Annual
STEP Project Number:	SC000060018
Estimated Cost:	$15,000.00 Annual
Proponent:	ENV
Year Proposed:	Current

Conduct ECO Training Statewide (Project# 104)

Currently the SCARNG has limited materials for unit ECO's to use in their training programs. This project is for the development of a DVD that ECO's could use to train Unit Personnel

Facility:	Statewide/ Program Wide

Status:	Active
Frequency:	C-Annual
STEP Project Number:	SC000060018
Estimated Cost:	$5,000.00 Annual
Proponent:	ENV
Year Proposed:	Current

Develop Awareness Materials (Project #135)

Develop awareness materials, to include soldier cards, maps, and other handouts.

Facility:	Statewide/ Program Wide
Status:	Planning
Frequency:	C-Annual
STEP Project Number:	SCC70060007
Estimated Cost:	$13,000.00 Total
Proponent:	ENV
Year Proposed:	Current

Develop Training Aids and Materials (Project # 226)

Facility Statewide/ Program Wide	
Status:	Active
Frequency:	C-Annual
STEP Project Number:	SCB18060001
Estimated Cost:	$2,000.00 Total
Proponent:	ENV
Year Proposed:	21

Develop an Integrated Training Plan/Curriculum (Project #102)

Currently the SCARNG has no integrated curriculum for environmental training. This leads to an inconsistent message and gaps in the quality and the type of information that is disseminated. This project will develop a standard set of courses along with tools & materials to be used during training.

Facility:	Statewide/ Program Wide
Status:	Planning
Frequency:	Defined
STEP Project Number:	SC000060018
Estimated Cost:	$5,000.00 Total
Proponent:	ENV/ITAM
Year Proposed:	21

Outreach and Education: Raise Community Awareness

Maintain and Upgrade Interpretive Nature and Fitness Trail System (Project # 99)

Working under a National Public Lands Day grant from the NTF SCARNG constructed an interpretive nature trail and outdoor class room on the McCrady Training Center. The trail is a spur off of the

Palmetto Trail, a trail that runs across the breadth of South Carolina, connecting the mountains to the coast. The trail has become a center piece of our current outreach program. This project is to maintain and expand the existing trail system. This will facilitate our outreach efforts and provide increased outreach opportunities. In the past volunteers have been used to help construct and maintain the trail, this is a practice that will continue.

Facility:	MTC
Status:	Active
Frequency:	C-Annual
STEP Project Number:	GRANT
Estimated Cost:	$1,000.00 Annual
Proponent:	ENV
Year Proposed:	Current

Conduct Requested Outreach Programs (Project # 100)

The Conservation office is periodically asked throughout each year to give talks & lectures or to set up a booth. These present excellent opportunities to educate the community about the mission and activities of the South Carolina Army National Guard. At a minimum the objective of this project is to meet the current demand. The ultimate goal of the project is to increase the number of Public Outreach Opportunities.

Facility:	Statewide/ Program Wide
Status:	Active
Frequency:	C-Annual
STEP Project Number:	SC000060018
Estimated Cost:	$5,000.00 Annual
Proponent:	ENV
Year Proposed:	Current

Develop Outreach Curriculum & Materials (Project # 101)

Currently the SCARNG has no standard or base curriculum or materials for outreach programs. They are developed as needed before each opportunity. This leads to an inconsistent message and gaps in the quality and the type of information that is disseminated. The creation of unique materials and curriculum for each opportunity also increases the staff's workload. This project will develop a standard set of tools & materials to be used during outreach opportunities. This project will be completed with in-house staff and equipment.

Facility:	Statewide/ Program Wide
Status:	Active
Frequency:	C-Annual
STEP Project Number:	SC000060018
Estimated Cost:	$10,000.00 Annual
Proponent:	ENV/ITAM
Year Proposed:	21

National Public Lands Day (Project # 150)

National Public Lands Day is the nation's largest hands-on volunteer effort to improve and enhance public lands and military lands open to the public for recreation.

Facility:	Statewide/ Program Wide
Status:	Planning
Frequency:	D-Annual
STEP Project Number:	GRANT
Estimated Cost:	$6,085.00 Total
Proponent:	ENV
Year Proposed:	Current

Pest: Manage Invasive/Noxious Plant Species

Implement Management activities from Invasive and Noxious Plant Management Plan (Project # 95)

Implement management activities through use of mechanical, chemical and biological control methods to reduce or eliminate invasive and noxious plant species.

Facility:	Statewide/ Program Wide
Status	Active
Frequency	C-Annual
STEP Project Number:	SCC70060019
Estimated Cost	$30,000.00 Annual
Proponent	ENV/ITAM/ Facilities
Year Proposed	Current

Develop an Early Detection Rapid Response Plan for Invasive Species (Project # 158)

Develop an EDRR program in accordance with the National Invasive Species Councils guidelines that allows for immediate reaction to specific invasive species that have the potential to cause significant long-term impacts if not dealt with in a much-expedited timeline from when discovered.

Facility:	Statewide/ Program Wide
Status:	Planning
Frequency:	Defined
STEP Project Number:	SCC70060019
Estimated Cost:	$10,000.00 Total
Proponent:	-
Year Proposed:	22

Invasive Species Control MTC (Project # 308)

This project is for the control and eradication of invasives.

Facility:	Statewide/ Program Wide
Status:	Active
Frequency:	C-Annual
STEP Project Number:	SCC70060019
Estimated Cost:	$20,000.00 Annual

Proponent: ENV
Year Proposed: Current

Treatment of Invasive Species at the Donaldson Center (Project # 332)

Eradication of invasive/noxious species by chemical and/or manual methods.

Facility: Statewide/ Program Wide
Status: Planning
Frequency: D-Annual
STEP Project Number: SCC70060019
Estimated Cost: $5,000.00 Annual
Proponent: ENV
Year Proposed: 21

Treatment of Invasive Species at Fountain Inn (Project # 334)

Eradication of invasive/noxious species by chemical and/or manual methods.

Facility: Statewide/ Program Wide
Status: Planning
Frequency: D-Annual
STEP Project Number: SCC70060019
Estimated Cost: $1,000.00 Annual
Proponent: ENV
Year Proposed: 21

Nuisance Wildlife Pest Control (Project # 125)

Reduce Impacts from nuisance wildlife through activities such as trapping and/or relocating.

Facility: Statewide/ Program Wide
Status: Active
Frequency: C-Annual
STEP Project Number: SCC70060019
Estimated Cost: $500.00 Annual
Proponent: ENV
Year Proposed: Current

Pests: Reduce the Quantity of Pesticides Applied

Tracking Pesticide usage through the IPMP (Project # 152)

Tracking the pounds of active pesticide ingredients applied on Army National Guard Land through the IPMP.

Facility Statewide/ Program Wide
Status Active
Frequency C-Annual
STEP Project Number: SCC70060019
Estimated Cost $0.00 Total
Proponent

Year Proposed	Current

Environmental Advisory Council (Project # 201)

Participation on the EAC

Facility	Statewide/ Program Wide
Status	Active
Frequency	C-Annual
STEP Project Number:	SCB18060003
Estimated Cost	$5,000.00 Annual
Proponent	ENV
Year Proposed	Current

Program Management: Contribute to the National Guard Environmental Program at a National Level

National Awards Program (Project # 320)

Participate in the NGB & Army National Awards program

Facility	Statewide/ Program Wide
Status	Active
Frequency	D-Annual
STEP Project Number:	SCC70160002
Estimated Cost	$0.00
Proponent	Env
Year Proposed	Current

EAC Meetings (Project # 328)

Facility	Statewide/ Program Wide
Status	Active
Frequency	C-Annual
STEP Project Number:	SC0NG150001
Estimated Cost	$5,000.00 Annual
Proponent	-
Year Proposed	Current

Program Management: Ensure Fiscal Sustainability for the Conservation Program

NGB Data Calls (Project # 318)

Facility	Statewide/ Program Wide
Status	Active
Frequency	C-Annual
STEP Project Number:	SCC70060010
Estimated Cost	$0.00
Proponent	ENV
Year Proposed	Current

Program Management: Ensure That All Planning Documents are Relevant & Current

CHTS INRMP Review for Operation and Effect (Project # 117)

This project is for the update and revision of the Clarks Hill Training Site INRMP.

Facility	Clarks Hill Training Center
Status	Active
Frequency	Multi-Year
STEP Project Number:	SC96A060002
Estimated Cost	$20,000.00 Total
Proponent	ENV
Year Proposed	24

MTC INRMP Review for Operation and Effect (Project # 109)

This project is for the revision and update of the SCARNG INRMPs (McCrady & CHT).

Facility	Statewide/ Program Wide
Status	Active
Frequency	Multi-Year
STEP Project Number:	SC96A060002
Estimated Cost	$20,000.00 Total
Proponent	ENV
Year Proposed	25

Update ICRMP (Project # 140)

Maintain and update ICRMP.

Facility	Statewide/ Program Wide
Status	Planning
Frequency	C-Annual
STEP Project Number:	SC0NG160001
Estimated Cost	$7,500.00 Annual
Proponent	ENV
Year Proposed	24

Maintain and Update Tracking Database (Project # 143)

Maintain and Update Tracking Database. This includes database administration, report and query development, as well as data entry.

Facility	Statewide/ Program Wide
Status	Active
Frequency	C-Annual
STEP Project Number:	SCC70060010
Estimated Cost	$3,000.00 Annual
Proponent	ENV

Year Proposed	Current

Update INRMPs (Project # 338)

Conduct Annual Updates and 5-year Reviews for Operation and Effect.

Facility	Statewide/ Program Wide
Status	Active
Frequency	C-Annual
STEP Project Number:	SCC70060010
Estimated Cost	$27,000.00 Annual
Proponent	ENV
Year Proposed	25

Program Management: Maintain Current and Accurate Species Lists

Species Database (Project # 124)

Develop and maintain a species database. The database should be capable of housing a running species list as well as storing results from planning level surveys, monitoring activities, and incidental captures and observations.

Facility	Statewide/ Program Wide
Status	Active
Frequency	C-Annual
STEP Project Number:	SCC70060014
Estimated Cost	$7,500.00 Annual
Proponent	ENV
Year Proposed	Current

Program Management: Maintain Easy and Up-to-Date Access to All Relevant Documents

Maintain IT Systems (Project # 237)

Maintain and Upkeep of IT Systems within the Conservation office.

Facility	Statewide/ Program Wide
Status	Active
Frequency	C-Annual
STEP Project Number:	SCB18060001
Estimated Cost	$10,000.00 Annual
Proponent	-
Year Proposed	Current

State Property Inventory Tracking (Project # 274)

Facility	Statewide/ Program Wide
Status	Active
Frequency	C-Annual
STEP Project Number:	SCC70160002
Estimated Cost	$0.00
Proponent	-

Year Proposed	Current

Program Management: Maintain State-of-the-Art Technology

Implement IT maintenance & replacement plan (Project # 292)

The SCARNG Conservation Section operates under an IT replacement and maintenance plan. This plan details the distribution of IT assets and replacement schedules.

Facility	Statewide/ Program Wide
Status	Active
Frequency	C-Annual
STEP Project Number:	SCC70160002
Estimated Cost	$8,000.00 Annual
Proponent	ENV
Year Proposed	Current

Database Development and testing (Project # 169)

Facility	Statewide/ Program Wide
Status	Active
Frequency	C-Annual
STEP Project Number:	SCC70160002
Estimated Cost	$7,500.00 Annual
Proponent	ENV
Year Proposed	Current

Project Management: Provide staff the tools, equipment, and supplies needed to perform their day to day work activities.

Maintain and Repair Equipment (Project # 303)

This project is for the repair, maintenance, and general upkeep of the Conservation Teams equipment.

Facility	Statewide/ Program Wide
Status	Active
Frequency	C-Annual
STEP Project Number:	SCC70060019
Estimated Cost	$5,000.00 Annual
Proponent	ENV
Year Proposed	Current

Procurement of routine office supplies (Project # 242)

This project is for the procurement of day-to-day office supplies and equipment that the staff need to successfully complete their job.

Facility	Statewide/ Program Wide
Status	Active
Frequency	C-Annual

STEP Project Number:	SCB18060001
Estimated Cost	$5,000.00
Proponent	-
Year Proposed	Current

Routine Admin (Project # 322)

Provide tools, equipment and supplies for routine administrative functions in support of the Conservation Program

Facility	Statewide/ Program Wide
Status	Active
Frequency	C-Annual
STEP Project Number:	SCC70160002
Estimated Cost	$5,000.00 Annual
Proponent	ENV
Year Proposed	Current

Program Management: To employ a staff of subject matter experts that are innovative leaders

Staff Training (Project # 233)

This project ensures that our staff has the opportunity to receive subject matter specific training to stay current in their field and to expand their knowledge base.

Facility	Statewide/ Program Wide
Status	Active
Frequency	C-Annual
STEP Project Number:	SCB18060015
Estimated Cost	$40,000.00 Annual
Proponent	ENV
Year Proposed	Current

Staff Development Training Plan (Project # 236)

The development and maintenance of individual staff development and training plans. The intent is to link these training plans to measurable objectives that can/ will lead to salary increases.

Facility	Statewide/ Program Wide
Status	Planning
Frequency	C-Annual
STEP Project Number:	SCB18060002
Estimated Cost	$0.00
Proponent	Conservation
Year Proposed	20

Mission Travel (Project # 250)

This project supports Mission related travel. This project supports other projects with the INRMP & ICRMP with travel expenses.

Facility	Statewide/ Program Wide
Status	Active
Frequency	C-Annual
STEP Project Number:	SCB18060003
Estimated Cost	$35,000.00 Annual
Proponent	ENV
Year Proposed	Current

Yearly Performance Planning and Evaluation Reviews (Project # 252)

Conduct yearly performance planning and evaluation reviews as required by agency policy.

Facility	Statewide/ Program Wide
Status	Active
Frequency	D-Annual
STEP Project Number:	TBD
Estimated Cost	$0.00
Proponent	ENV
Year Proposed	Current

Soil and Water: Develop a Systemic Approach for Soil & Water Management

Develop and Update Soil Management Plan and Inventory (SMPI) (Project # 30)

This plan serves as the database of record for unimproved road condition and erosion sights on MTC. The plan contains site locations, descriptions, impact/ priority, root cause/ triggering impact, construction grade site designs with complete specs and cost estimates. Sites identified in the plan will be divide into three categories; Major, Moderate, and Routine. Once sights have been identified they will be added to INRMP Project List. The status of the site will be monitored in the INRMP. The plan is updated annually with subwatershed surveys for new problem areas. Sights in the inventory that have not been repaired are assessed annually for changes in condition. Sights that have been repaired are monitored annually for three years with recommendations for site maintenance.

Facility	Statewide/ Program-Wide
Status	Planning
Frequency	Multi-Year
STEP Project Number:	SCC70060009
Estimated Cost	$60,000.00 Annual
Proponent	ENV
Year Proposed	20

Conduct SMPI Planning & Coordination Meetings (Project # 32)

Stakeholders will meet bi-annually at a minimum. The purpose of the first meeting is twofold; first determine which sites from plan will be remediated and determine who will be the project proponent,

second to determine design prepotency for newly identified sites. This determination will be based on actual current year available dollars, not on projected out year budgets. The second and proceeding meetings in a given year will be to track progress and to apprise other stakeholders of any changes from the first meeting. After individual projects are selected for remediation by the stakeholders those projects will be updated in the INRMP. Based on these selections from the yearly planning meeting stakeholders will remediate the agreed to sites in accordance with the SMPI design. Stakeholders will track all remediation cost and report them back to the Environmental Conservation Office for inclusion into the yearly SMPI and INRMP updates. Implementation of the designs in the SMPI is crucial to meeting the stated goal of reduced soil loss.

Facility	Statewide/ Program Wide
Status	Active
Frequency	Multi-Year
STEP Project Number:	SCC70060009
Estimated Cost	$0.00
Proponent	Facilities, ITAM, ENV
Year Proposed	Current

Open Area Stabilization and Maintenance (Project # 247)

Stabilize and maintain open areas that area susceptible to erosion and runoff ex: right of way, fields, logging deck, etc.

Facility	Statewide/ Program Wide
Status	Active
Frequency	C-Annual
STEP Project Number:	SCC70060009
Estimated Cost	$5,000.00 Annual
Proponent	-
Year Proposed	Current

Follow up surveys for all remediated erosion sites (Project # 71)

This survey is to assess and monitor the condition of remediated erosion sites as it pertains to soil erosion and stormwater management.

Facility	Statewide/ Program Wide
Status	Active
Frequency	D-Annual
STEP Project Number:	SCC70060009
Estimated Cost	$6,500.00 Annual
Proponent	ENV
Year Proposed	Current

Soil & Water: Erosion Repair Site Monitoring & Evaluation

Soil Management Site Cataloging at CHT (Project # 339)

This plan serves as the database of record for unimproved road condition and erosion sites. The plan contains site locations, descriptions, impact/ priority, annual estimated soil loss, root cause/ triggering

impact, and cost estimates for repair. Sites identified in the plan will be divide into three categories; major, Moderate, and Routine. Once sights have been identified they will be added to INRMP Project List. The status of the site will be tracked monitored in the INRMP. The plan is updated annually with sub-watershed surveys for new problem areas. Sights in the inventory that have not been repaired are assessed annually for changes in condition. Sights that have been repaired are monitored annually for three years with recommendations.

Facility	Statewide/ Program Wide
Status	Active
Frequency	Multi-Year
STEP Project Number:	SC96A060001
Estimated Cost	$15,000.00 Annual
Proponent	ENV
Year Proposed	21

Special Status Species: Special Status Species (SSS) Habitat Management

Monitoring Interaction between Military training and T&E habitat types (Project # 82)

Develop procedure to evaluate training activities occurring in each T&E habitat type that may have an impact on protected species.

Facility	Statewide/ Program Wide
Status	Active
Frequency	Defined
STEP Project Number:	SCC70060008
Estimated Cost	$7,500.00 Annual
Proponent	ENV/ITAM
Year Proposed	Current

T & E Habitat Mapping (Project # 80)

Develop habitat maps outlining areas of potential Threatened and Endangered species occurring on MTC. This data will be used to focus future T&E surveys, and as a guide to make biologically sound management decisions. This will be part of a larger state-wide effort for SCARNG to develop habitat potential maps.

Facility	Statewide/ Program Wide
Status	Planning
Frequency	Defined
STEP Project Number:	SC000060010
Estimated Cost	$7,500.00 Total
Proponent	ENV
Year Proposed	21

T&E Species Awareness (Project # 83)

Develop training material for trainers and soldiers to educate them on the importance and the penalties associated with T&E laws and regulations as they affect MTC and the military mission.

Facility	Statewide/ Program Wide
Status	Active
Frequency	C-Annual
STEP Project Number:	SCC70060008
Estimated Cost	$20,000.00 Annual
Proponent	ENV
Year Proposed	Current

Special Status Species Habitat Mapping (Project # 85)

Develop habitat maps outlining areas of potential Special Status Species occurring on MTC. This data will be used to focus future surveys, and as a guide to make biologically sound management decisions. This will be part of a larger state-wide effort for SCARNG to develop habitat potential maps and will be incorporated into the T&E habitat mapping project if possible.

Facility	Statewide/ Program Wide
Status	Planning
Frequency	Defined
STEP Project Number:	SC000060010
Estimated Cost	$7,500.00 Total
Proponent	ENV
Year Proposed	21

Special Status Species PL Surveys (Project # 86)

Completion of Planning Surveys that identify locations of Special Status Species at the MTC. This data will be used to focus future studies, and as a guide to make biologically sound management decisions.

Facility	Statewide/ Program Wide
Status	Active
Frequency	Multi-Year
STEP Project Number:	SCC70060014
Estimated Cost	$10,700.00 Annual
Proponent	ENV
Year Proposed	Current

Special Species Habitat Management (Project # 304)

This project is for the active and adaptive management of special status species.

Facility	Statewide/ Program Wide
Status	Active
Frequency	C-Annual
STEP Project Number:	SCC70060008
Estimated Cost	$50,000.00 Annual
Proponent	Env

Year Proposed	Current

Honey Bee Management (Project # 105)

Honey bee projects on MTC are in support of two main goals. One is the support of the SCARNG Agrobusiness Unit who has a specific training task of managing honey bee populations and instructing individuals on honey bees and their use in the agricultural community. The second Goal honey bees are helping to meet is the requirements to promote biodiversity and increase the survivorship of the native vegetation in the area.

Facility	McCrady Training Center
Status	Active
Frequency	C-Annual
STEP Project Number:	SCC70060008
Estimated Cost	$1,000.00 Annual
Proponent	ENV
Year Proposed	Current

Special Status Species: Special Status Species Monitoring

Special Species Planning Level Survey Update (Project # 269)

Update of the Special Status Species at SCARNG Training Centers. This includes T&E, Candidate, state listed and invasives.

Facility	Statewide/ Program Wide
Status	Planning
Frequency	Multi-Year
STEP Project Number:	SCC70060015
Estimated Cost	$20,000.00 Total
Proponent	ENV
Year Proposed	21

Special Status Species PL Surveys CHT (Project # 311)

Completion of Planning Surveys that identify locations of Special Status Species at the CHT. This data will be used to focus future studies, and as a guide to make biologically sound management decisions.

Facility	Clarks Hill Training Center
Status	Planning
Frequency	Multi-Year
STEP Project Number:	SC96A160001
Estimated Cost	$25,000.00 Total
Proponent	ENV-Conservation
Year Proposed	21

PLS for T&E at CHT (Project # 312)

Conduct PLS at CHT for "Special Status" species to include T&E and candidate species.

Facility	Clarks Hill Training Center

Status	Planning
Frequency	Multi-Year
STEP Project Number:	SC96A160001
Estimated Cost	$25,000.00 Total
Proponent	ENV-Conservation
Year Proposed	21

Wetlands: Sustain or Enhance Wetland Systems at MTC

Develop a Wetlands Monitoring Protocol (Project # 3)

Design a monitoring protocol that will measure and track the relative health of the wetland systems on MTC. The final design will need to be one that can be implemented cost effectively and maintained with in-house staff.

Facility	Statewide/ Program Wide
Status	Planning
Frequency	Multi-Year
STEP Project Number:	SCC70060005
Estimated Cost	$15,000.00 Total
Proponent	ENV
Year Proposed	21

Routine Wetlands Management CHT (Project # 343)

Implementation of routine wetlands management projects at CHTC

Facility	Clarks Hill Training Center
Status	Planning
Frequency	C-Annual
STEP Project Number:	SC96A060006
Estimated Cost	$15,000.00 Annual
Proponent	-
Year Proposed	Current

Wetlands Flora and Fauna Guidelines (Project # 5)

Develop guidelines for management of sensitive species, including protection, propagation and research on the health and stability of the species.

Facility	Statewide/ Program Wide
Status	Planning
Frequency	Multi-Year
STEP Project Number:	SCC70060005
Estimated Cost	$15,000.00 Total
Proponent	ENV
Year Proposed	21

Colonels Creek drainage monitoring program (Project # 73)

Monitor and assess the health and biodiversity of the stream system on McCrady Training Center to aid in developing sound management decisions for military training, and to comply with all State and Federal regulation. Specific actions will include water quality monitoring, macroinvertebrate sampling, and monitoring physiographic stream characteristics.

Facility	McCrady Training Center
Status	Active
Frequency	D-Annual
STEP Project Number:	SCC70160004
Estimated Cost	$15,000.00 Annual
Proponent	ENV
Year Proposed	Current

Implementation a Wetlands Monitoring Protocol (Project # 115)

Implement the monitoring protocol developing project 3.

Facility	Statewide/ Program Wide
Status	Planning
Frequency	C-Annual
STEP Project Number:	SCC70060017
Estimated Cost	$13,000.00 Annual
Proponent	ENV
Year Proposed	22

Wetlands Flora and Fauna PLS (Project # 205)

Collect macro-invertebrates at predesignated sites in streams on McCrady Training Center. Use findings to scientifically conclude the health of the streams.

Facility	McCrady Training Center
Status	Planning
Frequency	Multi-Year
STEP Project Number:	SCC70060015
Estimated Cost	$10,000.00 Total
Proponent	ENV
Year Proposed	22

Erosion Project Design MTC (Project # 235)

Assist in funding erosion project design that help sustain or enhance MTC Wetlands.

Facility	McCrady Training Center
Status	Planning
Frequency	D-Annual
STEP Project Number:	SCC70060018
Estimated Cost	$5,000.00 Annual
Proponent	ENV
Year Proposed	22

Wetland and Wetland Plant Community Survey and Mapping (Project # 323)

All wetlands (as defined by the USACE) present on SCARNG Training Centers will be inventoried in the field and geolocated using GPS. Maps will be made of all wetland communities and an accompanying text will discuss the botanical, ecological, hydrological, and strategic value of each wetland and wetland community type. The rarity of each wetland type and the management of wetlands on the site will also be discussed in the text.

Facility	Statewide/ Program Wide
Status	Planning
Frequency	Defined
STEP Project Number:	SCC70060016
Estimated Cost	$25,000.00 Total
Proponent	Env
Year Proposed	22

Monitor Wetland Conditions (Project # 327)

Facility	Statewide/ Program Wide
Status	Active
Frequency	Multi-Year
STEP Project Number:	SCC70060005
Estimated Cost	$10,000.00
Proponent	ENV
Year Proposed	Current

D. SPECIES LISTS

The following tables present the species documented on MTC through 2022, based on multiple surveys and reports (see Appendix H for a full list of relevant reports and data). The SCARNG maintains all observations in a database and updates observations as needed.

Table D-1. Plant Species Documented on McCrady Training Center.			
GENUS	**SPECIES**	**COMMON**	**NOTES**
Acanthospermum	*australe*	paraguayan starburr	
Acer	*rubrum*	red maple	
Agalinis	*fasciculata*	beach false foxglove	
Agrostis	*hyemalis*	winter bentgrass	
Ailanthus	***altissima***	**tree-of-heaven**	**non-native**
Albizia	***julibrissin***	**silktree/ mimosa**	**non-native**
Alchemilla	*microcarpa*	cockleburr	
Alnus	*serrulata*	hazel alder	
Amelanchier	*arborea var. arborea*	common serviceberry	
Amelanchier	*canadensis*	canadian serviceberry	
Amorpha	*fruiticosa*	Indigo bush	
Amorpha	*herbacea var. herbacea*	clusterspike indigobush	
Andropogon	***gyrans var. stenophyllus***	**Elliott's bluestem**	**state species of concern**
Andropogon	*ternarius*	splitbeard bluestem	
Andropogon	*virginicus*	broomsedge bluestem	
Antennaria	*plantaginifolia*	woman's tobacco	
Anthoxanthum	*aristatum*	annual vernalgrass	
Anthoxanthum	*odoratum*	sweet vernalgrass	
Aphanes	*microcarpa*	slender parsley piert	
Apios	*americana*	groundnut	
Apocynum	*cannabinum*	indianhemp	
Arabidopsis	*thaliana*	thalecress	
Arabidopsis	*thaliana*	mouseear cress	
Aralia	*spinosa*	devil's walkingstick	
Arenaria	*caroliniana*	Carolina sandwort	
Arenaria	*serpyllifolia*	thymeleaf sandwort	
Aristida	***condensata***	**Piedmont three-awned grass**	**state species of concern**
Aristida	*lanosa*	woollysheath threeawn	
Aristida	*oligantha*	prairie threeawn	
Aristida	*tuberculosa*	seaside threeawn	
Aristolochia	*serpentaria*	virginia snakeroot	
Arundo	*donax*	giantreed	
Asclepias	*amplexicaulis*	clasping milkweed	
Asclepias	*tuberosa*	butterfly milkweed	
Aster	*dumosus*	rice button aster	
Aster	*ericoides*	heath aster	
Aster	*lateriflorus*	calico aster	

Table D-1. Plant Species Documented on McCrady Training Center.			
GENUS	**SPECIES**	**COMMON**	**NOTES**
Aster	*linariifolius*	flax-leaf white-top aster	
Aster	*paternus*	toothed white-top aster	
Aster	*solidagineus*	narrow-leaf white-top aster	
Aster	*solidagineus*	narrowleaf aster	
Aster	*tortifolius*	dixie aster	
Astragalus	***michauxii***	**sandhills milkvetch**	**state species of concern**
Athyrium	*filix-femina ssp. asplenioides*	ladyfern	
Aureolaria	*pectinata*	combleaf yellow false foxglove	
Axonopus	*fissifolius*	common carpetgrass	
Baccharis	*halimifolia*	groundseltree	
Baptisia	*alba*	white wild indigo	
Baptisia	*bracteata*	longbract wild indigo	
Baptisia	*cinerea*	grayhairy wild indigo	
Baptisia	*tinctoria*	horseflyweed	
Berchemia	*scandens*	alabama supplejack	
Berlandiera	*pumila*	soft greeneyes	
Betula	*nigra*	river birch	
Bidens	*polylepis*	Beggarticks	
Bignonia	*capreolata*	crossvine	
Brachiaria	*ramosa*	dixie signalgrass	
Brickellia	*eupatorioides*	false boneset	
Briza	*minor*	little quakinggrass	
Buddeleia	***davidii***	**butterfly bush**	**non-native**
Bulbostylis	*capillaris*	threadleaf beakseed	
Bulbostylis	*stenophylla*	sandy field hairsedge	
Burmannia	***biflora***	**northern bluethread**	**state species of concern**
Calamagrostis	*coarctata*	arctic reedgrass	
Calamovilfa	***brevipilis***	**pine-barrens reed-grass**	**state species of concern**
Callicarpa	*americana*	american beautyberry	
Calopogon	*barbatus*	bearded grasspink	
Calopogon	*tuberosus*	tuberous grass-pink	
Calopogon	*tuberosus*	tuberous grasspink	
Camellia	***spp.***	**Camellia**	**non-native**
Campsis	*radicans*	trumpet creeper	
Capsella	*bursa-pastoris*	shepherd's purse	
Carex	*alata*	broadwing sedge	
Carex	*albolutescens*	greenwhite sedge	
Carex	*debilis var. debilis*	white-edge sedge	
Carex	***elliottii***	**Elliot's sedge**	**state species of concern**
Carex	*glaucescens*	southern waxy sedge	
Carex	*leptalea*	bristlystalk sedge	
Carex	*venusta*	darkgreen sedge	
Carphephorus	*bellidifolius*	sandywoods chaffhead	

Table D-1. Plant Species Documented on McCrady Training Center.			
GENUS	**SPECIES**	**COMMON**	**NOTES**
Carya	*aquatica*	Water Hickory	
Carya	*carolinae-septentrionalis*	Southern Shagbark	
Carya	*ovata*	shag-bark hickory	
Carya	*ovata*	shagbark hickory	
Cassia	*nictitans*	Wild sensitive plant	
Castanea	*pumila*	Chinkapin	
Castanea	*pumila ashe*	Coastal chinquapin	
Catalpa	*bignonioides*	southern catalpa	
Ceanothus	*americanus*	new jersey tea	
Celtis	*laevigata*	sugarberry	
Cenchrus	*longispinus*	innocent-weed	
Centrosema	*virginianum*	spurred butterfly pea	
Cephalanthus	*occidentalis*	Button brush	
Cerastium	*glomeratum*	sticky mouse-ear chickweed	
Cerastium	*semidecandrum*	fivestamen chickweed	
Ceratiola	*ericoides*	sand heath	
Cercis	*canadensis*	eastern redbud	
Chaerophyllum	*tainturieri*	hairyfruit chervil	
Chamaecrista	*nictitans*	partridge pea	
Chamaecyparis	*thyoides*	atlantic white cedar	
Chamaedaphne	*calyculata var. angustifolia*	leatherleaf	
Chenopodium	*album*	lamb's quarters	
Chimaphila	*maculata*	striped prince's pine	
Chrysopsis	*gossypina*	cottony goldenaster	
Chrysopsis	*graminifolia*	Grass-leaved Golded Aster	
Chrysopsis	*mariana*	maryland goldenaster	
Cirsium	*repandum*	sandhill thistle	
Clethra	*alnifolia*	coastal sweetpepperbush	
Clitoria	*mariana*	atlantic pigeonwings	
Cnidoscolus	*stimulosus*	finger rot	
Collinsonia	***serotina***	**southern horse-balm**	**state species of concern**
Commelina	*erecta*	whitemouth dayflower	
Coreopsis	*gladiata*	coastalplain tickseed	
Coreopsis	*lanceolata*	lance-leaf tickseed	
Coreopsis	*major*	greater tickseed	
Coreopsis	*verticillata*	Tickseed	
Coreopsis	*X delphiniifolia*	larkspurleaf tickseed	
Cornus	*florida*	flowering dogwood	
Crataegus	*flava*	yellow-leaf hawthorn	
Crataegus	*flava*	yellowleaf hawthorn	
Crataegus	*phaenopyrum*	hawthorn	
Croptilon	*divaricatum*	slender scratchdaisy	
Crotalaria	*angulata*	Rattlebox	
Crotalaria	*spectabilis*	showy rattlebox	

Table D-1. Plant Species Documented on McCrady Training Center.			
GENUS	**SPECIES**	**COMMON**	**NOTES**
Croton	*glandulosus*	vente conmigo	
Cynodon	*dactylon*	bermudagrass	
Cyperus	*compressus*	poorland flatsedge	
Cyperus	*croceus*	baldwin's flatsedge	
Cyperus	*erythrorhizos*	redroot flatsedge	
Cyperus	*iria*	ricefield flatsedge	
Cyperus	*plukenetii*	plukenet's flatsedge	
Cyperus	*polystachyos*	manyspike flatsedge	
Cyperus	*retrofractus*	rough flatsedge	
Cyperus	*retrorsus*	pine barren flatsedge	
Cyperus	*strigosus*	strawcolored flatsedge	
Cyrilla	*racemiflora*	swamp titi	
Dactyloctenium	*aegyptium*	durban crowsfoot grass	
Danthonia	*sericea*	downy danthonia	
Danthonia	*spicata*	poverty oatgrass	
Desmodium	*ciliare*	hairy smallleaf ticktrefoil	
Desmodium	*floridanum*	florida ticktrefoil	
Desmodium	*laevigatum*	smooth ticktrefoil	
Desmodium	*lineatum*	sand ticktrefoil	
Desmodium	*paniculatum*	panicledleaf ticktrefoil	
Desmodium	*strictum*	Pine barren ticktrefoil	
Dichanthelium	*acuminatum var. fasciculatum*	western panicgrass	
Dichanthelium	*commutatum*	variable panicgrass	
Dichanthelium	*erectifolium*	erectleaf panicgrass	
Dichanthelium	*oligosanthes var. scribner*	scribner's rosette grass	
Dichanthelium	*scoparium*	velvet panicum	
Dichondra	*carolinensis*	carolina ponysfoot	
Digitaria	*ischaemum*	smooth crabgrass	
Diodia	*teres*	poorjoe	
Diospyros	*virginiana*	common persimmon	
Draba	*brachycarpa*	shortpod whitlowgrass	
Drosera	*capillaris*	Sundew	
Drosera	*intermedia*	spoon-leaf sundew	
Drosera	*intermedia*	spoonleaf sundew	
Duchesnea	*indica*	indian strawberry	
Dulichium	*arundinaceum*	threeway sedge	
Echinacea	***laevigata***	**smooth purple coneflower**	**federal threatened, state endangered**
Echinochloa	*crus-galli*	barnyardgrass	
Eleagnus	***pungens***	**silverthorn**	**non-native**
Eleocharis	*baldwinii*	baldwin's spikerush	
Eleocharis	*compressa*	flat-stem spikerush	
Eleocharis	*equisetoides*	jointed spikesedge	
Eleocharis	*melanocarpa*	black-fruit spikerush	

Table D-1. Plant Species Documented on McCrady Training Center.			
GENUS	**SPECIES**	**COMMON**	**NOTES**
Eleocharis	*microcarpa*	small-fruit spike-rush	
Eleocharis	*olivacea*	bright green spikerush	
Eleocharis	***robbinsii***	**Robbin's spicebush**	**state species of concern**
Eleocharis	*tenuis*	slender spikerush	
Eleocharis	*tortilis*	twisted spikerush	
Eleocharis	*tricostata*	three-angle spikerush	
Eleocharis	*tuberculosa*	cone-cup spikerush	
Elephantopus	*nudatus*	smooth elephantsfoot	
Elephantopus	*tomentosus*	devil's grandmother	
Elymus	*virginicus*	virginia wildrye	
Epigaea	*repens*	trailing arbutus	
Eragrostis	*curvula*	weeping lovegrass	
Eragrostis	*refracta*	coastal lovegrass	
Eragrostis	*spectabilis*	purple lovegrass	
Erigeron	*strigosus*	prairie fleabane	
Erigeron	*strigosus var. beyrichii*	beyrich's fleabane	
Eriocaulon	*compressum*	flattened pipewort	
Eriocaulon	*decangulare*	tenangle pipewort	
Eriogonum	*tomentosum*	dog-tongue wild buckwheat	
Eupatorium	*capillifolium*	dog-fennel	
Eupatorium	*hyssopifolium*	hyssop-leaf thoroughwort	
Eupatorium	*purpureum*	sweet-scented joe-pye-weed	
Eupatorium	*rotundifolium*	round-leaf thoroughwort	
Eupatorium	*X pinnatifidum*	common eupatorium	
Euphorbia	*curtisii*	curtis' spurge	
Euphorbia	*ipecacuanhae*	american-ipecac	
Fothergilla	*gardenii*	dwarf witch-alder	
Fraxinus	*americana*	white ash	
Froelichia	*floridana*	plains snake-cotton	
Galactia	*erecta*	erect milk-pea	
Galactia	*regularis*	eastern milk-pea	
Galactia	*volubilis*	downy milk-pea	
Galium	*aparine*	sticky-willy	
Gamochaeta	*purpurea*	spoon-leaf purple everlasting	
Gaura	*filipes*	slender-stalk beeblossom	
Gaylussacia	*dumosa*	dwarf huckleberry	
Gelsemium	*sempervirens*	evening trumpet-flower	
Geranium	*carolinianum*	carolina crane's-bill	
Glottidium	*vesicarium*	Bladderpod	
Gnaphalium	*obtusifolium*	rabbit-tobacco	
Goodyera	*pubescens*	downy rattlesnake plantain	
Gratiola	*aurea*	golden hedge-hyssop	
Gratiola	*pilosa*	shaggy hedge-hyssop	
Gratiola	*virginiana*	round-fruit hedge-hyssop	

Table D-1. Plant Species Documented on McCrady Training Center.			
GENUS	**SPECIES**	**COMMON**	**NOTES**
Gymnopogon	*brevifolius*	short-leaf skeleton grass	
Habenaria	*repens*	water-spider false rein orchid	
Helenium	*amarum*	yellow sneezeweed	
Helianthemum	*canadense*	long-branch frostweed	
Helianthus	*angustifolius*	swamp sunflower	
Helianthus	*atrorubens*	purpledisk sunflower	
Helianthus	*tuberosus*	Jerusalem artichoke	
Heliotropium	*amplexicaule*	clasping heliotrope	
Heliotropium	*indicum*	Turnsole	
Heterotheca	*gossypina*	Wooly Golden Aster	
Hexastylis	*arifolia*	little-brown-jug	
Hibiscus	*moscheutos*	rose mallow or wild cotton	
Holosteum	*umbellatum*	jagged-chickweed	
Houstonia	*caerulea*	Bluets	
Houstonia	*longifolia*	long-leaf summer bluet	
Hydrocotyle	*umbellata*	many-flower marsh-pennywort	
Hypericum	*canadense*	lesser canadian st. john's-wort	
Hypericum	*crux-andreae*	st. peter's-wort	
Hypericum	*denticulatum*	coppery st. john's-wort	
Hypericum	*drummondii*	nits-and-lice	
Hypericum	*fasciculatum*	peelback St. johnswort	
Hypericum	*galioides*	bedstraw st. john's-wort	
Hypericum	*gentianoides*	orange-grass	
Hypericum	*hypericoides*	st. andrew's-cross	
Hypericum	*lloydii*	sandhill st. john's-wort	
Hypericum	*mutilum*	dwarf st. john's-wort	
Hypericum	***nitidum***	**Carolina st. john's-wort**	**state species of concern**
Hypericum	*setosum*	hairy st. john's-wort	
Hypericum	*virginicum*	Virginia marsh st. johnswort	
Hypericum	*walteri*	walter's marsh St. johnswort	
Hypochoeris	*glabra*	smooth cat's-ear	
Hypochoeris	*radicata*	spotted cat's-ear	
Hypoxis	*hirsuta*	eastern yellow star-grass	
Hypoxis	*sessilis*	glossy-seed yellow star-grass	
Ilex	***amelanchier***	**sarvis holly**	**state species of concern**
Ilex	***aquifolium***	**spiny holly**	**non-native**
Ilex	*coriacea*	large gallberry	
Ilex	***cornuta***	**single-spine holly**	**non-native**
Ilex	*glabra*	inkberry	
Ilex	*opaca*	american holly	
Ipomoea	*pandurata*	man-of-the-earth	
Iris	*cristata*	Dwarf Wild Iris	
Iris	*virginica*	virginia iris	
Juncus	***abortivus***	**pine barren rush**	**state species of concern**

Table D-1. Plant Species Documented on McCrady Training Center.			
GENUS	**SPECIES**	**COMMON**	**NOTES**
Juncus	*acuminatus*	knotty-leaf rush	
Juncus	*diffusissimus*	slim-pod rush	
Juncus	*marginatus*	grass-leaf rush	
Juncus	*polycephalus*	many-head rush	
Juncus	*scirpoides*	needle-pod rush	
Juniperus	***sp.***	**creeping virginia**	**non-native**
Juniperus	*virginiana*	eastern redcedar	
Kalmia	*latifolia*	mountain-laurel	
Krigia	*cespitosa*	weedy dwarf-dandelion	
Krigia	*virginica*	virginia dwarf-dandelion	
Lachnocaulon	*anceps*	white-head bogbutton	
Lactuca	*graminifolia*	grass leaf lettuce	
Lagerstroema	***indica***	**Crape myrtle**	**non-native**
Lamium	*amplexicaule*	giraffehead	
Lechea	*minor*	thyme-leaf pinweed	
Lechea	***torreyi***	**piedmont pinweed**	**state species of concern**
Leersia	*hexandra*	southern cutgrass	
Leiophyllum	*buxifolium*	sand-myrtle	
Lepidium	*virginicum*	poorman's-pepperwort	
Lespedeza	*angustifolia*	narrow-leaf bush-clover	
Lespedeza	***bicolor***	**shrubby bush-clover**	**non-native**
Lespedeza	***cuneata***	**chinese bush-clover**	**non-native**
Lespedeza	*hirta*	hairy bush-clover	
Lespedeza	*procumbens*	trailing lespedeza	
Lespedeza	*repens*	creeping bush-clover	
Lespedeza	*stuevei*	tall bush-clover	
Liatris	*gramnifolia*	blazing star	
Liatris	***microcenphala***	**small flowered blazing star**	**state species of concern**
Liatris	*secunda*	piedmont gayfeather	
Liatris	*tenuifolia*	short-leaf gayfeather	
Ligustrum	***vulgare***	**privet**	**non-native**
Lilium	***pyrophilum***	**sandhills lily**	**state species of concern**
Linaria	*canadensis*	toad flax	
Lindera	***subcoriacea***	**bog spicebush**	**federal at-risk-species**
Lindernia	*dubia var. anagallidea*	yellow-seed false pimpernel	
Liquidambar	*styraciflua*	sweet-gum	
Lobelia	*elongata*	long-leaf lobelia	
Lobelia	*puberula*	downy lobelia	
Lonicera	*japonica*	japanese honeysuckle	
Loropetalum	***sp.***	**Chinese witch hazel**	**non-native**
Ludwigia	*alternifolia*	seedbox	
Ludwigia	*decurrens*	wing-leaf primrose-willow	
Ludwigia	*leptocarpa*	angle-stem primrose-willow	
Ludwigia	*linearis*	narrow-leaf primrose-willow	

Table D-1. Plant Species Documented on McCrady Training Center.			
GENUS	**SPECIES**	**COMMON**	**NOTES**
Ludwigia	*palustris*	marsh primrose-willow	
Ludwigia	*uruguayensis*	uruguayan primrose-willow	
Lycopodiella	*alopecuroides*	fox-tail club-moss	
Lycopodiella	*appressa*	southern bog club-moss	
Lycopodium	*digitatum*	fan ground-pine	
Lycopus	***cokeri***	**Carolina bugleweed**	**state species of concern**
Lycopus	*rubellus*	taper-leaf water-horehound	
Lycopus	*uniflorus*	northern water-horehound	
Lycopus	*virginicus*	virginia water-horehound	
Lygodium	***japonicum***	**Japanese climbing fern**	**non-native**
Lysimachia	***asperulifolia***	**rough-leaf yellow-loosestrife**	**federal endangered, state species of concern**
Lysimachia	*quadrifolia*	whorled yellow-loosestrife	
Macbridea	***caroliniana***	**Carolina's birds-in-a-nest**	**federal at-risk-species, state species of concern**
Magnolia	*virginiana*	sweet-bay	
Malus	***sp.***	**apple**	**non-native**
Marshallia	*graminifolia*	grass-leaf barbara's-buttons	
Marshallia	*obovata*	spoon-shape barbara's-buttons	
Mayaca	*fluviatilis*	stream bog-moss	
Mecardonia	*acuminata*	axil-flower	
Melia	***azedarach***	**chinaberry tree**	**non-native**
Melilotus	*officinalis*	yellow sweetclover	
Minuartia	*caroliniana*	pine-barren stitchwort	
Modiola	*caroliniana*	carolina bristle-mallow	
Monarda	*punctata*	spotted beebalm	
Monotropa	*hypopithys*	many-flower indian-pipe	
Muhlenbergia	*capillaris*	hairawn muhly	
Murdannia	*keisak*	wart-removing-herb	
Myrica	*heterophylla*	evergreen bayberry	
Myriophyllum	***laxum***	**loose water-milfoil**	**state species of concern**
Myriophyllum	*pinnatum*	cut-leaf water-milfoil	
Nandina	***domestica***	**nandina**	**non-native**
Nestronia	***umbellula***	**leechbrush**	**state species of concern**
Nuphar	*lutea*	yellow pondlily	
Nuttallanthus	*canadensis*	oldfield-toadflax	
Nymphaea	*odorata*	american white waterlily	
Nyssa	*biflora*	Black gum	
Nyssa	*sylvatica*	black tupelo	
Oenothera	*biennis*	Sundrops	
Oenothera	*fruticosa*	narrow-leaf evening-primrose	
Oenothera	*laciniata*	cut-leaf evening-primrose	
Oldenlandia	*uniflora*	clustered mille-graines	
Onosmodium	*virginianum*	wild job's-tears	

Table D-1. Plant Species Documented on McCrady Training Center.			
GENUS	**SPECIES**	**COMMON**	**NOTES**
Oplismenus	*hirtellus*	long-leaf basket grass	
Opuntia	*humifusa var. humifusa/ compressa*	eastern prickly pear	
Orbexilum	*pedunculatum var. psoralioides*	sampson's-snakeroot	
Osmathus	***sp.***	**tea olive**	**non-native**
Osmunda	*cinnamomea*	cinnamon fern	
Oxalis	*articulata ssp. rubra*	jointed wood-sorrel	
Oxalis	*corniculata*	creeping yellow wood-sorrel	
Oxalis	*dillenii*	slender yellow wood-sorrel	
Oxalis	*violacea*	Violet wood sorrel	
Oxydendrum	*arboreum*	sourwood	
Packera	*anonyma*	small's ragwort	
Panicum	*anceps*	beaked panicum	
Panicum	*dichotomiflorum*	fall panicgrass	
Panicum	*hemitomon*	maidencane	
Panicum	*verrucosum*	warty panicgrass	
Panicum	*virgatum*	switchgrass	
Parthenocissus	*quinquefolia*	virginia-creeper	
Paspalum	***bifidum***	**bead-grass**	**state species of concern**
Paspalum	*boscianum*	bull crowngrass	
Paspalum	*dilatatum*	dallasgrass	
Paspalum	*floridanum*	florida paspalum	
Paspalum	*laeve*	field paspalum	
Paspalum	*notatum var. saurae*	bahiagrass	
Paspalum	*setaceum*	thin paspalum	
Passiflora	*incarnata*	purple passion-flower	
Peltandra	*virginica*	green arrow-arum	
Pennisetum	*glaucum*	pearl millet	
Penstemon	*australis*	eustis lake beardtongue	
Penstemon	*laevigatus*	Beardtongue	
Petunia	*axillaris*	wild while petunia	
Phalaris	*caroliniana*	carolina canarygrass	
Photina	***fraseri***	**red tip**	**non-native**
Physalis	*virginiana*	virginia ground-cherry	
Pinus	*echinata*	shortleaf pine	
Pinus	*palustris*	longleaf pine	
Pinus	*taeda*	loblolly pine	
Pinus	*virginiana*	virginia pine	
Piptochaetium	*avenaceum*	black-seed spear grass	
Pittosporum	***sp.***	**pittosporum**	**non-native**
Pityopsis	*graminifolia var. graminifolia*	narrow-leaf silk-grass	
Pityopsis	***pinifolia***	**pine-leaved golden aster**	**state species of concern**
Plantago	*aristata*	large-bract plantain	

Table D-1. Plant Species Documented on McCrady Training Center.			
GENUS	**SPECIES**	**COMMON**	**NOTES**
Platanthera	*ciliaris*	yellow fringed orchid	
Pluchea	*camphorata*	plowman's-wort	
Poa	*annua*	annual bluegrass	
Poa	*chapmaniana*	chapman's bluegrass	
Pogonia	*ophioglossoides*	snake-mouth orchid	
Polygala	*grandiflora*	showy milkwort	
Polygala	*lutea*	orange milkwort	
Polygonella	*americana*	southern jointweed	
Polygonella	*polygama*	october-flower	
Polygonum	*aviculare*	White knotweed	
Polygonum	*sagittatum*	arrow-leaf tearthumb	
Polypremum	*procumbens*	juniper-leaf	
Polystichum	*acrostichoides*	christmas fern	
Potamogeton	***confervoides***	**algae-like pondweed**	**state species of concern**
Potentilla	*canadensis*	dwarf cinquefoil	
Prenanthes	*autumnalis*	slender rattlesnake-root	
Proserpinaca	*pectinata*	comb-leaf mermaidweed	
Prunus	***alabamensis***	**Alabama black cherry**	**state species of concern**
Prunus	*angustifolia*	chickasaw plum	
Prunus	*caroliniana*	carolina laurel cherry	
Pseudognaphalium	*obtusifolium*	rabbit tobacco	
Pteridium	*aquilinum*	western brackenfern	
Pueraria	***montana***	**kudzu**	**non-native**
Pycnanthemum	*flexuosum*	appalachian mountain-mint	
Pycnanthemum	*incanum*	hoary mountain-mint	
Pycnanthemum	*setosum*	awned mountain-mint	
Pycnanthemum	*tenuifolium*	narrow-leaf mountain-mint	
Pyrrhopappus	*carolinianus*	carolina desert-chicory	
Pyrus	***calleryana***	**Bradford pear**	**non-native**
Quercus	*alba*	white oak	
Quercus	*margaretta*	sand post oak	
Quercus	*phellos*	willow oak	
Ranunculus	*abortivus*	littleleaf buttercup	
Rhexia	*alifanus*	savannah meadow-beauty	
Rhexia	*mariana*	maryland meadow-beauty	
Rhexia	*petiolata*	fringed meadow-beauty	
Rhexia	*virginica*	handsome-harry	
Rhododendron	*viscosum*	clammy azalea	
Rhus	*glabra*	smooth sumac	
Rhynchosia	*tomentosa*	twining snout-bean	
Rhynchospora	*chalarocephala*	loose-head beak sedge	
Rhynchospora	***inundata***	**drowned hornedrush**	**state species of concern**
Rhynchospora	***macra***	**beak rush**	**state species of concern**
Rhynchospora	*nitens*	short-beak beak sedge	

Table D-1. Plant Species Documented on McCrady Training Center.			
GENUS	**SPECIES**	**COMMON**	**NOTES**
Rhynchospora	***oligantha***	**feather-bristle beak sedge**	**state species of concern**
Rhynchospora	***pallida***	**pale beak sedge**	**state species of concern**
Rhynchospora	*rariflora*	few-flower beak sedge	
Rhynchospora	***stenophylla***	**coastal-plain beak sedge**	**state species of concern**
Richardia	*brasiliensis*	tropical mexican-clover	
Richardia	*scabra*	rough mexican clover	
Robinia	*hispida*	bristly locust	
Robinia	*viscosa*	clammy locust	
Rosa	*wichuraiana*	memorial rose	
Rubus	*argutus*	saw-tooth blackberry	
Rudbeckia	*hirta var. pulcherrima*	black-eyed-susan	
Rumex	*acetosella*	common sheep sorrel	
Rumex	*hastatulus*	heartwing sorrel	
Sabal	*palmetto*	palmetto	
Sabal	*minor*	Dwarf Palmetto	
Sabatia	*brachiata*	narrow-leaf rose-gentian	
Sabatia	*difformis*	lance-leaf rose-gentian	
Sabatia	*quadrangula*	four-angle rose-gentian	
Saccharum	*alopecuroides*	silver plumegrass	
Saccharum	*giganteum*	sugarcane plumegrass	
Sagittaria	*latifolia*	duck-potato	
Salvia	*azurea*	azure-blue sage	
Salvia	*lyrata*	lyre-leaf sage	
Sambucus	*canadensis*	american elder	
Sanicula	*canadensis*	canadian black-snakeroot	
Sarracenia	*flava*	yellow pitcherplant	
Sarracenia	*purpurea*	purple pitcherplant	
Sarracenia	***rubra***	**sweet pitcherplant**	**state species of concern**
Saururus	*cernuus*	lizard's-tail	
Schizachyrium	*scoparium*	little bluestem	
Schizachyrium	*tenerum*	slender bluestem	
Schrankia	*microphylla var. microphylla*	little-leaf sensitive-briar	
Scirpus	*cyperinus*	woolgrass	
Scirpus	***etuberculatus***	**canby bulrush**	**state species of concern**
Scleria	*ciliata*	fringed nut-rush	
Scleria	*pauciflora*	few-flower nut-rush	
Scleria	*reticularis*	netted nut-rush	
Scleria	*triglomerata*	whip nut-rush	
Scutellaria	*integrifolia*	helmet-flower	
Scutellaria	*lateriflora*	Blue skullcap	
Selaginella	*arenicola*	sand spike-moss	
Setaria	*glauca*	yellow foxtail	
Setaria	*pumila*	yellow bristlegrass	
Setaria	*viridis*	green bristlegrass	

Table D-1. Plant Species Documented on McCrady Training Center.			
GENUS	**SPECIES**	**COMMON**	**NOTES**
Seymeria	*cassioides*	yaupon black-senna	
Sibara	*virginica*	virginia winged-rockcress	
Sisyrinchium	*angustifolium*	narrow-leaf blue-eyed-grass	
Sisyrinchium	*atlanticum*	eastern blue-eyed-grass	
Sisyrinchium	*rosulatum*	annual blue-eyed-grass	
Smilax	*herbacea*	smooth carrionflower	
Smilax	*laurifolia*	laurel greenbrier	
Smilax	*rotundifolia*	roundleaf greenbrier	
Smilax	*smallii*	lanceleaf greenbrier	
Smilax	*walteri*	coral greenbrier	
Solanum	*carolinense*	carolina horse-nettle	
Solanum	*ptychanthum*	west indian nightshade	
Solidago	*leavenworthii*	Goldenrod	
Solidago	*nemoralis*	gray goldenrod	
Solidago	*odora*	anise-scented goldenrod	
Solidago	*rugosa*	wrinkle-leaf goldenrod	
Solidago	*tortifolia*	twist-leaf goldenrod	
Sonchus	*oleraceus*	common sow-thistle	
Sorghastrum	*elliottii*	slender indiangrass	
Sorghastrum	*nutans*	yellow indiangrass	
Sorghum	***halepense***	**Johnson grass**	**non-native**
Spermolepis	*divaricata*	rough-fruit scaleseed	
Spiranthes	*praecox*	grass-leaved Ladies' tresses	
Spiranthes	*vernalis*	spring ladies'-tresses	
Sporobolus	*junceus*	pineywoods dropseed	
Sporobolus	***teretifolius***	**wire-leaved dropseed**	**federal at-risk-species, state species of concern**
Stillingia	*sylvatica*	queen's-delight	
Stipulicida	*setacea*	pineland scaly-pink	
Strophostyles	*umbellata*	pink fuzzy-bean	
Stylisma	*patens*	coastal-plain dawnflower	
Stylosanthes	*biflora*	side-beak pencil-flower	
Styrax	*americanus*	american snowbell	
Symplocus	*tinctoria*	Horse sugar	
Tamarix	*gallica*	Salt Cedar	
Tephrosia	*spicata*	spiked hoary-pea	
Tephrosia	*virginiana*	goat's-rue	
Tetragonotheca	*helianthoides*	pineland nerveray	
Thaspium	*trifoliatum*	purple meadow-parsnip	
Thuja	***occidentalis***	**arborvitae**	**non-native**
Tilia	*americana*	basswood	
Tillandsia	*usneoides*	spanish-moss	
Tofieldia	***glabra***	**white false-asphodel**	**state species of concern**
Toxicodendron	*pubescens*	atlantic poison-oak	

Table D-1. Plant Species Documented on McCrady Training Center.			
GENUS	**SPECIES**	**COMMON**	**NOTES**
Toxicodendron	*radicans*	eastern poison-ivy	
Toxicodendron	*vernix*	poison-sumac	
Tradescantia	*rosea*	Peidmont roseling	
Tragia	*urens*	wavy-leaf noseburn	
Tragia	*urticifolia*	nettle-leaf noseburn	
Trepocarpus	***aethusae***	**aethusa-like trepocarpus**	**state species of concern**
Triadenum	*virginicum*	virginia marsh-st. john's-wort	
Trichostema	*dichotomum*	forked bluecurls	
Trichostema	*setaceum*	narrow-leaf bluecurls	
Tridens	***chapmanii***	**Chapman's redtop**	**state species of concern**
Tridens	*flavus*	purpletop tridens	
Trifolium	*arvense*	rabbit-foot clover	
Trifolium	*campestre*	lesser hop clover	
Triodanis	*biflora*	clasping Venus' looking glass	
Triodanis	*perfoliata var. biflora*	clasping-leaf venus'-looking-glass	
Typha	*latifolia*	broadleaf cattail	
Ulmus	*alata*	winged elm	
Utricularia	*gibba*	humped bladderwort	
Vaccinium	*arboreum*	farkleberry	
Vaccinium	*corymbosum*	highbush blueberry	
Vaccinium	***crassifolium ssp. sempervirens***	**Rayner's blueberry**	**state species of concern**
Vaccinium	*tenellum*	small black blueberry	
Vaccinium	*virgatum*	small-flower blueberry	
Valerianella	*radiata*	beaked cornsalad	
Verbascum	*thapsus*	wooly mullein	
Verbena	*brasiliensis*	brazilian vervain	
Verbena	*carnea*	Mint	
Vernonia	*acaulis*	stemless ironweed	
Vernonia	*angustifolia*	tall ironweed	
Vicia	*angustifolia*	Vetch	
Viola	*pedata*	bird-foot violet	
Viola	*tricolor*	Johnny jumpup	
Viola	*X primulifolia*	primrose-leaved violet	
Vitis	*rotundifolia*	muscadine	
Vulpia	*myuros*	rattail fescue	
Vulpia	*octoflora*	sixweeks fescue	
Wahlenbergia	*marginata*	southern rockbell	
Warea	***cuneifolia***	**carolina pinelandcress**	**state species of concern**
Wisteria	*frutescens*	american wisteria	
Wisteria	*sinensis*	chinese wisteria	
Woodwardia	*areolata*	netted chain fern	
Xylorhiza	*tortifolia var. tortifolia*	mojave woody-aster	

Table D-1. Plant Species Documented on McCrady Training Center.			
GENUS	**SPECIES**	**COMMON**	**NOTES**
Xyris	*ambigua*	coastal-plain yellow-eyed-grass	
Xyris	*baldwiniana*	baldwin's yellow-eyed-grass	
Xyris	*caroliniana*	carolina yellow-eyed-grass	
Xyris	*elliottii*	elliott's yellow-eyed-grass	
Xyris	*fimbriata*	fringed yellow-eyed-grass	
Xyris	*jupicai*	richard's yellow-eyed-grass	
Xyris	*stricta*	pineland yellow-eyed-grass	
Youngia	*japonica*	oriental false hawk's-beard	
Zigadenus	*densus*	osceola's-plume	

Table D-2. Bird Species Documented on McCrady Training Center.			
GENUS	**SPECIES**	**COMMON NAME**	**NOTE**
Accipiter	*cooperii*	Cooper's Hawk	
Accipiter	*striatus*	Sharp-shinned Hawk	
Aimophila	*aestivalis*	Bachman's sparrow	
Anas	*platyrhynchos*	Mallard	
Archilochus	*colubris*	Ruby-throated hummingbird	
Ardea	*herodias*	Great Blue Heron	
Bombycilla	*cedrorum*	Cedar waxwing	
Branta	*canadensis*	Canada Goose	
Buteo	*jamaicensis*	Red-tailed hawk	
Buteo	*platypterus*	Broad-winged hawk	
Caprimulgus	*carolinensis*	Chuck-will's-widow	
Caprimulqus	*vociferus*	Whip-poor-will	
Cardinalis	*cardinalis*	Northern cardinal	
Carduelis	*tristis*	American goldfinch	
Carpodacus	*mexicanus*	House Finch	
Cathartes	*aura*	Turkey Vulture	
Catharus	*minimus*	Gray-cheeked thrush	
Catharus	*ustulatus*	Swainson's thrush	
Chaetura	*pelagica*	Chimney swift	
Charadrius	*vociferus*	Killdeer	
Chordeiles	*minor*	Common nighthawk	
Circus	*cyaneus*	Northen Harrier	
Coccyzus	*americanus*	Yellow-billed cuckoo	
Colaptes	*auratus*	Northern flicker	
Colinus	*virginianus*	Northern bobwhite	
Contopus	*virens*	Eastern wood-pewee	
Corvus	*brachyrhynchos*	American crow	
Corvus	*ossifragus*	Fish crow	
Cyanocitta	*cristata*	Blue jay	
Dendroica	*caerulrscens*	Black-throated Blue Warbler	
Dendroica	*discolor*	Prairie warbler	

Table D-2. Bird Species Documented on McCrady Training Center.			
GENUS	**SPECIES**	**COMMON NAME**	**NOTE**
Dendroica	*dominica*	Yellow-throated warbler	
Dendroica	*pinus*	Pine warbler	
Dolichonyx	*oryzivorus*	Bobolink	
Dryocopus	*pileatus*	Pileated woodpecker	
Dumetella	*carolinensis*	Gray Catbird	
Empidonax	*minimus*	Least flycatcher	
Empidonax	*traillii*	Traill's flycatcher	
Empidonax	*virescens*	Acadian flycatcher	
Falco	*sparverius*	American kestrel	
Geothlypis	*trichas*	Common yellowthroat	
Guiraca	*caerulea*	Blue grosbeak	
Hirundo	*rustica*	Barn swallow	
Hylocichla	*mustelina*	Wood thrush	
Icteria	*virens*	Yellow-breasted chat	
Icterus	*spurius*	Orchard oriole	
Ictinia	*mississippiensis*	Mississippi Kite	
Lanius	*ludovicianus*	Loggerhead Shrike	
Leiothlypus	*peregrina*	Tennessee warbler	
Limnothlypis	*swainsonii*	Swainson's warbler	
Melanerpes	*carolinus*	Red-bellied woodpecker	
Melanerpes	*erythrocephalus*	Red-headed woodpecker	
Meleagris	*gallopavo*	Eastern wild turkey	
Melospiza	*georgiana*	Swamp sparrow	
Mimus	*polyglottos*	Northern mockingbird	
Mniotilta	*varia*	Black-and-white warbler	
Molothrus	*ater*	Brown-headed cowbird	
Myiarchus	*crinitus*	Great crested flycatcher	
Oporornis	*formosus*	Kentucky warbler	
Otus	*asio*	Eastern screech-owl	
Pandion	*haliaetus*	Osprey	
Parus	*bicolor*	Tufted titmouse	
Parus	*carolinensis*	Carolina chickadee	
Passer	***domesticus***	**House Sparrow**	**non-native**
Passerina	*ciris*	Painted Bunting	
Passerina	*cyanea*	Indigo bunting	
Phalacrocorax	*auritus*	Double-crested Cormorant	
Pheucticus	*ludovicianus*	Rose-breasted Grosbeak	
Picoides	***borealis***	**Red-cockaded woodpecker**	**federal endangered, state endangered**
Picoides	*pubescens*	Downy woodpecker	
Picoides	*villosus*	Hairy Woodpecker	
Piranga	*olivacea*	Scarlet Tanager	
Piranga	*rubra*	Summer tanager	
Polioptila	*caerulea*	Blue-gray gnatcatcher	

Table D-2. Bird Species Documented on McCrady Training Center.			
GENUS	**SPECIES**	**COMMON NAME**	**NOTE**
Progne	*subis*	Purple martin	
Protonotaria	*citrea*	Prothonotary warbler	
Regulus	*calendula*	Ruby-crowned kinglet	
Regulus	*satrapa*	Golden-crowned kinglet	
Seiurus	*aurocapillus*	Ovenbird	
Seiurus	*motacilla*	Louisiana waterthrush	
Setophaga	*americana*	Northern parula	
Setophaga	*magnolia*	Magnolia Warbler	
Setophaga	*ruticilla*	American redstart	
Sialia	*sialis*	Eastern bluebird	
Sitta	*carolinensis*	White-breasted nuthatch	
Sitta	*pusilla*	Brown-headed nuthatch	
Sphyrapicus	*varius*	Yellow-bellied Sapsucker	
Spizella	*passerina*	Chipping sparrow	
Spizella	*pusilla*	Field Sparrow	
Thryothorus	*ludovicianus*	Carolina wren	
Toxostoma	*rufum*	Brown thrasher	
Troglodytes	*aedon*	House wren	
Turdus	*migratorius*	American robin	
Tyrannus	*tyrannus*	Eastern kingbird	
Vireo	*flavifrons*	Yellow-throated vireo	
Vireo	*griseus*	White-eyed vireo	
Vireo	*olivaceus*	Red-eyed vireo	
Wilsonia	*citrina*	Hooded warbler	
Zenaida	*macroura*	Mourning dove	

Table D-3. Mammal Species Documented on McCrady Training Center.			
GENUS	**SPECIES**	**COMMON NAME**	**NOTES**
Canis	*latrans*	Coyote	
Canis	***familiaris***	**Dog**	**non-native**
Castor	*canadensis*	Beaver	
Corynorhinus	***rafinesquii***	**Rafinesque's big-eared bat**	**state endangered**
Didelphis	*marsupialis*	opposum	
Eptesicus	*fuscus*	Big brown bat	
Felis	***catus***	**Feral cat**	**non-native**
Lasiurus	*borealis*	Eastern red bat	
Lasiurus	*seminolus*	Seminole bat	
Lynx	*rufus*	Bobcat	
Nycticeius	*humeralis*	Evening bat	
Odocoileus	*virginianus*	White-tailed Deer	
Perimyotis	***subflavus***	**Tri-colored bat**	**federal at-risk-species**
Procyon	*lotor*	Raccoon	
Sciurus	*carolinensis*	Eastern Gray Squirrel	
Sciurus	*niger*	Fox Squirrel	
Sylvilagus	*floridanus*	Eastern Cottontail	

Table D-4. Amphibian and Reptile Species Documented on McCrady Training Center.			
GENUS	**SPECIES**	**COMMON NAME**	**NOTES**
Acris	*c. crepitans*	Northern Cricket frog	
Acris	*gryllus*	Southern Cricket frog	
Agkistrodon	*c. contortrix*	Copperhead	
Agkistrodon	*p. piscivorus*	Cottonmouth	
Anaxyrus	*terrestris*	Southern toad	
Anolis	*carolinensis*	Green anole	
Bufo	*terrestris*	Southern toad	
Cnemidophorus	*s. sexlineatus*	Six-lined Racerunner	
Crotalus	*horridus*	Timber/Canebrake Rattlesnake	
Elaphe	*o. obsoleta*	Black Rat Snake	
Eumeces	*fasciatus*	Five-lined skink	
Eumeces	*inexpectatus*	Southeastern Five-lined Skink	
Gastrophryne	*carolinensis*	Eastern narrow-mouthed toad	
Heterodon	*platirhinos*	Eastern Hognose Snake	
Heterodon	***simus***	**Southern Hognose Snake**	**federal at-risk-species, state threatened**
Hyla	*chrysoscelis*	Cope's gray treefrog	
Hyla	*cinerea*	Green Treefrog	
Hyla	*femoralis*	Pinewoods Treefrog	
Kinosternon	*subrubrum*	Eastern Mud Turtle	
Lithobates	*catesbeianus*	American Bullfrog	
Lithobates	*clamitans*	Green frog	
Lithobates	*utricularia*	Southern leopard frog	

Table D-4. Amphibian and Reptile Species Documented on McCrady Training Center.			
GENUS	**SPECIES**	**COMMON NAME**	**NOTES**
Lithobates	*virgatipes*	Carpenter frog	
Scaphiopus	*h. holbrooki*	Eastern spadefoot toad	
Sceloporus	*undulatus*	Eastern fence lizard	
Scincella	*lateralis*	Ground skink	
Sistrurus	*miliarius*	Carolina Pigmy Rattlesnake	
Sternotherus	*odoratus*	Eastern Musk Turtle	
Terrapene	*c. carolina*	Eastern box turtle	
Trachemys	*s. scripta*	Yellow Bellied slider	

Table D-5. Fish Species Documented on McCrady Training Center.			
GENUS	**SPECIES**	**COMMON NAME**	**NOTES**
Acantharchus	*pomotis*	Mud Sunfish	
Ameiurus	*catus*	White Catfish	
Ameiurus	*melas*	Black Bullhead	
Ameiurus	*natalis*	Yellow Bullhead	
Aphredoderus	*sayanus*	Pirate perch	
Ctenopharyngodon	*idellus*	Grass Carp	
Enneacanthus	*chaetodon*	Black-banded Sunfish	
Enneacanthus	*gloriosus*	Bluespotted Sunfish	
Erimyzon	*oblongus*	Eastern Creek Chubsucker	
Erimyzon	*sucetta*	Lake Chubsucker	
Esox	*a. americanus*	Redfin Pickerel	
Esox	*niger*	Chain Pickerel	
Etheostoma	*fusiforme*	Swamp Darter	
Fundulus	*lineolatus*	Lined Topminnow	
Fundulus	*nottii*	Starhead Topminnow	
Gambusia	***affinis***	**Gambusia (mosquito fish)**	**non-native**
Ictalurus	***punctatus***	**Channel Catfish**	**non-native**
Lepomis	*auritus*	Redbreast Sunfish	
Lepomis	*gibbosus*	Pumpkinseed	
Lepomis	*gulosus*	Warmouth	
Lepomis	*macrochirus*	Bluegill	
Lepomis	*marginatus*	Dollar Sunfish	
Lepomis	*microlophus*	Redear Sunfish	
Micropterus	*salmoides*	Largemouth Bass	
Notemigonus	*crysoleucas*	Golden Shiner	
Notropis	*chalybaeus*	Ironcolor Shiner	
Notropis	*cummingsae*	Dusky Shiner	

Table D-6. Terrestrial Invertebrate Species Documented on McCrady Training Center.			
GENUS	**SPECIES**	**COMMON NAME**	**NOTES**
Achalarus	*lyciades*	Hoary Edge	
Agraulis	*vanillae*	Gulf Fritillary	
Amblyscirtes	*alternata*	Least Florida/ Dusky Road-side Skipper	
Ammophila	*procera*	Common thread-waisted wasp	
Ancyloxpha	*numitor*	Least Skipper	
Apis	*mellifera*	European honeybee	
Anthocharis	*midea*	Falcate Orange Tip	
Asterocampa	*celtis*	Hackberry Emperor	
Atlides	*halesus*	Great Purple Hairstreak	
Atrytone	*arogos*	Arogos Skipper	
Augochloropsis	*metallica*	Sweat bee/Metalic green bee	
Battus	*philenor*	Pipevine Swallowtail	
Bombus	*impatiens*	Common Eastern Bumblebee	
Bombus	*pennsylvanicus*	Amercian Bumblebee	
Calycopis	*cecrops*	Red-banded Hairstreak	
Celastrina	*argiolus*	Spring Azure	
Colias	*cesonia*	Dog Face	
Cyllopsis	*gemma*	Gemmed Satyr	
Danaus	***plexippus***	**Monarch Butterfly**	**federal at-risk-species**
Enodia	*creole*	Creole Pearly Eye	
Enodia	*portlandia*	Southern Pearly Eye	
Epargyreus	*clarus*	Silver-spotted Skipper	
Erynnis	*horatius*	Horace's Dusky Wing	
Erynnis	*juvenalis*	Juvenal's Dusky Wing	
Erynnis	*zarucco*	Zarucco Dusky Wing	
Euptoieta	*claudia*	Variegated Fritillary	
Eurema	*lisa*	Little Sulphur	
Eurema	*nicippe*	Sleepy Orange	
Everes	*comyntas*	Eastern Tailed Blue	
Hermeuptychia	*sosybius*	Carolina Satyr	
Hesperia	*meskei*	Meske's Skipper	
Hylephila	*phyleus*	Fiery Skipper	
Junonia	*coenia*	Buckeye	
Lerema	*accius*	Clouded Skipper	
Libytheana	*carinenta*	American Snout	
Limenitis	*a. astyanax*	Red-spotted Purple	
Megisto	*cymela*	Little Wood Satyr	
Nastra	*lherminier*	Swarthy Skipper	
Neonympha	*areolata*	Georgia Satyr	
Pieris	*rapae*	Cabbage White	
Popilia	*japonica*	Japanese beetle	
Papilio	*palamedes*	Palamedes Swallowtail	
Papilio	*troilus*	Spicebrush Swallowtail	

Table D-6. Terrestrial Invertebrate Species Documented on McCrady Training Center.			
GENUS	**SPECIES**	**COMMON NAME**	**NOTES**
Papilio	*glaucus*	Tiger Swallowtail	
Phoebus	*sennae*	Cloudless Sulphur	
Phyciodes	*tharos*	Pearl Crescent	
Poanes	*yehl*	Yehl Skipper	
Poanes	*Zabulon*	Zabulon Skipper	
Polites	*vibex*	Whirlabout	
Polistes	*carolina*	Red paper wasp	
Polistes	*exclamens*	Common paper wasp	
Pyrgus	*communis*	Common checkered skipper	
Scolia	*dubia*	Blue-winged wasp	
Strymon	*melinus*	Gray Hairstreak	
Systoechus	*spp*	Orange bee fly	
Thorybes	*bathyllus*	Southern Cloudy Wing	
Vanessa	*virginiensis*	American Painted Lady	

Table D-7. Aquatic Invertebrate Species Documented on McCrady Training Center.			
GENUS	**SPECIES**	**COMMON NAME**	**NOTES**
Ablabesmyia	*aspera*		
Ablabesmyia	*mallochi*		
Ablabesmyia	*hauberi*		
Ablabesmyia	*rhamphe_grp.*		
Acroneuria	*lycorias*		
Aedes/Ochlerotatus	*sp.*		
Agabus	*gagetes*		
Agabus	*johannsi*		
Agabus	*seriatus*		
Agarodes	*sp.*		
Alluaudomyia	*sp.*		
Amphinemoura	*nigritta*		
Anchytarsus	*bicolor*		
Ancyronyx	*variegata*		
Ancyronyx	*variegata*		
Anisocentropus	*pyraloides*		
Anopheles	*sp.*		
Apsectrotanypus	*johnsoni*		
Aquarius	*sp.*		
Argia	*sp.*		
Argia	*bipunctulata*		
Argia	*fumipennis*		
Argia	*sedula*		
Argia	*tibialis*		
Baetis	*sp.*		

Table D-7. Aquatic Invertebrate Species Documented on McCrady Training Center.			
GENUS	**SPECIES**	**COMMON NAME**	**NOTES**
Baetis	*pluto*		
Basiaeschna	*janta*		
Berosus	*sp.*		
Bezzia/Palpomyia	*cmplx*		
Bittacomorpha	*clavipes*		
Bittacomorphella	*sp.*		
Boyeria	*vinosa*		
Brachycentrus	*chelatus*		
Brillia	*flavifrons*		
Caeciodotea	*sp.*		
Caenis	*sp.*		
Callibaetis	*pretiosus*		
Calopteryx	*dimidiata*		
Calopteryx	*maculata*		
Cambarus	*sp.*		
Cambarus	*latimanus*		
Celina	*sp.*		
Celithemis	*verna*		
Centroptilum	*sp.*		
Cernotina	*sp.*		
Chaetocladius	*sp.*		
Chauliodes	*pectinicornis*		
Cheumatopsyche	*sp.*		
Chimarra	*sp.*		
Chironomus	*sp.*		
Chlorotabanus	*crepuscularis*		
Chrysops	*sp.*		
Cladotanytarsus	*sp.*		
Cladotanytarsus	*aeiparthenus*		
Cladotanytarsus	*sp.*		
Clinotanypus	*sp.*		
Corbicula	***fluminea***	**Asian clam**	**non-native**
Cordulegaster	*sp.*		
Cordulegaster	*bilineata*		
Corydalus	*cornutus*		
Corynoneura	*sp.*		
Crangonyx	*sp.*		
Cricotopus	*bicinctus*		
Cricotopus	*fugax*		
Cricotopus	*politus*		
Cricotopus	*vierriensis*		
Cricotopus	*sp._"Santa Fe"*		
Cryptochironomus	*sp.*		
Cryptotendipes	*sp.*		

Table D-7. Aquatic Invertebrate Species Documented on McCrady Training Center.			
GENUS	**SPECIES**	**COMMON NAME**	**NOTES**
Culex	*sp.*		
Culex	*territans*		
Culiciodes	*sp.*		
Cymbiodyta	*sp.*		
Cymbiodyta	*chamberlaini*		
Cyphon	*sp.*		
Demicryptochironomus	*sp.*		
Dicranota	*sp.*		
Dicrotendipes	*modestus*		
Dineutus	*sp.*		
Dineutus	*ciliatus*		
Dineutus	*discolor*		
Dineutus	*emarginatus*		
Diplectrona	*modesta*		
Djalmabatista	*pulchra_variant*		
Dromogomphus	*armatus*		
Dubiraphia	*sp.*		
Dubiraphia	*vittata*		
Enallagma	*sp.*		
Enallagma	*divagens*		
Enallagma	*signatum*		
Endochironomus	*nigricans*		
Enochrus	*sp.*		
Enochrus	*ochraceus*		
Epitheca	*princeps*		
Erioptera	*sp.*		
Eristalis	*sp.*		
Erythemis	*simplicicolis*		
Eurylophella	*sp.*		
Eurylophella	*doris*		
Ferrissia	*rivularis*		
Fissimentum	*sp.*		
Genus	*speceis*		
Glyptotendipes	*sp.*		
Glyptotendipes	*meridionalis*		
Gomphus	*sp.*		
Gomphus	*fraternus*		
Gomphus	*lividus*		
Gomphus	*minutus*		
Gomphus	*parvidens*		
Gonielmis	*dietrichi*		
Gonielmis	*dietrichi*		
Gonomyia	*sp.*		
Gymnometriocnemus	*sp.*		

Table D-7. Aquatic Invertebrate Species Documented on McCrady Training Center.			
GENUS	**SPECIES**	**COMMON NAME**	**NOTES**
Gyrinus	*sp.*		
Gyrinus	*pachysomus*		
Gyrinus	*woodruffi*		
Hagenius	*brevistylus*		
Helocordulia	*uhleri*		
Helophorus	*sp.*		
Hemerodromia	*sp.*		
Hesperocorixa	*brimleyi*		
Hesperocorixa	*nitida*		
Heteroplectron	*americanum*		
Heterotrissocladius	*marcidus*		
Hexatoma	*sp.*		
Hyalell	*azteca_cmplx*		
Hydaticus	*bimarginatus*		
Hydrobius	*sp.*		
Hydrocanthus	*iricolor*		
Hydrochus	*excavatus*		
Hydrometra	*sp.*		
Hydroporus	*sp.*		
Hydroporus	*signatus_youngi*		
Hydroporus	*sp.*		
Hydropsyche	*sp.*		
Hydropsyche	*betteni*		
Hydropsyche	*decalda*		
Hydropsyche	*elissoma*		
Hydroptila	*sp.*		
Ischnura	*sp.*		
Ischnura	*hastata*		
Ischnura	*posita*		
Labrundinia	*sp.*		
Labrundinia	*becki*		
Labrundinia	*johannseni*		
Labrundinia	*pilosella*		
Laccophilus	*f. rufus*		
Ladona	*deplanata*		
Larsia	*berneri*		
Larsia	*indistincta*		
Lepidostoma	*sp.*		
Lestes	*inaequalis*		
Leuctra	*sp.*		
Libellula	*vibrans*		
Limnophila	*sp.*		
Limnophyes	*sp.*		
Limnoporus	*canaliculatus*		

Table D-7. Aquatic Invertebrate Species Documented on McCrady Training Center.			
GENUS	**SPECIES**	**COMMON NAME**	**NOTES**
Liogma/Triogma	*sp.*		
Lype	*diversa*		
Maccaffertium	*modestum*		
Macromia	*sp.*		
Macromia	*taeniolata*		
Macronychus	*glabratus*		
Macrostemum	*carolina*		
Mayatrichia	*ayama*		
Menetus	*dilatatus*		
Meropelopia	*americana*		
Microcylloepus	*pusillus*		
Microcylloepus	*p._lodingi*		
Microcylloepus	*p._pusillus*		
Micropsectra	*sp.*		
Microtendipes	*pedellus_grp.*		
Microtendipes	*rydalensis_grp.*		
Microvelia	*sp.*		
Microvelia	*paludicola*		
Molanna	*blenda*		
Molanna	*tryphena*		
Molanna	*ulmerina*		
Mystacidae	*sepulchralis*		
Nanocladius	*balticus_grp.*		
Nanocladius	*crassicornis/rectinervus*		
Nasiaeschna	*pentacantha*		
Natarsia	*sp.*		
Neargyraticus	*sp.*		
Neoplea	*sp.*		
Neoporus	*sp.*		
Neoporus	*blanchardi*		
Neoporus	*clypealis*		
Neoporus	*lynceus*		
Neoporus	*undulatus*		
Neureclipsis	*crepuscularis*		
Neurocordulia	*sp.*		
Neurocordulia	*alabamensis*		
Nigronia	*serricornis*		
Nilotanypus	*sp.*		
Nilotanypus	*fimbriatus*		
Nilothauma	*sp.*		
Notonecta	*sp.*		
Notonecta	*irrorata*		
Notonecta	*uhleri*		
Nyctiophylax	*moestus*		

Table D-7. Aquatic Invertebrate Species Documented on McCrady Training Center.			
GENUS	**SPECIES**	**COMMON NAME**	**NOTES**
Ochterus	*sp.*		
Oecetis	*sp.*		
Oecetis	*georgia*		
Oecetis	*nocturna*		
Oecetis	*persimilis*		
Oecetis	*scala*		
Oecetis	*sp.*		
Omisus	*sp.*		
Orthocladius	*annectens*		
Orthocladius	*dubiatus*		
Orthocladius	*lignicola*		
Orthocladius	*obumbratus*		
Oxyethira	*sp.*		
Pachydiplax	*longipennis*		
Parachaetocladius	*abnobaeus*		
Parachironomus	*pectinatellae*		
Parachironomus	*tenuicaudatus_complex*		
Paracladopelma	*sp.*		
Paracloeodes	*minutus*		
Parakiefferiella	*sp.*		
Paralauterborniella	*nigrohalteralis*		
Paraleptophlebia	*sp.*		
Paramerina	*anomala*		
Parametriocnemus	*sp.*		
Paraphaenocladius	*sp.*		
Paratanytarsus	*dissimilis*		
Paratendipes	*albimanus*		
Paratendipes	*subaequalis*		
Pelocoris	*sp.*		
Pelocoris	*femoratus*		
Peltodytes	*sp.*		
Peltodytes	*bradleyi*		
Pentaneura	*inconspicua*		
Perithemis	*lydia*		
Perlesta	*sp.*		
Perlinella	*ephyre/zwicki*		
Phaenopsectra	*sp.*		
Phylocentropus	*carolinus*		
Phylocentropus	*lucidus*		
Phylocentropus	*placidus*		
Physa	*sp.*		
Pilaria	*sp.*		
Polycentropus	*sp.*		
Polypedilum	*aviceps*		

Table D-7. Aquatic Invertebrate Species Documented on McCrady Training Center.			
GENUS	**SPECIES**	**COMMON NAME**	**NOTES**
Polypedilum	*fallax*		
Polypedilum	*flavum*		
Polypedilum	*halterale_grp.*		
Polypedilum	*illinoense_grp.*		
Polypedilum	*scalaenum_grp.*		
Polypedilum	*trigonus*		
Polypedilum	*tritum*		
Polypedilum	*sp.*		
Potthastia	*longimana*		
Probezzia	*sp.*		
Procambarus	*sp.*		
Procambarus	*ancylus*		
Procladius	*sp.*		
Procloeon	*sp.*		
Progomphus	*obscurus*		
Psectrocladius	*elatus*		
Psectrotanypus	*dyari*		
Pseudochironomus	*sp.*		
Pseudocloeon	*ephippiatum*		
Pseudocloeon	*frondale*		
Pseudocloeon	*propinquum*		
Pseudolimnophila	*sp.*		
Pseudosmittia	*sp.*		
Psilotreta	*frontalis*		
Psorophora	*sp.*		
Psychoda	*alternata*		
Ptilostomus	*sp.*		
Pycnopsyche	*guttifer*		
Pycnopsyche	*luculento/sonso*		
Pycnopsyche	*scabripennis*		
Ranatra	*sp.*		
Ranatra	*kirkaldyi*		
Rhagovelia	*obesa*		
Rheocricotopus	*robacki*		
Rheocricotopus	*tuberculatus*		
Rheosmittia	*arcuata*		
Rheotanytarsus	*exiguus_grp.*		
Rheotanytarsus	*pellucidus*		
Robackia	*demeijerei*		
Saetheria	*tylus*		
Sciara	*sp.*		
Serratella	*serratoides*		
Sialis	*sp.*		
Sialis	*aequalis*		

Table D-7. Aquatic Invertebrate Species Documented on McCrady Training Center.			
GENUS	**SPECIES**	**COMMON NAME**	**NOTES**
Sialis	*vagans*		
Sigara	*sp.*		
Simulium	*sp.*		
Simulium	*jonesi*		
Simulium	*krebsorum*		
Simulium	*slossonae*		
Simulium	*tuberosum*		
Simulium	*ubiquitum*		
Simulium	*venustum/verecundum*		
Siphlonurus	*sp.*		
Siumlium	*dixiense*		
Smittia	*sp.*		
Sperchopsis	*tesselata*		
Sphaeromias	*sp.*		
Stelechomyia	*perpulchra*		
Stempellina	*sp.*		
Stempellinella	*fimbriata*		
Stempellinella	*leptocelloides*		
Stenelmis	*sp.*		
Stenelmis	*sp.*		
Stenelmis	*bicarinata*		
Stenelmis	*convexula*		
Stenelmis	*lignicola*		
Stenelmis	*musgravei*		
Stenelmis	*xylonastis*		
Stenochironomus	*sp.*		
Stenovelia	*stagnalis*		
Stictochironomus	*devinctus*		
Stylurus	*sp.*		
Stylurus	*townesi*		
Tabanus	*sp.*		
Taenioteryx	*sp.*		
Tanytarsus	*sp.*		
Telmatoscopus	*superbus*		
Thaumalea	*sp.*		
Thienemanniella	*lobapodema*		
Thienemanniella	*xena*		
Thienemannimyia_grp.	*sp.*		
Tipula	*sp.*		
Triaenodes	*sp.*		
Triaenodes	*ignitus*		
Triaenodes	*perna*		
Tribelos	*jucundum*		
Trichocorixa	*macroceps*		

Table D-7. Aquatic Invertebrate Species Documented on McCrady Training Center.			
GENUS	**SPECIES**	**COMMON NAME**	**NOTES**
Tvetenia	*paucunca*		
Tvetenia	*vitracies*		
Unniella	*multivirga*		
Wormaldia	*sp.*		
Xenochironomus	*xenolabis*		
Xylotopus	*par*		
Zalutschia	*sp.*		
Zavreliella	*marmorata*		
Zavrelimyia	*thryptica_cmplx*		
Zavrelimyia	*sp.*		

E. Special Status Species Management

E.1 Special Status Animals

This section summarizes those special status animal species that are either documented to occur or have the potential to occur on MTC. There are one federally listed species, two state listed species, and two other rare species documented on MTC. Following the review of potential and documented species presented in **Table E-1**, the management recommendations for documented and potential species are provided. The SCARNG maintains species information and management recommendations for special status species within a database.

Table E-1. Potential Special Status Animals on McCrady Training Center.

Species	Status	Comments/Habitat	Status on MTC
Mammals			
Star-nosed mole *Condylura cristata*	SC (S3)	Mesic mixed forest and mesic deciduous hardwood and bottomland or floodplain forests.	Potential-Suitable Habitat – multiple surveys have not found
Rafinesque's big-eared bat *Corynorhinus rafinesquii*	SE (S2)	In South Carolina, permanent residents of the coastal plain and hibernate in caves and similar habitats rather than move south in winter.	Documented
Tri-colored bat *Perimyotis subflavus*	ARS (S1S2)	Found state-wide and utilize T-beam bridges, buildings, mines, tunnels, caves, and hollow trees for roosts. First diagnosed case of white nose syndrome in South Carolina in this species was in 2013.	Documented
Northern long-eared bat *Myotis septentrionalis*	E (S1)	Documented in Piedmont and Coastal plain, acoustic records on MTC and in Midlands. Forage in cluttered wetlands with potential roost sites in Longleaf pine bark. One of top 3 bat species affected by WNS.	Potential-Suitable Habitat – multiple surveys have not found
Southern fox squirrel *Sciurus niger*	SC (S3S4)	Strongly associated with mature pine forests and mature pine-hardwood forests and prefer open herbaceous understory and patchy shrub cover.	Documented
Eastern spotted skunk *Spilogale putorius*	SC (S3)	A variety of habitats but associated with preferring woodlands, semi-open farmland, and old abandoned fields.	Potential-Suitable Habitat – multiple surveys have not found
Swamp rabbit *Sylvilagus aquaticus*	SC (S2?)	Found in close proximity to water with down woody debris.	Potential-Suitable Habitat – multiple surveys have not found
Black bear *Ursus americanus*	SC (S5)		Unlikely – no habitat
Birds			

Bald eagle *Haliaeetus leucocephalus*	BGEPA ST (S2)	Wide variety of habitats that provide suitable nest sites close to open water. Nests may be placed in snags or large live trees as well as on constructed platforms or utility poles. They are	Potential – within habitat range

Table E-1. Potential Special Status Animals on McCrady Training Center.			
Species	**Status**	**Comments/Habitat**	**Status on MTC**
		resident (stay year round) as long as there is open water where they can forage. Bald eagles in South Carolina are smaller than their northern counterparts	
American wood stork *Mycteria americana*	FT SE (S1S2)	Often seen walking slowly through marshes while foraging. Nests are typically located on trees surrounded by water, such as in cypress swamps, shallow creeks, and impoundments.	Potential – suitable habitat
Red-cockaded woodpecker *Picoides borealis*	FE SE (S2)	Mature pine forests, with an age of 60 years or greater, that lack a hardwood understory. Reside in clans and dig nest cavity in living tree. Nesting occurs in spring, from late April through May.	Documented
Barn-owl *Tyto alba*	SC (S4)		Potential-Suitable Habitat – multiple surveys have not found
Herptiles			
American alligator *Alligator mississippiensis*	FE ST (S5)	Coastal marshlands and inland impoundments frequented by waterfowl.	Unlikely – no suitable habitat
Chamberlain's dwarf salamander *Eurycea chamberlaini*	ARS (SNR)	Found in seepages near small streams and other wet areas. Commonly discovered under leaf and pine straw litter or other vegetative cover. Occasionally observed at depths of 15 cm. or greater, leading to under sampling in some cases.	Potential-Suitable Habitat – multiple surveys have not found
Southern hognose snake *Heterodon simus*	ARS ST (SNR)	Sandhill, pine flatwood, and coastal dunes.	Documented
Pine barrens treefrog *Hyla andersonii*	ST (S2S3)		
Insects			
Monarch butterfly *Danaus plexippus*	ARS (SNR)	Open fields and meadows with milkweed.	Documented
Mollusks			
Gravel elimia *Elimia catenaria*	SC (SNR)	Found in freshwater rivers and streams with cobble bottoms.	Unlikely – no suitable habitat
Carolina heelsplitter	FE (CH)	Although once found in large rivers and streams, now restricted to cool, clean, shallow,	

Table E-1. Potential Special Status Animals on McCrady Training Center.			
Species	**Status**	**Comments/Habitat**	**Status on MTC**
Lasmigona decorate	SE (S1)	shaded streams with pool, riffle and run sequences.	
Eastern floater *Pyganodon cataracta*	SC (SNR)		Potential-Suitable Habitat – insufficient surveys
Creeper *Strophitus undulatus*	SC (S2)	Shallow water in both small streams and large rivers in a variety of substrates.	Potential-Suitable Habitat – insufficient surveys
Eastern creekshell *Villosa delumbis*	SC (S4)	Found in deep muddy flock but can also be found in sand and boulder fields. It is most often close to the bank of streams and rivers among tree roots.	Potential-Suitable Habitat – insufficient surveys
Fish			
Shortnose sturgeon *Acipenser brevirostrum*	FE SE (S3)	Diadromous fish that inland prefer deep water. Often found in areas with soft substrate and a vegetated bottom.	Unlikely – no suitable habitat
Atlantic sturgeon *Acipenser oxyrinchus*	FE		Unlikely – no suitable habitat
Blueback herring *Alosa aestivalis*	ARS SC (S5)	Travels upstream in the Coastal Plain to spawn. In South Carolina it spawns on the Savannah River and Thurmond reservoir.	Unlikely – no suitable habitat
Carolina darter *Etheostoma collis*	SC (SNR)		Potential-Suitable Habitat – insufficient surveys
Banded killifish *Fundulus diaphanous*	SC (S1)		Potential-Suitable Habitat – insufficient surveys
Robust redhorse *Moxostoma robustum*	ARS SC (SNR)	Inhabit large rivers and are found from the rocky reaches of the mid-Piedmont to the coast. Gravel bars required for spawning (primarily in the transition zone between the piedmont and coastal plain).	Unlikely – no suitable habitat
Redlip shiner *Notropis chiliticus*	SC (S1?)		Potential-Suitable Habitat – insufficient surveys
Blacknose dace *Rhinichthys obtusus*	SC (S1)		Potential-Suitable Habitat – insufficient surveys
Crustacean			

Table E-1. Potential Special Status Animals on McCrady Training Center.			
Species	**Status**	**Comments/Habitat**	**Status on MTC**
Broad River spiny crayfish *Cambarus spicatus*	ARS SC (S3)	Restricted to the Broad River basin. Streams in basin exhibit signs of flash flooding including sand deposits and log jams. Usually found in or beneath debris.	Potential – insufficient survey effort

Sources: USFWS Richardson County list; USFWS IPaC Report for McCrady Training Center; South Carolina Department of Natural Resources Rare, Threatened, and Endangered Species of South Carolina for Richardson County.

FE=federally endangered, FT=federally threatened; ARS = USFWS has been petitioned to list the species and a positive 90-day finding has been issued (listing may be warranted); information provided only for conservation actions as no federal protections currently exist.

SE=state endangered, ST=state threatened,
SC = state species of special concern (S1, S2, S3 all indicate state Species of Conservation Concern)

S RANK: The priority assigned by SCDNR based upon the element's status within the state.
S1 = critically imperiled in the state because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extirpation in the state.
S2 = imperiled in state because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extirpation from the state.
S3 = rare or uncommon in state (on the order of 21 to 100 occurrences).
S4 = apparently secure in state, with many occurrences.
SNR = not ranked at state level

E.1.1 **Documented Animal Species**

The following are management recommendations for species confirmed as occurring on MTC. Species descriptions and background information is maintained by SCARNG in a centralized location.

Rafinesque's big-eared bat

1. Identify, protect, and provide new and/or existing roosts/colonies.
2. Continue population inventory and monitoring surveys.
3. Maintain and/or contribute to a bat database.
4. Monitor and mitigate threats such as WNS, pesticide contamination, anthropologic disturbance, invasive species, etc.
5. Identify, protect, and enhance bat habitat and drinking resources
6. Conduct further research into species.
7. Provide education and outreach.

Tri-colored bat

1. Identify, protect, and provide new and/or existing roosts/colonies.
2. Continue population inventory and monitoring surveys.
3. Maintain and/or contribute to a bat database.
4. Monitor and mitigate threats such as WNS, pesticide contamination, anthropologic disturbance, invasive species, etc.
5. Identify, protect, and enhance bat habitat and drinking resources
6. Conduct further research into species.
7. Provide education and outreach.

Red-Cockaded Woodpecker

1. Work in coordination with Fort Jackson to aid in the implementation of their RCW Management Plan, and follow the RCW management recommendations within the plan. (File Path: \\mtc-envsrvr5\Library\Conservation\Program Management\INRMP\FJ INRMP FY17\FTJK_RCW_ESMC.docx)
2. Manage to provide optimum foraging and nesting habitat that is contiguous with, and as close as possible to each cluster.
3. Develop and implement habitat management practices within the HMU to aid in the establishment of Good Quality Foraging Habitat (GQFH) as specified in the Recovery Plan.
4. Foraging stands should consist of no or sparse hardwood maintained below 7 feet in height.
5. Canopy hardwoods will be li mited to no more than 10 square feet (ft^2) of basal area (BA).
6. Pines which are large enough to provide foraging habitat or large/old enough for cavity trees within 50 feet of an existing cavity tree will only be removed if deemed necessary.
7. The quality of foraging stands should be maintained to control hardwood growth, eliminate dense midstory, and reduce fuel levels available to wildfires. This can be accomplished through the following methods;
    a. Mechanical Mowers- These will be either tractor-drawn mowers or tracked or rubber-tired cutters with front or rear mounted rotary drum severe duty flail cutter heads or fixed tooth mulching/cutter heads.
    b. Manual - Hand operated chainsaws and gas-powered line trimmers with saw blades.
    c. Chemical - Registered herbicides applied by broadcast and single stem techniques.

Southern hognose snake

1. Protect and restore upland, longleaf pine and wiregrass habitat utilized by this species.
2. Manage longleaf and wiregrass habitat on long rotations and with large stumps remaining after harvest for underground refugia and hibernation sites.
3. Use prescribed fire to maintain open understory characteristics.
4. Continue inventory and research of known populations.
5. Continue outreach and education efforts.

Monarch butterfly

1. Habitat restoration, maintenance, and enhancement
2. Planting of milkweed host plants and wildflower nectar sources.
3. Public education
4. Research
5. Monitoring

E.1.2 **Potential Animal Species**

The following are management recommendations for species with some potential to occur on MTC, but not yet confirmed. See Table E-1 for more information about their likelihood on MTC. Species descriptions and background information is maintained by SCARNG in a centralized location.

Bald eagle

1. Maintaining current regulations/statutes
2. Protect nest/roost/foraging sites and communal areas
3. Limit disturbance: human development; construction; timber operations/ forestry; off-road vehicle use; motorized watercraft use; non-motorized recreation and human entry; helicopters and fixed-wing aircraft; blasting other loud, intermittent noise
4. Limit disturbance at foraging sites
5. Only use federal and state approved pesticides, herbicides, fertilizers, and other chemicals
6. Monitor and minimize contaminants/pollution/hazardous waste.

American wood stork

1. Conduct aerial surveys annually to locate new Wood Stork nesting colonies and to determine which colonies should be visited from the ground.
2. Conduct complete ground counts of Wood Stork nests at colony sites in South Carolina each year.
3. Provide permitting agencies with current information on Wood Stork colonies by updating distribution maps every year.
4. Monitor a sample of nests each year to quantify nesting success.
5. Determine survivorship of fledgling, immature, and adult Wood Storks using mark and recapture (band re-sighting) and satellite telemetry.
6. Document important habitat for Wood Storks during the nonbreeding season.
7. Determine if the amount of foraging habitat limits species recovery. Study foraging ecology and habitat use in South Carolina.
8. Participate in and contribute to the regional Wood Stork working group.
9. Integrate management for Wood Storks into traditional waterfowl management of currently impounded wetlands by timing draw downs during key feeding periods (post fledging).
10. Provide technical guidance and assistance to owners and managers of land where storks nest, feed, and roost.

Chamberlain's dwarf salamander

1. Maintaining current regulations/statutes protecting wetlands and streams
2. Protection of known populations
3. Furthering taxonomic study
4. Supporting survey efforts
5. Education.

Broad River spiny crayfish

Due to limited/deficient data on this species, additional surveys are recommended to determine further management decisions.

E.2 SPECIAL STATUS PLANTS

This section summarizes those special status plant species that are either documented to occur or have the potential to occur on MTC. There are currently two federally listed plant species and 35 state species of concern and/or federal at-at-risk plant species known to occur on MTC. Following the summary

presented in **Table E-2**, a summary by species is provided regarding management recommendations for these species, if found on MTC.

Table E-2. Potential Special Status Plants on McCrady Training Center.			
Species	**Status**	**Comments/Habitat**	**Status on MTC**
Pennell's false foxglove *Agalinis tenella*	SC (SNR)		
Elliott's bluestem *Andropogon gyrans var. stenophyllus*	SC (S1)		Documented
Piedmont three-awned grass *Aristida condensata*	SC (S2)		Documented
Sandhills milkvetch *Astragalus michauxii*	SC (S3)	Longleaf pine-wiregrass sandhills, pine woodlands, turkey oak-rosemary scrub.	Documented
Purple balduina *Balduina atropurpurea*	ARS (S1)		
Northern burmannia or Northern blue threads *Burmannia biflora*	SC (S2)		Documented
Winter grape-fern *Botrychium lunarioides*	SC (S1)		
Pine-barrens reed-grass *Calamovilfa brevipilis*	SC (S1)		Documented
Cherokee sedge *Carex cherokeensis*	SC (S2)		
Colin's sedge *Carex collinsii*	SC (S2)		
Ravenfoot sedge *Carex crus-corvi*	SC (S2)		
Elliot's sedge *Carex elliottii*	SC (S1)		Documented
Social sedge *Carex socialis*	SC (S1)		
Cayaponia *Cayaponia quinqueloba*	SC (S1?)		
Southern horse-balm	SC		Documented

Table E-2. Potential Special Status Plants on McCrady Training Center.			
Species	**Status**	**Comments/Habitat**	**Status on MTC**
Collinsonia serotina	(S1)		
Whorled horse-balm *Collinsonia verticillata*	SC (S3)		
Southeastern tickseed *Coreoposis gladiata*	SC (SNR)		
Ciliate-leaf tickseed *Coreopsis integrifolia*	ARS		
Spinulose shield fern *Dryopteris carthusiana*	SC (S1)		
Smooth coneflower *Echinacea laevigata*	FE SE (S3)	Typically found in open woods, glades, cedar barrens, roadsides, clearcuts, dry limestone bluffs, and power line rights-of-way with open areas and periodic disturbances.	Documented
Robbin's spicebush *Eleocharis robbinsii*	SC (S2)		Documented
Shoals spider-lily *Hymenocallis coronaria*	SC (S2)		
Carolina St. John's-wort *Hypericum nitidum*	SC (S1)		Documented
Sarvis holly *Ilex amelanchier*	SC (S3)		Documented
Red standing-cypress *Ipomopsis rubra*	SC (S2)		
Pine barren rush *Juncus abortivus*	SC (S2)		Documented
Piedmont pinweed *Lechea torreyi*	SC (SNR)		Documented
Small-head gayfeather *Liatris microcephala*	SC (S1)		Documented
Sandhills lily *Lilium pyrophilum*	SC (S1)		Documented
Bog spicebush *Lindera subcoriacea*	ARS		Documented

Table E-2. Potential Special Status Plants on McCrady Training Center.			
Species	**Status**	**Comments/Habitat**	**Status on MTC**
Spatulate seedbox *Ludwigia spathulate*	SC (S2)		
Carolina bugleweed *Lycopus cokeri*	SC (S2)		Documented
Rough-leaved loosestrife *Lysimachia asperulaefolia*	FE SC (S1)	Occurs in edges between longleaf pine uplands and pond pine pocosins (areas of dense shrub and vine growth usually on a wet, peaty, poorly drained soil) on moist to seasonally saturated sands and on shallow organic soils overlaying sand. Habitat is fire-maintained. Several populations are known from roadsides and power line rights of way where regular maintenance mimics fire and maintains vegetation so that herbaceous species are open to sunlight.	Documented
Carolina's birds-in-a-nest *Macbridea caroliniana*	ARS SC (S3)		Documented
Bigleaf magnolia *Magnolia macrophylla*	SC (S1)		
Pyramid magnolia *Magnolia pyramidata*	SC (S1)		
Piedmont water-milfoil *Myriophyllum laxum*	SC (S2)		Documented
Nestronia or leechbush *Nestronia umbellula*	SC (S3)	Habitat varies and includes upland mixed pine and hardwood stands, pine stands, and growing with upland oaks and hickories.	Documented
Adder's-tongue *Ophioglossum vulgatum*	SC (S2)	Shaded secondary and floodplain forests and forested bottomlands.	
Canby's dropwort *Oxypolis canbyi*	FE SC (S2)	Inhabits a variety of coastal plain communities, including pond cypress savannahs, the shallows and edges of cypress/pond pine ponds, sloughs, and wet pine savannas.	
Bead-grass *Paspalum bifidum*	SC (S2)		Documented
Pine-leaved golden aster	SC		Documented

Table E-2. Potential Special Status Plants on McCrady Training Center.			
Species	**Status**	**Comments/Habitat**	**Status on MTC**
Pityopsis pinifolia	(S2)		
Green-fringe orchis *Platanthera lacera*	SC (S2)		
Algae-like pondweed *Potamogeton confervoides*	SC (S1)		Documented
Alabama black cherry *Prunus alabamensis*	SC (S1)		Documented
Whisk fern *Psilotum nudum*	SC (S1)		
Crestless plume orchid *Pteroglossaspis ecristata*	SC (S2)		
Oglethorpe's oak *Quercus oglethorpensis*	SC (S3)	Occurs marshes and stream bottoms.	
Awned meadowbeauty *Rhexia aristosa*	SC (S3)		
May white *Rhododendron eastmanii*	SC (S2)		
Michaux's sumac *Rhus michauxii*	FE SC (SX)	Grows in sandy or rocky open woods in association with basic soils. Sometimes occur on highway rights-of way, roadsides, or on the edges of artificially maintained clearings.	
Drowned hornedrush *Rhynchospora inundata*	SC (S2?)		Documented
Beak rush *Rhynchospora macra*	SC (S1)		Documented
Few-flowered beaked-rush *Rhynchospora oligantha*	SC (S2)		Documented
Pale beakrush *Rhynchospora pallida*	SC (S1)		Documented
Chapman beakrush *Rhynchospora stenophylla*	SC (S2)		Documented
Sweet pitcher-plant *Sarracenia rubra*	SC (S3S4)		Documented

Table E-2. Potential Special Status Plants on McCrady Training Center.			
Species	**Status**	**Comments/Habitat**	**Status on MTC**
Canby bulrush *Scirpus etuberculatus*	SC (SNR)		Documented
Wire-leaved dropseed *Sporobolus teretifolius*	ARS SC (S1)		Documented
Elliott's aster *Symphyotrichum elliotii*	SC (S3)		
Georgia aster *Symphyotrichum georgianum*	ARS (SNR)	Open, sunny areas, including edges and openings in rocky, upland oak-hickory-pine forests, and rights-of-way. Primary limiting factor is availability of sunlight.	
White false-asphodel *Tofieldia glabra*	SC (S1S2)		Documented
Aethusa-like trepocarpus *Trepocarpus aethusae*	SC (S1)		Documented
Chapman's redtop *Tridens chapmanii*	SC (S1)		Documented
Wateree trillium *Trillium oostingii*	SC (S1)		
Weak nettle *Urtica chamaedryoides*	SC (S2)		
Rayner's blueberry *Vaccinium crassifolium ssp. sempervirens*	SC (S1)		Documented
Nuttall warea *Warea cuneifolia*	SC (S1)		Documented

Sources: USFWS Richardson County list; USFWS IPaC Report for McCrady Training Center; South Carolina Department of Natural Resources Rare, Threatened, and Endangered Species of South Carolina for Richardson County and SCARNG reports for MTC.

FE=federally endangered, FT=federally threatened; ARS = USFWS has been petitioned to list the species and a positive 90-day finding has been issued (listing may be warranted); information provided only for conservation actions as no federal protections currently exist.

SE=state endangered, ST=state threatened,
SC = state species of special concern (S1, S2, S3 all indicate state Species of Conservation Concern)

S RANK: The priority assigned by SCDNR based upon the element's status within the state.

Table E-2. Potential Special Status Plants on McCrady Training Center.			
Species	**Status**	**Comments/Habitat**	**Status on MTC**
S1 = critically imperiled in the state because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extirpation in the state. S2 = imperiled in state because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extirpation from the state. S3 = rare or uncommon in state (on the order of 21 to 100 occurrences). S4 = apparently secure in state, with many occurrences. SNR = not ranked at state level			

E.2.1 **Documented Plant Species**

The following are management recommendations for species confirmed as occurring on MTC. Species descriptions and background information is maintained by SCARNG in a centralized location.

Elliott's bluestem

1. Conserve current populations.
2. Maintain moist, open habitat by protecting hydrology.
3. Spread seed to propagate new and strengthen current populations.
4. Avoid off-road vehicle use, as well as dredging, and filling activities,
5. Avoid/ limit chemical herbicide use.

Piedmont three-awned grass

1. Protect current populations and habitat.
2. Spread seed to propagate new and strengthen current populations.
3. Use prescribed burning and/or hand clearing to restore open habitats.
4. Avoid mechanical clearing and logging.
5. Avoid/ limit chemical herbicide use.

Sandhills milkvetch

1. Apply prescribed fire early in the growing season every 2-3 years, before plants flower.
2. Prevent pine straw raking and other ground disturbance.
3. Protect sandhills and scrub from development and conversion to pine plantation and agriculture.

Northern burmannia or Northern bluethread

1. Protect current populations and habitat.
2. Spread seed to propagate new and strengthen current populations.
3. Use prescribed burning and/or hand clearing to restore open habitats.
4. Avoid mechanical clearing and logging.
5. Avoid/ limit chemical herbicide use.

Pine-barrens reed-grass

1. Protect current populations and habitat.
2. Use prescribed burning and/or hand clearing to restore open habitats.
3. Avoid mechanical clearing and logging.
4. Avoid/ limit chemical herbicide use.

Elliott's sedge

5. Protect current populations and habitat.
6. Use prescribed burning and/or hand clearing to restore open habitats.
7. Avoid mechanical clearing and logging.
8. Avoid/ limit chemical herbicide use.

Southern horse-balm

1. Protect current populations and habitat.
2. Use prescribed burning and/or hand clearing to restore open habitats.
3. Avoid mechanical clearing and logging.
4. Avoid/ limit chemical herbicide use.

Smooth coneflower

1. See Ft. Jackson's Endangered Species Management Plan for Smooth Coneflower and Rough-leaved Loosestrife
2. File Path: \\mtc-envsrvr5\Library\Conservation\Threatened and Endangered\ESMP coneflower loosestrife
3. Use prescribed burning and/or hand clearing to restore open habitats.
4. Avoid mechanical clearing and logging.
5. Protect roadside and right-of-way population from herbicides and poorly timed mowing.

Robbin's spicebush

1. Avoid broadcast spraying of herbicides; use care with spot spraying.
2. Avoid known individual plant locations and conduct operations elsewhere when they are least likely to cause damage.
3. Minimize disturbance to hydrology, including soil disturbance from rutting.
4. Prescribed burns and/or brushing may be beneficial (dependent on local site conditions).
5. This species is likely sensitive to water quality. Following BMPs around streams and buffering associated drainages will reduce eutrophication and prevent water quality degradation.
6. Maintain and restore open habitat through selective clearing and brushing.

Carolina St. John's-wort

1. Protect current populations and habitat.
2. Use prescribed burning and/or hand clearing to restore open habitats.
3. Avoid mechanical clearing and logging.
4. Avoid/ limit chemical herbicide use.

Sarvis holly

5. Protect current populations and habitat.
1. Protect hydrology of swamp land habitat where Sarvis holly is found.
2. Avoid mechanical clearing and logging.
3. Avoid/ limit chemical herbicide use.

Pine barren rush

1. Protect current populations and habitat.
2. Use prescribed burning and/or hand clearing to restore open habitats.
3. Avoid mechanical clearing and logging.
4. Avoid/ limit chemical herbicide use.

Piedmont pinweed

1. Protect current populations and habitat.
2. Use prescribed burning and/or hand clearing to restore open habitats.
3. Avoid mechanical clearing and logging.
4. Avoid/ limit chemical herbicide use.

Small-head gayfeather

1. Protect current populations and roadside habitat.
2. Use prescribed burning and/or hand clearing to restore open habitats.
3. Avoid mechanical clearing and logging.
4. Avoid/ limit chemical herbicide use along roadsides and right-of-way.

Sandhills lily

1. Protect current populations and habitat.
4. Protect hydrology of swamp land habitat where it is/can be found.
5. Avoid mechanical clearing and logging.
6. Avoid/ limit chemical herbicide use.

Bog spicebush

1. Identify and protect current populations of bog spicebush.
2. Protect seepage wetlands from clearing, draining, and filling.
3. Following biofuel reduction in overgrown sites, allow fires in adjacent uplands to periodically burn into and across wetlands.

Carolina bugleweed

1. Protect current populations and habitat.
7. Protect hydrology of wetland habitat where it is found, such as damp meadows, ponds, and stream banks.
8. Avoid mechanical clearing and logging.
9. Avoid/ limit chemical herbicide use.

Rough-leaved loosestrife

1. See Ft. Jackson's Endangered Species Management Plan for Smooth Coneflower and Rough-leaved Loosestrife
2. File Path: \\mtc-envsrvr5\Library\Conservation\Threatened and Endangered\ESMP coneflower loosestrife
3. Protection of public and privately owned species population sites.
4. Maintenance by periodic prescribed burning.
5. Protection from adverse habitat alteration by ditching and drainage activities.
6. Collect and store seeds and plant material for propagation, research, and restoration projects.

Carolina's birds-in-a-nest

1. Identify, survey, monitor, and protect current populations.
2. Enhance, restore, and protect wetlands.
3. Work with landowners in/near key Carolina-birds-in-a-nest habitat to discourage indiscriminate use of herbicides for right-of-way maintenance.

Piedmont water-milfoil

1. Protect natural hydrology and water levels in ponds.
2. Prevent pollution runoff and sedimentation into ponds and streams.
3. Eradicate invasive water milfoil species.
4. Maintain historic water table levels.
5. Limit motorized boat use in ponds.

Nestronia or leechbush

1. Protect current populations and habitat.
2. Avoid logging and mechanical clearing.
3. Use fire or hand-clearing to create sunny openings in woodlands.

Bead-grass

1. Protect current populations and longleaf pine/ sandhill habitat.
2. Use prescribed burning and/or hand clearing to restore open habitats.
3. Avoid mechanical clearing and logging.
4. Avoid/ limit chemical herbicide use along roadsides and right-of-way

Pine-leaved golden aster

1. Apply prescribed fire every 2 - 3 years.
2. Avoid clearcutting, pine-straw raking, and other mechanical disturbances to the ground cover.

Algae-like pondweed

1. Conserve and monitor current populations.
2. Protect hydrology and wetland habitats where it is and can be found.
3. Remove vegetation where overcrowding occurs to reduce competition.

Alabama black cherry

1. Protect current populations and habitat

Drowned hornedrush

1. Protect current populations and habitat.
2. Protect hydrology of swamp land habitat where it is/can be found.
3. Avoid mechanical clearing and logging.
4. Avoid/ limit chemical herbicide use.

Beak rush

1. Protect current populations and habitat.
2. Use prescribed burning and/or hand clearing to restore open habitats.
3. Avoid mechanical clearing and logging.
4. Avoid/ limit chemical herbicide use.

Few-flowered beaked-rush

1. Protect current populations and habitat.
2. Use prescribed burning and/or hand clearing to restore open habitats.
3. Avoid mechanical clearing and logging.
4. Avoid/ limit chemical herbicide use.

Pale beakrush

1. Protect current populations and habitat.
2. Use prescribed burning and/or hand clearing to restore open habitats.
3. Avoid mechanical clearing and logging.
4. Avoid/ limit chemical herbicide use.

Chapman beakrush

1. Protect current populations and habitat.
2. Use prescribed burning and/or hand clearing to restore open habitats.
3. Avoid mechanical clearing and logging.
4. Avoid/ limit chemical herbicide use.

Sweet pitcher-plant

1. Protect current populations for destruction and illegal take.
2. Protect wetland habitat where it is/can be found.
3. Avoid mechanical clearing and logging.
4. Avoid/ limit chemical herbicide use.

Canby bulrush

1. Protect current populations.

2. Protect wetland habitat where it is/can be found.
3. Avoid mechanical clearing and logging.
4. Avoid/ limit chemical herbicide use.

Wire-leaved dropseed

1. Burn on a 2-3 year rotation during the growing season.
2. Avoid plowing fire lines, especially streamside transition zones.
3. Prevent pine straw raking and use of herbicides in longleaf pine habitats.
4. Protect pine communities from clearing and logging.
5. Avoid altering hydrology of seepage slopes and savannas.

White false-asphodel

1. Protect current populations.
2. Protect wetland habitat where it is/can be found.
3. Avoid mechanical clearing and logging.
4. Avoid/ limit chemical herbicide use.

Aethusa-like trepocarpus

1. Protect current populations.
2. Protect wetland habitat where it is/can be found such as floodplain forests, wet ditches, and disturbed sites.
3. Avoid mechanical clearing and logging.
4. Avoid/ limit chemical herbicide use.

Chapman's redtop

1. Protect current populations and habitat.
2. Use prescribed burning, mowing, and/or hand clearing to restore open habitats.
3. Avoid mechanical clearing and logging.
4. Avoid/ limit chemical herbicide use.

Rayner's blueberry

1. Protect current populations and habitat.
2. Use prescribed burning, mowing, and/or hand clearing to restore open habitats.
3. Avoid mechanical clearing and logging.
4. Avoid/ limit chemical herbicide use.

Nuttall warea

1. Protect current populations and habitat.
2. Use prescribed burning, mowing, and/or hand clearing to restore open habitats.
3. Avoid mechanical clearing and logging.
4. Avoid/ limit chemical herbicide use.

E.2.2 **Potential Plant Species**

The following are management recommendations for species with some potential to occur on MTC, but not yet confirmed. See Table E-2 for more information about their likelihood on MTC. Species descriptions and background information is maintained by SCARNG in a centralized location.

Purple baldina

1. Burn on a 2-3 year rotation during the growing season.
2. Avoid soil disturbance, ditching, draining, firebreak construction, bedding, and mechanical clearing in wetlands

Ciliate-leaf tickseed

1. Identify and protect current populations.
2. Avoid damming and polluting streams.
3. Avoid clearcutting of floodplains and other disturbances along riverbanks.
4. Avoid the use of pesticides near streams.
5. Exclude cattle from bottomlands and streambanks.

Canby's dropwort

1. Burn on a 2-3 year rotation and allow fire in uplands to burn into edges of ponds and Carolina Bays
2. Avoid placing firebreaks in transition zones between uplands and wetlands.
3. Avoid ditching, draining, or altering hydrology of ponds, sloughs, and bays.
4. Limit ground water withdrawal.

Michaux's sumac

1. Use prescribed burning and/or hand clearing to maintain sunny conditions.
2. Avoid mechanical clearing and the use of herbicides and heavy equipment.
3. Support efforts to introduce female plants to male-only sites and vice versa.
4. Artificially pollenate female plants.

F. PHYSICAL OVERVIEW

F.1 CLIMATE

MTC is located east of the state capital and second largest city in South Carolina, Columbia. The warm Gulf Stream current moves along the long coastline in the state of South Carolina, while the Appalachian Mountains to the north and west block or delay many cold air masses approaching from those directions. The climate at MTC is classified as humid continental. The predominant climatic factors are the location in the lower latitudes and its proximity to the Appalachian Mountains to the west, which block the approach of unseasonable cold weather in the winter. These factors result in a relatively narrow annual temperature range. The Bermuda high, a maritime tropical air mass brings warm, moist air inland from the ocean, which forms localized thunderstorms and high precipitation (South Carolina State 2019).

F.1.1 Climate Summary

The climate at CHTC is classified as humid continental. The predominant climatic factors are the location in the lower latitudes and its proximity to the Appalachian Mountains to the west, which block the approach of unseasonable cold weather in the winter. These factors result in a relatively narrow annual temperature range. The most rain in the region typically occurs in the summer months July (between 5 and 6 inches) (CPPP 2019). **Table F-1** summarizes the climate near MTC over a period of 19 years, from 1981 to 2010.

Table F-1. Climate Summary for McCrady Training Center, SC: 1981-2010

Month	Temperature (°F) –Monthly Normal			Precipitation (Inches) - Average Monthly Normal
	Maximum	Minimum	Mean	
January	56.0	35.9	45.9	3.63
February	60.5	38.4	49.4	3.65
March	68.6	44.7	56.7	3.88
April	76.5	52.4	64.5	2.69
May	83.9	60.5	72.2	2.97
June	89.9	69.0	79.5	4.91
July	93.0	72.3	82.7	5.18
August	90.9	71.5	81.2	4.94
September	85.7	66.0	75.8	4.04
October	76.2	54.4	65.3	3.32
November	67.5	44.6	56.1	2.99
December	58.5	37.6	48.1	3.20

Source: (National Weather Service 2019)

MTC is located in a subtropical climate characterized by hot, humid summers and moderately cold winters. Summer temperatures are generally in the low 80°F Fahrenheit (F) range, with temperatures sometimes exceeding 100°F and falling below 50°F. Winter months average 56 F during daylight hours and 33°F at night. Average annual precipitation from 2000 to 2019 is 44.31 inches (National Weather Service 2019). With the exception of wet periods, climate conditions on MTC are ideal for training. It is

important to note that during wet periods, limitations on vehicle maneuvering will curtail training activities. About every five years an ice storm occurs, severe enough to cause some timber damage. Every few years a tropical storm will cause heavy rains for 2-3 days. In extremely rare instances, tropical storm winds come inland far enough to cause damage, such as occurred during Hurricane Hugo in 1989.

Thunderstorms during summer months can also limit training activities. Lightning strikes occur frequently at MTC from June through October. Fort Jackson Range Control is responsible for notifying all users of ranges and training areas of impending severe weather including electrical storm information in accordance with the Fort Jackson Severe Weather Emergency Action Plan. Once alerted, units are required to stop training and seek appropriate shelter for their personnel until the storm has passed. Lightning is and will continue to be a training distracter.

F.1.2 Regional Projections

It is expected that across the southwest, including South Carolina, warming will continue at an accelerated rate, with the largest temperature increases occurring in the summer months. The number of very hot days of > 100°F is projected to rise at a greater rate than the average temperature. Under the lower GHG emissions scenario, average temperatures are expected to rise by about 4.5°F over the next 70 years, while the higher scenario raises the temperature by about 9°F (SCDNR 2013). Summers by the 2080s are projected to be about 11°F hotter, with increased incidence of drought and more extreme precipitation events. Since the 1990s, changes in precipitation throughout the state have occurred, with increases in heavy downpours in many parts of the Southeast, even though much of the region has experienced moderate to severe droughts during the same period of time (SCDNR 2013). Additionally, impacts from sea level rise are anticipated to be more intense in coastal states such as South Carolina, with impacts reaching inland via streams, and lakes (SCDNR 2013).

F.1.3 DoD Climate Assessment Tool

In 2020 the DOD introduced the Army Directive 2020-08 (U.S. Army Installation Policy to Address Threats Caused by Changing Climate and Extreme Weather), requiring installations to implement the DOD Climate Assessment Tool into their INRMPS.

The DoD Climate Assessment Tool is a web-based collection of scientific climate data used to support research, analysis, and decision making regarding exposure to historical extreme weather and reasonably foreseeable climate effects. At the installation scale, the Climate Assessment Tool can be used to analyze an installation's susceptibility to climate and extreme weather events via hazard exposure assessments, inform planning and land use recommendations, and identify areas for additional climate studies. The Tool can be accessed via CAC-card at https://dodclimate.sec.usace.army.mil/ords/f?p=118:01:::::.

As the Tool does not provide assessments for the National Guard, only the Air Force, Army, and Navy, the closest department- level assessment we can generate is the Army. Geographically, the closest Army installation that can be used as a proxy for a McCrady Training Center Hazard Assessment is Fort Jackson in Eastover, South Carolina. The following documents are an Extreme Weather and Climate Change Hazard Report and Projected Installation-Specific Hazard Details for Fort Jackson, South Carolina.

Extreme Weather and Climate Change Hazard Report

Fort Jackson

Background

RPSUID: 5017

Installation Name: Fort Jackson

Report Date: 15 September 2022

Data Version: 2.0

Location: South Carolina

Area: 52711 acres

Department: Army

Service: Army

Component: Army Active

NCA4 Region: Southeast

Historical Extreme Weather and Climate Change Exposure

Historical Extreme Weather Event Occurrence

For historical extremes, this table shows whether the installation, or the immediately surrounding region (small watershed or county, depending on the measure) has experienced this event. of this location is classified as being in the Wildland Urban Interface as defined by the USDA.

Event Type	Has Occurred
Hurricane Frequency	X
Tornado Frequency	X
Ice Storms Occurrence	X
Hurricane Wind > 50 Knots	X
Hurricane Maximum Precipitation	X
Ice Jam Occurrence	

Damaging Extreme Weather and Wildfire Events, 2000-2021

This shows the damage sustained in the county or counties (for Alaska, NOAA forecast zone) in which Fort Jackson is located. The first table shows the total damage by event type since 2000. The second table shows the largest fifteen events across all types recorded at this location since 2000. The data for these tables come from the NOAA Storm Events Database (https://www.ncdc.noaa.gov/stormevents/).

Many NWS storm event types (https://www.nws.noaa.gov/directives/sym/pd01016005curr.pdf) are broadly similar in impact, but differ along a continuum of magnitudes or geographies (marine vs. land, for instance). In order to provide a readily accessible assessment of damages by type of damage, some NWS storm event type categories are combined for presentation in the Installation Report. More information about that event types represented by the categories below, and event types that were excluded from this analysis, can be found in *Documentation of and Justification for Collapsing NOAA Storm Event Categories* located in the Manuals tab of this tool.

Damages data for ROW locations are not available at this time as the NOAA Storm Events Database does not extend to this domain. The DCAT Team is working to identify comparable data for the ROW domain.

Damages from Extreme Weather and Wildfire, 2000-2021
Administrative Unit(s): Richland, SC

Type	# of Events	Property Damage Estimate	Direct Deaths
Riverine and Lakeshore Flooding	186	$30,678,910.00	9
Wind Damage	511	$3,310,750.00	2
Heavy Rain	40	$1,124,900.00	0
Tornadoes and Waterspouts	18	$440,000.00	0
Hail	134	$17,700.00	0

Top Property Damaging Storm Events, 2000-2021
Administrative Unit(s): Richland, SC

Rank	Date	Type	Property Damage Estimate	Direct Deaths
1	10/04/2015	Flash Flood	$28,125,000.00	7
2	08/01/2016	Flash Flood	$1,074,000.00	0
3	08/01/2016	Heavy Rain	$1,000,000.00	0
4	04/05/2011	Thunderstorm Wind	$920,000.00	0
5	07/17/2013	Thunderstorm Wind	$823,000.00	0
6	09/07/2004	Tornado	$400,000.00	0
7	08/12/2004	Thunderstorm Wind	$306,000.00	0
8	07/22/2009	Flash Flood	$300,000.00	0
9	08/05/2015	Thunderstorm Wind	$210,000.00	0
10	06/04/2015	Flash Flood	$127,000.00	0
11	09/25/2011	Heavy Rain	$120,000.00	0
12	09/25/2011	Flash Flood	$104,000.00	0
13	10/10/2015	Flash Flood	$100,000.00	0
14	10/07/2015	Flash Flood	$100,000.00	2
15	09/26/2015	Flood	$78,000.00	0

Dominant Climate Change Hazards

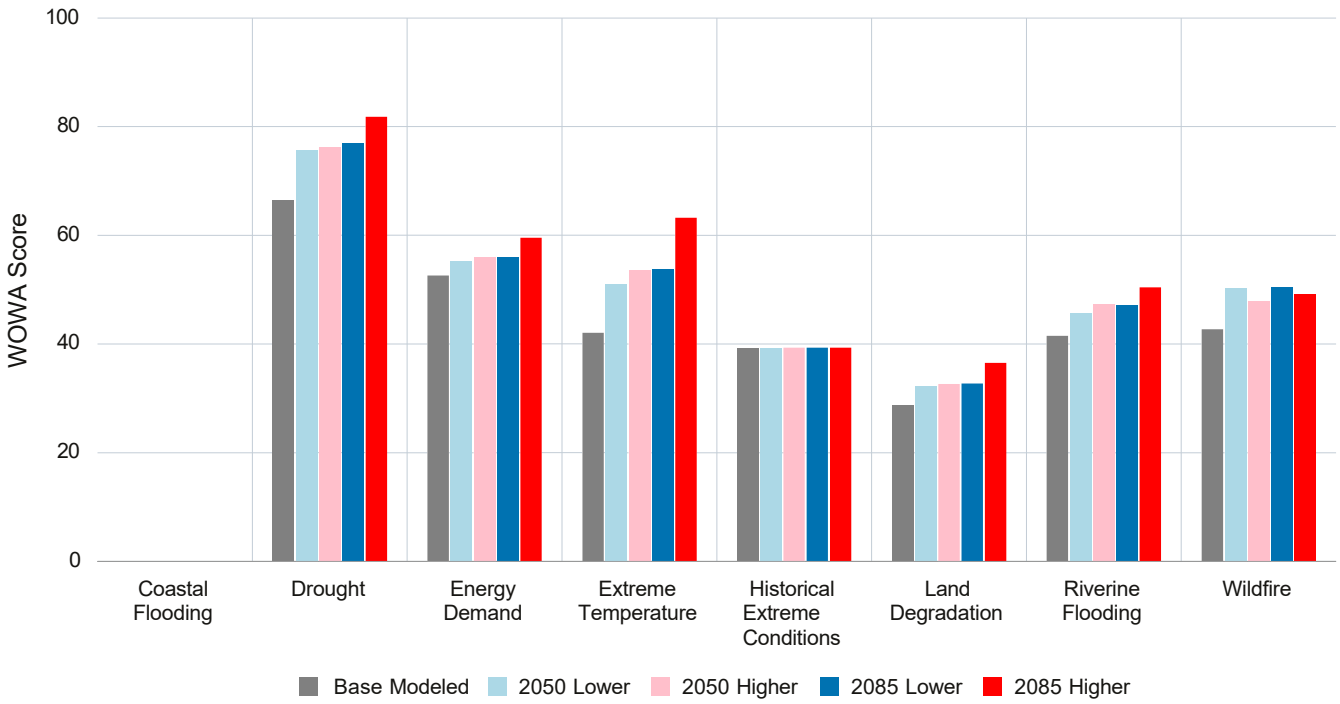
This section explores the dominant climate hazards that Fort Jackson is likely to be exposed to in the future, compared to its exposure based on the modeled historical baseline (1950-2005) data. To bracket the range of potential future conditions, the data are presented to two climate epochs (a 30-year average centered on 2050 (2035-2064) and another centered on 2085 (2070-2099). For each epoch, information for two future scenarios* is provided: a Higher emissions scenario that assumes minimal greenhouse gas mitigation and therefore higher rates of warming and a Lower emissions scenario that assumes more aggressive greenhouse gas mitigation and, therefore, lower rates of warming.

* The Higher scenario corresponds to representative concentration pathway (RCP) 8.5, the Lower to RCP 4.5 used in climate modeling studies.

Ranked Future Climate Exposure Hazards per Epoch-Emission Scenario (and the hazard's greatest contributing indicator)

Rank	2050-High	2085-High
1	Drought (Mean Annual Runoff)	Drought (Mean Annual Runoff)
2	Energy Demand (5-Day Maximum Temperature)	Extreme Temperature (5-Day Maximum Temperature)
3	Extreme Temperature (5-Day Maximum Temperature)	Energy Demand (5-Day Maximum Temperature)
4	Wildfire (Flash Drought Frequency)	Riverine Flooding (Extreme Precipitation Days)
5	Riverine Flooding (Extreme Precipitation Days)	Wildfire (Flash Drought Frequency)
6	Historical Extreme Conditions (Ice Storms Occurrence)	Historical Extreme Conditions (Ice Storms Occurrence)
7	Land Degradation (Aridity)	Land Degradation (Aridity)

The contribution of each hazard to overall exposure through time is also illustrated graphically, below. **Note that historical extreme conditions is a static hazard across the future.**



Heat Exposure Hazard

Changing temperatures are the driving force behind all climate change hazards, either directly through factors such as excess morbidity and mortality, or indirectly through changes to drought, wildfire, flooding, coastal inundation, and other hazards.

Indicator ID	Indicator Name	Base	2050 Lower	2050 Higher	2085 Lower	2085 Higher
402	5-Day Maximum Temperature (°F)	98	103	104	104	108
401	Days Above 95°F (days/year)	16	54	66	65	104
405	High Heat Index Days* (days/year)	71	114	123	122	151

* The Wet Bulb Globe Temperature, cannot be calculated with the data available from climate models, so the National Weather Service Heat Index is provided as an estimate of the combined effects of heat and humidity on people working and exercising outdoors.

Riverine Flood Inundation Hazard

Percent Installation Area Inundated

This table shows the percent of the installation boundary that is inundated at the current 1% annual exceedance probability (AEP) riverine flood event, and when freeboards of 2 ft and 3 ft are added to the 1% AEP flood elevation in accordance with 10 USC 2802 and UFC 3-201-01, Civil Engineering. If the values are 0, no part of the installation is subject to riverine flooding. Riverine floodplain maps are available on Defense Installations Spatial Data Infrastructure (DISDI) Portal.

Indicator ID	Indicator Name	1% AEP	1% AEP+2 F	1% AEP+3f
301	Riverine Flood Exten	23.9%	36.8%	40.2%

Percent of Buildings Inundated Based on DISDI Data

This table shows the percent of the installation buildings likely to be inundated at the current 1% annual exceedance probability (AEP) riverine flood event, and when freeboards of 2 ft and 3 ft are added to the 1% AEP flood elevation in accordance with 10 USC 2802 and UFC 3-201-01, Civil Engineering. If the values are 0, no buildings are flooded by the event.

RPSUID	Total # of Buildings*	Base 1% AEP	1% AEP + 2Ft	1% AEP + 3Ft
5017	1965	6% (122)	18% (357)	20% (397)

* DoD Buildings from DISDI FY19 Buildings Sites Geodatabase

Coastal Flood Inundation Hazard

Percent Installation Area Inundated

This table shows the percent of the installation boundary that is inundated at the current 1% annual exceedance probability (AEP) coastal flood event, in accordance with UFC 3-201-01, Civil Engineering. Sea level elevations are based on the Defense Regional Sea Level (DRSL) Lowest and Highest sea level rise curves and a simple bathtub model of inundation. Storm surge is explicitly excluded, and would be in addition to the elevations modeled here. If the values are 0, no part of the installation is subject to coastal flooding or no data are available for the installation DRSL. Coastal inundation maps are available on Defense Installations Spatial Data Infrastructure (DISDI) Portal.

Indicator ID	Indicator Name	Base	2050 Lower	2050 Higher	2085 Lower	2085 Higher
201	Coastal Flood Extent	0%	0%	0%	0%	0%

Percent of Buildings Inundated Based on DISDI Data

This table shows the percent of the installation buildings likely to be inundated by the 1% annual exceedance probability (AEP) coastal flood event, and by this event in the future given sea level rise. Future sea levels are determined from data in the Defense Regional Sea Level (DRSL) Lowest and Highest sea level rise curves, bracketing the scenarios required by UFC 3-201-01, Civil Engineering. If the values are 0, no buildings are flooded by the event.

RPSUID	Total # of Buildings*	Base 1% AEP	2050 Low	2050 High	2085 Low	2085 High
5017	1965	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)

* DoD Buildings from DISDI FY19 Buildings Sites Geodatabase

Permafrost

Area of Installation With Permafrost Hazard Index > 0

The permafrost Hazard Index (Hjort et al. 2018) is an estimate of where permafrost co-occurs with fine, non-gravelly sediment. Permafrost thaw in these locations is likely to result in subsidence and damage to buildings and infrastructure. This indicator is the percent area of the installation where this index is greater than 0, indicating future subsidence hazard from permafrost thaw. A value of 0 indicates future thaw will not result in infrastructure damage (because the substrate, for example is gravelly) or because no permafrost is currently present (therefore there is also no hazard).

Indicator ID	Indicator Name	Base	2050 Lower	2050 Higher	2085 Lower	2085 Higher
702	Permafrost Hazard Potential	0%	0%	0%	0%	0%

Percent of Buildings With Permafrost Exposure Based on DISDI Data

The table below shows the percent of installation buildings located within areas where permafrost modeled to occur today based on USGS 50% likelihood estimate of permafrost extent (Pastick et al. 2015). If the values are 0, no buildings are anticipated to be affected by permafrost thaw. Permafrost extent maps are available on Defense Installations Spatial Data Infrastructure (DISDI) Portal.

RPSUID	Total # of Buildings*	Permafrost Likely
5017	1965	0% (0)

* DoD Buildings from DISDI FY19 Buildings Sites Geodatabase

Climate Change Exposure Overview

This section provides an overview of the key climate change concerns of the region in which Fort Jackson is located. Additional information about this region is provided in the Hazard Awareness Tab of the DCAT, and from the National Climate Assessment (https://nca2018.globalchange.gov/).

4th National Climate Assessment - Key Messages: Southeast

Southeast Key Message 1: Urban Infrastructure and Health Risks

Many southeastern cities are particularly vulnerable to climate change compared to cities in other regions, with expected impacts to infrastructure and human health. The vibrancy and viability of these metropolitan areas, including the people and critical regional resources located in them, are increasingly at risk due to heat, flooding, and vector-borne disease brought about by a changing climate. Many of these urban areas are rapidly growing and offer opportunities to adopt effective adaptation efforts to prevent future negative impacts of climate change.

Southeast Key Message 2: Increasing Flood Risks in Coastal and Low-Lying Regions

The Southeast's coastal plain and inland low-lying regions support a rapidly growing population, a tourism economy, critical industries, and important cultural resources that are highly vulnerable to climate change impacts. The combined effects of changing extreme rainfall events and sea level rise are already increasing flood frequencies, which impacts property values and infrastructure viability, particularly in coastal cities. Without significant adaptation measures, these regions are projected to experience daily high tide flooding by the end of the century.

Southeast Key Message 3: Natural Ecosystems will be Transformed

The Southeast's diverse natural systems, which provide many benefits to society, will be transformed by climate change. Changing winter temperature extremes, wildfire patterns, sea levels, hurricanes, floods, droughts, and warming ocean temperatures are expected to redistribute species and greatly modify ecosystems. As a result, the ecological resources that people depend on for livelihood, protection, and well-being are increasingly at risk, and future generations can expect to experience and interact with natural systems that are much different than those that we see today.

Southeast Key Message 4: Economic and Health Risks for Rural Communities

Rural communities are integral to the Southeast's cultural heritage and to the strong agricultural and forest products industries across the region. More frequent extreme heat episodes and changing seasonal climates are projected to increase exposure-linked health impacts and economic vulnerabilities in the agricultural, timber, and manufacturing sectors. By the end of the century, over one-half billion labor hours could be lost from extreme heat-related impacts. Such changes would negatively impact the region's labor-intensive agricultural industry and compound existing social stresses in rural areas related to limited local community capabilities and associated with rural demography, occupations, earnings, literacy, and poverty incidence. Reduction of existing stresses can increase resilience.

U.S. Caribbean Key Message 1: Freshwater

Freshwater is critical to life throughout the Caribbean. Increasing global carbon emissions are projected to reduce average rainfall in this region by the end of the century, constraining freshwater availability, while extreme rainfall events, which can increase freshwater flooding impacts, are expected to increase in intensity. Saltwater intrusion associated with sea level rise will reduce the quantity and quality of freshwater in coastal aquifers. Increasing variability in rainfall events and increasing temperatures will likely alter the distribution of ecological life zones and exacerbate existing problems in water management, planning, and infrastructure capacity.

U.S. Caribbean Key Message 2: Marine Resources

Marine ecological systems provide key ecosystem services such as commercial and recreational fisheries and coastal protection. These systems are threatened by changes in ocean surface temperature, ocean acidification, sea level rise, and changes in the frequency and intensity of storm events. Degradation of coral and other marine habitats can result in changes in the distribution of species that use these habitats and the loss of live coral cover, sponges, and other key species. These changes will likely disrupt valuable ecosystem services, producing subsequent effects on Caribbean island economies.

U.S. Caribbean Key Message 3: Coastal Systems

Coasts are a central feature of Caribbean island communities. Coastal zones dominate island economies and are home to critical infrastructure, public and private property, cultural heritage, and natural ecological systems. Sea level rise, combined with stronger wave action and higher storm surges, will worsen coastal flooding and increase coastal erosion, likely leading to diminished beach area, loss of storm surge barriers, decreased tourism, and negative effects on livelihoods and well-being. Adaptive planning and nature-based strategies, combined with active community participation and traditional knowledge, are beginning to be deployed to reduce the risks of a changing climate.

U.S. Caribbean Key Message 4: Rising Temperatures

Natural and social systems adapt to the temperatures under which they evolve and operate. Changes to average and extreme temperatures have direct and indirect effects on organisms and strong interactions with hydrological cycles, resulting in a variety of impacts. Continued increases in average temperatures will likely lead to decreases in agricultural productivity, changes in habitats and wildlife distributions, and risks to human health, especially in vulnerable populations. As maximum and minimum temperatures increase, there are likely to be fewer cool nights and more frequent hot days, which will likely affect the quality of life in the U.S. Caribbean.

U.S. Caribbean Key Message 5: Disaster Risk Response to Extreme Events

Extreme events pose significant risks to life, property, and economy in the Caribbean, and some extreme events, such as flooding and droughts, are projected to increase in frequency and intensity. Increasing hurricane intensity and associated rainfall rates will likely affect

human health and well-being, economic development, conservation, and agricultural productivity. Increased resilience will depend on collaboration and integrated planning, preparation, and responses across the region.

U.S. Caribbean Key Message 6: Increasing Adaptive Capacity through Regional Collaboration

Shared knowledge, collaborative research and monitoring, and sustainable institutional adaptive capacity can help support and speed up disaster recovery, reduce loss of life, enhance food security, and improve economic opportunity in the U.S. Caribbean. Increased regional cooperation and stronger partnerships in the Caribbean can expand the region's collective ability to achieve effective actions that build climate change resilience, reduce vulnerability to extreme events, and assist in recovery efforts.

Fort Jackson - Fort Jackson

(* = selected locations)

Hazard			Wildfire	Drought	Coastal Flooding	Riverine Flooding	Extreme Temperature	Energy Demand	Historical Extreme Conditions	Land Degradation
Modeled Historical Period (1950-2005)		314	13.6%	21.2%	0.0%	13.2%	13.4%	16.8%	12.5%	9.2%
Lower	2050	350	14.4%	21.7%	0.0%	13.1%	14.6%	15.8%	11.3%	9.2%
Lower	2085	356	14.1%	21.6%	0.0%	13.2%	15.1%	15.7%	11.0%	9.2%
Higher	2050	353	13.6%	21.6%	0.0%	13.4%	15.2%	15.9%	11.1%	9.2%
Higher	2085	380	12.9%	21.5%	0.0%	13.3%	16.6%	15.7%	10.4%	9.6%

Hazards

- Wildfire
- Drought
- Coastal Flooding
- Riverine Flooding
- Extreme Temperature
- Energy Demand
- Historical Extreme Conditions
- Land Degradation

Wildfire	Drought	Coastal Flooding	Riverine Flooding	Extreme Temperature	Energy Demand	Historical Extreme Conditions	Land Degradation
101	101	201	301	401	402	801	105
601	102	202	302C	402	501	802	202
602	105		303	403	502	803	604
604	106		304	404	503	804	701
	108C		305	405		805	702
						806	
						807	
						808	

ORness: 0.70
Using National Standard? Yes

Dataset: DoD Climate Assessment Tool 2.0
Climate Data Source: CMIP5 GCM - LOCA dataset (CONUS); BCSD dataset (AK, HI); Globus dataset (ROW)

CUI
Controlled Unclassified Information

F.2 GEOLOGY

Fort Jackson is on the northwestern edge of the Atlantic Coastal Plain Province, a region of low to moderate relief and gently rolling plains, known as the Sandhills. The Fall Line, a zone that mark the boundary between younger softer sediments of the province and ancient crystalline rocks the Piedmont Plateau Province, is about 4 miles west of the cantonment area (Gene Stout and Associates 2004).

The principal geologic formation in the Sandhills is the Tuscaloosa, which consists of marine deposits of light-colored sands and kaolin clays. Most soils at Fort Jackson are formed from Tuscaloosa sediment. A Quaternary sand terrace layer overlies the Tuscaloosa formation, which lies on a complex of old metamorphic and igneous rock. The Tuscaloosa complex general consists of clay strata overlying unconsolidated sands. The Upper Cretaceous-age Tuscaloos formation outcrops over most of Fort Jackson and consists of unconsolidated, cross bedded, kaolinitic, and arkosic sands. It lies uncomformably on the peneplained surface of crystalline rocks. Near the northern boundary of the installation, older crystalline rocks of the Carolina SlaGroup outcrop at the surface. In the northwest portions of Fort Jackson, Pleistocene sands and gravel are at the ground surface (Gene Stout and Associates 2004).

The MTC is in the upper cretaceous geologic map unit of South Carolina (SCDNR 2018). The upper cretaceous is mostly coarse to fine-grained sands, with lenses of clay of variable thickness, representing fluvial or upper delta-plain environments (SCDNR 2018). The sandhills are often characterized by soils

that are highly permeable, and in upland, interfluvial; vegetation is often well adapted to dry, even arid, conditions. Soils are classed as Entisols, which are generally low in nutrients and organics due to rapid leaching. They include the excessively drained Lakeland soils, the Vaucluse-Ailey-Pelion series, the Fuquay-Troup-Vaucluse series, and the Pelion Johnston-Vaucluse series (Lawrence 1978). Because of the areas shallow aquifers and high sand component, soil productivity tends to be low.

F.3 TOPOGRAPHY

Gently to moderately rolling, moderately dissected high plains occupy most of Fort Jackson. These high plains are interrupted by the nearly flat alluvial plains of Gills, Cedar, and Colonels creeks and their tributaries and an irregularly distributed, gently sloping, low relief area in the central portion of the installation near the headwaters of Cedar Creek. Local relief in the high plains is largely 165-250 feet. Slopes are predominately 3-8%; however, along narrow stream valleys, slopes commonly exceed 15%.

The landscape on MTC within Fort Jackson is made up of rolling coarse-grained, pine-dominated sand hills and lowlands, including three old Sandhill ponds, a large shrub-marsh complex (formerly a pond), and extensive black gum and mixed hardwood swamps along streams. The main ridges are mostly gentle slopes with elevations ranging from 350 to 500 feet above mean sea level. Intersecting side slopes and smaller ridges give rise to elevations of 300 to 400 feet. The majority of slopes are gentle and the few moderately steep slopes that do occur on the installation are short in length. Intermittent sandstone outcroppings can be found along various ridge tops. Elevations along streams range from 200 to 300 feet. The highest point is approximately 500 feet and is found near the center of the installation.

Colonel's Creek is the primary drainages on the installation (see Water Resources below). Colonel's Creek flows southeast across the installation. Colonel's Creek has a relatively deep valley.

F.4 SOILS

A description of the soils at MTC can be found in the Soil Survey of Richland County South Carolina (via the NRCS Soil Mapper and associated GIS data). Within the nine soils series (**Table F-2**), there are ten different soils located on MTC (**Appendix B**, **Figure 2**). Nine of these soils are sand or sand/loam combinations. The Colonel's Creek basin is dominated by well drained and semi well drained loamy sands.

The major soil association at the MTC is the Vaucluse loamy sand is well drained and has high erodibility potential, especially on a steep slope with rainfall. The MTC's relatively small vehicle maneuver area severely limits its ability to rotate heavy maneuver areas for natural reclamation, contributing to soil erosion.

A number of physical and chemical factors contribute to the susceptibility of a soil to damage. These include texture, organic matter content, permeability, clay mineralogy, structure, and depth. There are several indices that incorporate the physical and chemical factors into numeric scales or broad categories that are more easily related to the potential effects of tracked vehicle training: K-factor, T-factor, hydrologic soil groups, and land use capability class. A listing of these indices and links to their descriptions can be found at
https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/office/ssr10/tr/?cid=nrcs144p2_074835
and an overview of soils and characteristics in South Carolina can be found at

https://www.nrcs.usda.gov/wps/portal/nrcs/main/sc/soils/. An in-depth review of these factors as they relate to each soil type can be found in the Soil Survey of Richland County, South Carolina (https://efotg.sc.egov.usda.gov/references/public/SC/Richland_Soils_eFOTG.pdf).

Interpretation of the data found in the soil survey reveals that soil erosion is a major management concern on steep slopes and heavily disturbed areas. Due to slopes and other soil conditions, 15 percent of the surveyed acres contain highly erodible soils if vegetation cover is removed. In total, approximately 1 to 2 percent of all soils on the training center would require special treatment and consideration when planning for land rehabilitation. Furthermore, the capability class/subclass from the soil survey reveal that 8 percent of all soils on the center require special conservation practices due to wetness.

Table F-2. Soils Information for McCrady Training Center, SC

Soil Series	% Slope	Drainage	Erodibility (T-Factor)	Acres
Ailey loamy sand	2 to 10	Well-drained	Potentially high (4)	624
Blanton sand	0 to 6	Moderate	Not highly erodible (5)	300
Fuquay sand	2 to 6	Well-drained	Not highly erodible (5)	228
Johnston loam	N/A	Very poorly drained	Not highly erodible (5)	31
Lakeland sand	2 to 6	Excessive	Not highly erodible (5)	381
Lakeland sand	6 to 15	Excessive	High (5)	392
Pelion loamy sand	2 to 6	Moderately well-drained	Potentially high (4)	80
Pelion loamy sand	6 to 15	Moderately well-drained	Potentially high (4)	113
Vaucluse loamy sand	6 to 10	Well-drained	High (3)	2972
Vaucluse loamy sand	10 to 15	Well-drained	High (3)	871
Source: (NRCS 2019)				

F.5 WATER RESOURCES

F.5.1 **Watersheds and Streams**

MTC is located in the Catawba River Basin, which encompasses 11 sub-watersheds and 1,487,114 acres that flow from the Piedmont region of the state to the Sandhills and Upper Coastal Plain regions. The Catawba Basin includes the South Carolina portion of the Catawba River Basin (Hydrologic Unit Code (HUC) 03050101, 03050103) and the Wateree River Basin (HUC 03050104), where MTC is located. The Wateree River Basin is subdivided into 4 watersheds that include the Catawba River, Wateree River, and Lake Wateree. MTC is located in the Wateree River subwatershed (SCDHEC 2019).

The waters flowing near MTC include Bee Branch, a stream that drains the areas north of MTC in a southwesterly direction and which drains into Colonel's Creek east of MTC (USEPA 2019a). Colonel's Creek drains the eastern portion of MTC. Leesburg Branch drains the majority of MTC and flows southwest to its confluence with Colonel's Creek – downstream and off installation, Colonel's Creek follows an artificial path terminating at Murray's Pond (USEPA 2019a). Pertinent data relative to surface waters at MTC are given in **Table F-3** and in **Figure 4** in **Appendix B**.

Colonel's Creek (HUC# 030501040403) is the primary drainage on MTC. Colonel's Creek flows southeast across the installation. Colonel's Creek has a relatively deeper valley.

Table F-3. Surface Waters on McCrady Training Center, SC			
Watershed	**Drainage Area (acres)**	**Stream Length (miles)**	**Lake/Pond Surface Area (acres)**
Colonel's Creek	90,079	25	311
Bee Branch	54,303	30	37*
Leesburg Branch	2,979	0	0.1
Varn Lake	?	?	?
Total	*147,361*	*185*	*348*
Source: (USEPA 2019a, 2019b)			

F.5.2 **Water Quality**

MTC has its own drinking water system that is fed through five underground wells. These wells are about 300 feet deep. The drinking water at the MTC is iron rich and is not in short supply.

Water quality management, water quality monitoring, drinking water and wastewater are monitored weekly and monthly as required by existing MTC and SCARNG permits. Currently, drinking water is treated with sodium hydroxide to neutralize the pH. An oil-water separator treats wastewater from the wash rack.

F.5.3 **Wetlands**

Wetlands usually occur in conjunction with the hydric soils along the surface drainage systems. Logging, clearing for firebreaks, vehicular traffic, and sedimentation resulting from erosion has historically impacted on-site wetlands through siltation.

By the definition of "jurisdictional wetland" under Section 404 of the Clean Water Act, an area must display three characteristics: (1) hydrophytic vegetation, (2) hydric soil, and (3) wetland hydrology. Areas that are periodically wet but do not meet all three criteria are not jurisdictional wetlands.

Wetlands were first mapped on MTC in 1998, when the USACE created a wetland map for Fort Jackson (Minikin et al. 1998). Vegetation studies on MTC occurred in 2003, 2016, and 2018, which provided some details on wetland plant communities but did not provide geospatial and wetland delineation details for wetlands or any other waters of the US (SCARNG 2003; Gaddy 2018). An even more detailed wetland vegetation study was completed in 2018, but did not include wetland delineation details. Six notable wetlands were identified as part of this project (Gaddy 2018) (see **Figure 4** in **Appendix B**). The installation has a total of 1,642 acres of potential waters of the US: 1,609 acres of seasonal wetlands, 33 acres of ponds, plus intermittent and perennial streams.

Table F-4. Wetland Types Present on McCrady Training Center	
Wetland Description	**Acres**
Palustrine Forested/Broadleaf Deciduous Needle Leaf Evergreen	368.88
Palustrine Forested	1,162.16
Palustrine Scrub-Shrub	6.30
Palustrine Open Water	39.24
Palustrine Scrub-Shrub/Broadleaf Deciduous	2.18
Palustrine Forested/Broadleaf Deciduous/Scrub-Shrub	9.92
Palustrine Forested/Needle Leaf Evergreen/Scrub-Shrub	7.44
Palustrine Emergent	6.36
Palustrine Scrub-Shrub/Broadleaf Evergreen	33.46
Palustrine Scrub-Shrub Emergent	3.50

Palustrine Open Water/Scrub-Shrub/Broadleaf Deciduous	1.48
Palustrine Scrub-Shrub/Broadleaf Deciduous	0.78
Palustrine Forested/Needle Leaf Evergreen/Scrub-Shrub/Broadleaf Deciduous	0.30
Total	1,642.00
Source: McCrady GIS and NWI	

G. Biological Overview

G.1 Ecoregion

Following the USEPA ecoregion hierarchy, MTC is located in the Southeastern Plains (Level III Ecoregion) in the Upper Coastal Plain known as the Sandhills (Level IV Ecoregion) in central South Carolina. The Sand Hills are unique to the Southeast United States (Griffin et al. 2002). Major rivers include the Lynches, Wateree, Congaree and Savannah Rivers, and flow in streams is consistent due to the large infiltration capacity of the sandy soil and the great ground-water storage capability of the sand aquifer (Griffith et al. 2002). This is area is rolling to hilly region composed primarily of Cretaceous-age marine sands and clays, capped in places with Tertiary sands, deposited over the crystalline and metamorphic rocks of the Piedmont with soils that are droughty, low-nutrient soils formed in thick beds of sand (Griffin et al. 2002). Many areas are in woodland, and some areas are used for pasture. Portions of the region are also known for its peach orchards, golf courses, and horse farms.

G.2 Vegetative Communities

On-site vegetation is primarily composed of long-leaf pine (*Pinus palustris*) and scrub oak (*Quercus laevis*) with other mixed hardwoods and pines. Geographic areas range from almost xeric barrens to permanent streams, saturated wetlands, mesophytic forests, and man-made impoundments. Most plant communities at MTC are forest communities. There have been several studies conducted at MTC over the years to assess vegetative communities, with recent studies in 2003, 2016 and 2018.

Plant community diversity at MTC has a high number of upland mixed hardwood communities, including 30 plant community types and 11 subtypes (SCARNG 2003). The community types are based on the US National Vegetation Classification (NVC) Associations and details about these are available at http://usnvc.org. This high diversity included the presence of several rare plant communities. A relatively rare plant community, the Sandstone Gravel Longleaf Pine Woodland, was found on the high ridges of MTC. This is a dry, open longleaf pine-turkey oak community that is only found in South Carolina. For a summary of vegetative communities, refer to **Table G-1**.

Table G-1. Vegetative Communities of McCrady Training Center, SC.

DOMINANT SPECIES (Plot Number)	NVC ASSOCIATION(S)*	NVC CEGL CODE*	GLOBAL RANK
Wetland Mixed Hardwoods (and Pines and/or Shrubs)			
TULIP POPLAR (001, 013, 060)	Sandhills Black Gum-Pine Streamhead Swamp (Tulip Tree Phase);	4734b	G3
SWAMP TUPELO (003, 005, 006, 032, 054, 056, 065, 089; 031; 100, 103, 104)	Sandhills Black Gum-Pine Streamhead Swamp (Black Gum Phase); Sandhills Swamp Black Gum Hillside Seepage Forest; Sandhills Black Gum-Pine Streamhead Swamp (Pond Pine Phase)	4734a; 4645; 4734d	G4; G3; G4?
CAROLINA MAPLE (007, 081, 095)	Sandhills Swamp Black Gum Hillside Seepage Forest	4645	G3
SWEET GUM (038)	Loblolly Pine-Sweet Gum-Red Maple Saturated Forest	7560	G?

Table G-1. Vegetative Communities of McCrady Training Center, SC.			
DOMINANT SPECIES (Plot Number)	**NVC ASSOCIATION(S)***	**NVC CEGL CODE***	**GLOBAL RANK**
TULIP POPLAR (051); SWAMP TUPELO (078), CAROLINA MAPLE (077)	Sandhills Black Gum-Pine Streamhead Swamp (Tulip Tree Phase); Sandhills Black Gum Hillside Seepage Forest	4734b; 4645	G3?; G3
POND PINE (083)	Pond Pine-Fetterbush-Pepperbush-Gallberry Woodland	4435	G?
LOBLOLLY PINE (042)	Loblolly Pine-Sweet Gum-Black Gum Successional Swamp Forest	4606	G4
Upland Mixed Hardwoods			
POST OAK (002, 029, 036)	Dry Acid Eastern Coastal Plain Oak-Hickory Forest (Post Oak Phase)	7246b	G4?
SAND POST OAK (057; 086)	Sandhill Ravine Oak Forest; Carolina Longleaf Pine-Mixed Shrub Oak Sandhills	7766; 3591	G2?; G3
SOUTHERN RED OAK (004, 066, 093)	Dry Acid Eastern Coastal Plain Oak-Hickory Forest (Southern Red Oak Phase)	7246a;	G4?
BLACKJACK OAK (025)	Dry Acid Eastern Coastal Plain Oak-Hickory Forest	7246c	G4
WHITE OAK (019, 024)	White Oak-Black Oak Inner Coastal Plain Mesic Slope Forest	7278	G3G4
MOCKERNUT HICKORY (012)	Fire Suppressed Longleaf Sandhills	7511	G4
BLACK OAK (017)	Sandhills Sandy Fire-Suppressed Black Oak-Sparkleberry Forest	8553	G3G4
Pine (and Shrubs)			
LONGLEAF PINE (008, 062; 015, 044; 018; 010, 034; 092)	Longleaf Pine-Turkey Oak-Dwarf Huckleberry-Carolina Wiregrass Woodland; Longleaf Pine Plantation; South Carolina Central Longleaf Woodland; Fire Suppressed Longleaf Sandhills; Atlantic Coastal Plain Mesic Longleaf Woodland	3586; 7176; 3593; 7511; 3569	G3?; G5; G2; G4; G2G3
LOBLOLLY PINE (009, 022; 027)	Loblolly Pine-Shortleaf Pine Forest; Loblolly Pine Plantation	8403; 7179	G4; G5
POND PINE (046, 079, 099)	Pond Pine-Fetterbush-Sweet Pepperbush-Gallberry Woodland	4435	G?
LOBLOLLY PINE (084)	Sandhills Black Gum-Pine Streamhead Swamp (Lobolly Pine Phase)	4734c	G4
Pine-Mixed Hardwoods			
LONGLEAF PINE (014, 033, 059, 067; 064; 070; 073, 091, 074)	Fire Suppressed Longleaf Sandhills; South Carolina Central Longleaf Woodland; Longleaf Pine-Turkey Oak-Dwarf Huckleberry-Carolina Wiregrass Woodland; Sandstone Gravel Longleaf Pine Woodland; Atlantic Coastal Plain Mesic Longleaf Woodland	7511; 3593; 3586; 7767; 3569	G4; G2; G3?; G1; G2G3
LOBOLLY PINE (011, 026, 049, 050, 053; 030; 035; 040; 063)	Loblolly Pine-Oak Forest (Southern Red Oak Phase); Loblolly Pine-Oak Forest (Blackjack Oak Phase); Loblolly Pine Oak Forest (Water Oak Phase); Loblolly Pine Plantation; Loblolly Pine-Oak Forest (Hickory Phase)	4766b; 4766d; 4766e; 7179; 4766f	G?; G4

Table G-1. Vegetative Communities of McCrady Training Center, SC.			
DOMINANT SPECIES (Plot Number)	**NVC ASSOCIATION(S)***	**NVC CEGL CODE***	**GLOBAL RANK**
SHORTLEAF PINE (048)	Coastal Plain Shortleaf-Loblolly Pine Mixed Oak Dry-Mesic Forest	4713	G2G3
Mixed Hardwoods-Pine			
PIGNUT HICKORY (094)	Loblolly Pine-Oak Forest (Southern Red Oak Phase)	4766b	G?
SOUTHERN RED OAK (058, 082, 090)	Loblolly Pine-Oak Forest (Southern Red Oak Phase)	4766b	G?
TURKEY OAK (043, 045, 061, 075, 076)	Longleaf Pine-Turkey Oak-Dwarf Huckleberry-Carolina Wiregrass Woodland	3586	G3?
BLACKJACK OAK (020)	Atlantic Longleaf Pine-Blackjack Oak Woodland	3595	G2G3
WATER OAK (021; 052)	Loblolly Pine-Water Oak Shrub Mixed Herbs; Coastal Plain Shortleaf-Loblolly Pine Mixed Oak Dry-Mesic Forest	7533; 4713	G2G3; G2G3
SOURWOOD (047)	Atlantic Coastal Plain Sweet Bay-Black Gum (Sourwood) Seepage Forest	8552	G3
BLUEJACK OAK (096)	Fire Suppressed Longleaf Sandhills	7511?	G4
Shrublands			
LONGLEAF PINE (016; 072)	Fire Suppressed Longleaf Sandhills; Longleaf Pine-Turkey Oak-Dwarf Huckleberry-Carolina Wiregrass Woodland	7511; 3586	G4; G3?
TURKEY OAK (069)	Longleaf Pine Plantation	7176	G5
POND PINE (079, 080)	Evergreen High Pocosin	3846	G3
BLUEJACK OAK (097)	Fire Suppressed Longleaf Sandhills	7511	G4
Marsh			
WOOLGRASS BULRUSH- (101)	Woolgrass Bulrush Seasonally Flooded Herbaceous Vegetation	3866	G4
Floating Aquatic			
WHITE WATERLILY (102)	White Waterlily-Broadleaf Pondlily Herbaceous Vegetation	4326	G3?
WATERSHIELD (108)	Watershield Pond	4527	G4?
WHITE WATERLILY (110)	Coastal Plain Pond	6086	G2
MIXED AQUATIC (109)	White Waterlily-Broadleaf Pondlily Herbaceous Vegetation	4326	G3?

Source: (SCARNG 2003)

*NVC Associations listed here are the Colloquial Names. NVC CEGL Codes refer to the CEGL 00#### number that provides a stable connection to NVC Associations. For example, CEGL 004734 remains the same association regardless of name changes. See http://usnvc.org to find the Association descriptions.
Global Ranks are defined at http://www.natureserve.org/conservation-tools/standards-methods and are similar to state ranks included in Tables E-1 and E-2 but at a global level.

G.2.1 **Woodlands and Forests**

The four major forest community types found at the installation are longleaf pine/turkey oak, scrub oak, upland hardwoods, and bottomland hardwoods. Longleaf pine/scrub oak forests are dominated by longleaf pine (*Pinus palustris*) and occur on the upper slopes and ridges of the installation, although loblolly pine (*Pinus taeda*) also occurs on MTC. Understories are predominantly scrub oak species such as turkey oak (*Quercus laevis*), bluejack oak (*Quercus incana*), blackjack oak (*Quercus marilandica*), and dwarf post oak (*Quercus stellata* var. *margeretta*) with scattered hawthorne (*Crataegus* spp).

Although scrub oak communities usually contain a scattering of longleaf pines, they are dominated by a variety of oak species, including turkey oak, bluejack oak and dwarf post oak. Blackgum (*Nyssa sylvatica*) and persimmon (*Diospyros virginiana*) are sometimes found in association with these scrub oaks. This community type has the lowest plant diversity on MTC.

Upland hardwood communities are generally found on sandy clay loam soils on mid to lower slopes and tend to be well developed. This zone is sometimes called Xeric Sandhill Scrub. A closed canopy with a mixture of deciduous and evergreen trees, shrubs, and pines typifies this upland forest. While these forest communities are dominated by hardwoods, longleaf pine are still present in substantial numbers. A recognizable component of turkey oak, southern red oak (*Quercus falcata*), water oak (*Quercus nigra*), black oak (*Quercus velutina*), post oak (*Quercus stellata*), and blackjack oak are dominant in upland hardwood communities. Dominant hickory species on these sites include pignut hickory (*Carya glabra*) and mockernut hickory (*Carya tomentosa*). Other commonly associated species are black gum, persimmon, flowering dogwood (*Cornus florida*) and black cherry (*Prunus serotina*). The upland hardwood community has the highest plant diversity of any of the major forest types on the installation.

Bottomland hardwood communities are found in wetland and riparian areas that are typified by poorly drained soils. Species encountered in these communities include swamp tupelo (*Nyssa sylvatica* var. *biflora*), red maple (*Acer rubrum*), scattered sweetgum (*Liquidambar styraciflua*), and yellow poplar (*Liriodendron tulipifera*). Other species found in the bottomland hardwood communities include red bay (*Persea borbonia*), American holly (*Ilex opaca*), sweetbay (*Magnolia virginiana*), and swamp azalea (*Rhododendron viscosum*). Bottomland forest ecosystems are very stable requiring one hundred or more years to mature. These areas tend to be well canopied with trees very often swollen or with “knees”. Because of the wet and humid conditions, they rarely burn except during times of drought and low water levels.

G.2.2 **Wetland Communities**

Out of the associations described above, most of them are wetland communities, with 20 different associations identified in and near wetlands on MTC. These are identified in Table G-1 in the categories wetland mixed hardwood, marsh, floating aquatic vegetation and the two pond pine cover types. So they may not represent the majority of acreage on MTC, but they do capture much of the plant biodiversity on MTC. A number of rare plants are associated with these wetland plant communities (see Appendix E).

The wetland communities tend to be in transition zones between bottomland forests and aquatic plant communities. Other than road crossings, bottomland and wetland communities tend have little or no disturbance. Wetland ecosystems include floodplain forest, swamp forest, and marsh.

G.2.3 **Historic Vegetation**

Since European settlement, extensive clearing for agriculture, grazing, logging, and urban development contributed to the alteration and introduction of many types of vegetation. Most notable is the increase in slash pine (*Pinus elliottii*).

G.3 FLORA

The flora found on MTC are typical of the sand hills of South Carolina's Upper Coastal Plain physiographic province. Forty-three tree species and twenty-six shrub and vine species (69 woody plant species) were recorded in the 2003 survey, and these included four rare species (state special concern – refer to **Table E-2 in Appendix E**) identified in and near vegetative community sampling sites. These include sweet pitcher plant (*Sarracenia rubra*; Noah's Marsh), Robbins' spikerush (*Eleocharis robbinsii*; shores of Odum Pond), drowned hornedrush (*Rhynchospora inundata*; Chavis Pond), and Canby's bulrush (*Scirpus etuberculatus*; Davis Pond).

Although surveys specific to invasive plants have not been conducted on MTC to date, some incidental notations of invasive plant species have been made during other surveys. These include *Aneilema keisak* (Asiatic dayflower), *Ligustrum sinense* (Chinese privet), *Lonicera japonica* (Japanese honeysuckle), *Microstegium vimineum* (Vietnam grass), and *Prunella vulgaris* (self-heal) (Gaddy 2018).

G.4 FAUNA

The fauna found on MTC are typical of the sand hills of South Carolina's Upper Coastal Plain physiographic province. The relatively unaltered state of this unique and dynamic Sandhill environment provides a wealth of biological and ecological research opportunities. Baseline and trend studies are available for several fish and wildlife communities. Both the USC and the SCDNR have been involved in several biological studies such as bat population surveys, herpetological surveys, a raptor survey, butterfly surveys, mammal surveys, and fish population surveys.

G.4.1 **Neo-tropical Migratory Birds**

Neo-tropical migratory birds include species with at least some populations breeding in the United States and/or Canada that spend their nonbreeding months south of the US. Examples include songbirds, shorebirds, water birds, and waterfowl. Fort Jackson and MTC have an abundant and varied breeding bird resource, including both permanent residents and neo-tropical migrants (Cely 1994). Efforts to monitor and manage neo-tropical migrant birds have been ongoing for several years. In 1992 and 1993, initial survey data was collected through LCTA. Since that that time our neo-topical migrant monitoring and management program has matured. Since 2002 we have been partnering with SCDNR to run a MAPS banding station at MTC. The MAPS station provides us dual benefits. It provides us a good data set on our neo-tropical population. The station also provides us an excellent outreach opportunity. Working with SCDNR we have hosted groups ranging from students, to zoo keepers, to US Park Service volunteers. The MAPS Station at MTC has also received media coverage over the years ranging from newspaper articles to episodes of ETV programs and field pieces. These outreach opportunities provide an impactful way to share both the mission and importance of the National Guard, and our stewardship and conservation. It is MTC's intention to continue to partner with SCDNR to run the MAPS Station and manage the neo-tropical bird populations at MTC.

G.4.2 **Wildlife Game Species**

All fishing, hunting, and game management is handled by the Environmental Office at Fort Jackson. The management includes licensing and permitting, as well as monitoring of population trends. Season dates and harvest quotas are aligned with those set each year by the State of South Carolina for Richland County. Variations to the state regulations apply to the harvest of white-tailed deer (*Odocoileus*

virginianus) and game fish on Fort Jackson. Fort Jackson regulations are more restrictive than the those for the state. There is no commercial trapping allowed on Fort Jackson.

Currently, Fort Jackson performs surveys to track game species. In cooperation with SCDNR, annual surveys are performed for bobwhite quail, fox squirrels, eastern wild turkey (*Meleagris gallopavo*) and furbearer species as part of state-wide survey efforts. The results of these surveys are not adequate to make site-specific recommendations for harvest quotas. The only census data used in making harvest recommendations is that collected on fish populations in the ponds managed intensively for game fish.

H. SUMMARY OF SUPPORTING REPORTS, DOCUMENTS, AND DATASETS

CPPP. 2019. Average Monthly Precipitation by Climate Division. Carolinas Precipitation Patterns & Probabilities. Available from https://cisa.sc.edu/atlas/regions-precip-average.html [accessed 20 March 2019].

Gaddy, L.L. 2018. Inventory of the Wetlands of McCrady Training Center, Fort Jackson, Richland County, South Carolina. Richland County, SC.

Griffin, G., Omernick, J.M., Comstock, J., Glover, J., and Shelburne, V. 2002. Ecoregions of South Carolina. Corvallis, OR. Available from ftp://newftp.epa.gov/EPADataCommons/ORD/Ecoregions/sc/sc_eco.pdf.

Griffith, G.E., Omernick, J.M., and Comstock, J. 2002. Ecoregions of South Carolina. Corvallis, OR.

National Weather Service. 2019. Monthly Climate Normals for Columbia Owens Downtown AP, SC from 1981-2010. Available from https://w2.weather.gov/climate/xmacis.php?wfo=cae [accessed 13 March 2019].

NRCS. 2019. Web Soil Survey for McCrady Training Center in Richland County, SC. Available from https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx [accessed 13 March 2019].

SCARNG. 2003. Vegetation Cover Types, Plant Community Diversity, and Species Dominance: McCrady National Guard Training Center. Richland County, SC.

SCDHEC. 2019. Wateree River. Available from http://wwwprod.dhec.sc.gov/HomeAndEnvironment/Water/Watersheds/WatershedMap/CatawbaWatershed/WatereeRiver/ [accessed 22 March 2019].

SCDNR. 2013. Climate Change Impacts to Natural Resources in South Carolina. Available from http://www.dnr.sc.gov/pubs/CCINatResReport.pdf [accessed 11 March 2019].

South Carolina State. 2019. South Carolina Climate. Available from http://www.dnr.sc.gov/climate/sco/ClimateData/cli_sc_climate.php [accessed 10 March 2019].

USEPA. 2019a. WATERS GeoViewer report for McCrady Training Center Area, SC. Available from https://epa.maps.arcgis.com/apps/webappviewer/index.html?id=ada349b90c26496ea52aab66a092593b [accessed 21 March 2019].

USEPA. 2019b. Wetlands in McCrady Training Center, SC.

I. REVIEW AND COORDINATION

Document 1. NGB INRMP Comments

Document 2. JAG INRMP Correspondence and Concurrence

Document 3. G3 INRMP Correspondence and Concurrence

Document 4. State Safety Office INRMP Correspondence and Concurrence

Document 5. CFMO INRMP Correspondence and Concurrence

Document 6. Environmental Compliance INRMP Correspondence and Concurrence

Document 7. Fort Jackson INRMP Correspondence and Concurrence

Document 8. USFWS INRMP Correspondence and Concurrence

Document 9 SCDNR INRMP Correspondence and Concurrence

Document 10. Call for Final Signature Transmittal Letter

Comment #	INRMP Section					Comments	Reviewed	Complete?	Completed By	Response
	Chapter	Section	Page	Paragraph	Line					
	Overall					Update dates throughout, begins in 2021		Addressed	In meeting	
	Signature Page					SC TAG is required to sign		Addressed	In meeting	
	Signature Page					Update Signature Line for NGB: Anthony Hammett Colonel, U.S. Army Chief, G9 Army National Guard		Addressed	In meeting	
	Signature Page					Suggest giving each Agency it's own signature page, makes it easier for routing		Addressed	Rebecca	Do TAG and COL Hammet (G9) receive their own pages?
	Executive Summary					2nd paragraph: Add that a Review for Operation and Effect was also completed in 2019		Addressed	In meeting	
	Executive Summary					Delete "the Department of Defense (DoD) and Army National Guard Policy" and replace with "The Sikes Act"-- ARNG INRMPS use to be required by Policy, the Sikes Act has been modified since then to include ARNG		Addressed	In meeting	
		1.3.2				Fort Jackson: Is SCARNG responsible for all natural resources management, or does Fort Jackson maintain control for some aspects? If so, please spell out that relationship/responsibilty		Addressed	In meeting	
		3.13				Climate Change. SC is required to use the new Army climate change tool, it may or may not work at this time, so may need to be incorporated in a future INRMP update: https://corpsmapr.usace.army.mil/cm_apex/f?p=115.		Addressed	In meeting	
	Appendix C					A number of Cultural resources projects listed here. Recommend deleting.		Addressed	Rebecca	
	Appendix C					I think the Project List in Appendix C is a print out from your database, but consider including STEP Project Numbers where appropriate. All STEP projects (for natural), must be in your INRMP, so having them aligned helps with easy approval		Addressed	In meeting	
	Appendix C					Table of Projects. This table would be udpated annually, it's current format works for me, but be sure it's one you can update easily to show new projects, what was funded, what wasn't funded, etc		Addressed: listing what was/wasn't funded is unnecessary	In meeting	
	Appendix C					Table of Projects. This table would be udpated annually, it's current format works for me, but be sure it's one you can update easily to show new projects, what was funded, what wasn't funded, etc		Addressed	In meeting	Unnecessary to list what was/wasn't funded.
	GENERAL					I strongly recommend SCARNG establish BMPs or SOPs for MTC that describes what practices can be done to minimize or avoid impacts on migratory birds, herpetofauna, wetlands,... Such practices or procedures could be as follows: - To the greatest extent possible, conduct land disturbing activities/prescribed fire/pesticide applications/mowing ... outside of the migratory bird nesting season, or later in the nesting season (after 1 July) to allow for fledging of the first nests. - Ensure new powerlines use avian safe designs. Retrofit powerlines that have frequent electrocutions. Consider burying powerlines that bird collisions frequently occur. - Put designs on windows where bird collisions occur or may occur based on windows and landscaping. Avoid landscaping that will attract birds near windows. - Establish a feral cat control and removal program. - Establish a routine to ensure migratory birds do not nest on equipment or structures that will be needed during the breeding season. Ensure nests are removed before they have eggs or chicks. Have procedures available on how to address migratory bird nests with eggs or chicks when a purposeful take is necessary. - Establish buffers around water bodies for herps. Avoid mowing such areas - Set mower heights higher during periods when herps are active. Avoid mowing during times of day they are most active in your area. - Establish corridors for movements of herps. - Do not introduce fish into herp breeding ponds. - Reduce lighting at night to minimize attraction to lights by migrating birds. - Check structures for bats and birds before razing them. Establish procedures on how to deal with such animals in these structures. - Avoid or at least minimize removal of trees during 1 June to 31 July to reduce impacts on roosting bats, especially unknown maternity roosts. - Prohibit use of sticky traps or glue boards in areas where non-target species could be captured. - ...		Addressed	TBD	Need to add/create a project for development. Would be unable to be efficiently completed in this update.
	3	3.5	21			Address efforts to comply with EO 11990 - Protection of Wetlands. Include wetlands that may not be considered waters of the US. EO 11990 Section 1(a) states: "Each agency shall provide leadership and shall take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities..." The EO does not distinguish between jurisdictional and non-jurisdictional waters on federal land.		Addressed	In meeting	
	3	3.9	30			SInce there is a lot of confusion about compliance with MBTA as opposed to DoD/Army policy, I recommend including info on expectations for managing/conserving migratory birds per the DoD/MBTA rule and EO 13186 and associated MOU. Easier for those who use or reference the INRMP to understand then having to read applicable laws/regs/policies.		Addressed	Layne	Need further research on compliance confusion/ EO 13186
	3	3.9	31			Consider connecting your current project list to these goals and objectives. Easy cross reference as to what's being proposed to achieve success.		Addressed	Bryan	Need to add/create a project for development. Would be unable to be efficiently completed in this update.
	3	3.10	32			There are a number of T&Es on MTC, I recommend identifying if there are any non-discretionary requirements for the management and conservation of the species. If so, what they are. Ensure installation personnel know what the ESA compliance requirements are. Maybe a process on how installation addresses ESA consultation for proposed actions or changes to current actions. Also, what are MTC's conservation commitments for species undergoing 12-month status reviews (tri-colored bat, bog spicebush...) or are Candidates (monarch butterfly).		first half addressed	In meeting/TBD	first half addressed need to generate a review process in appropriate appendix

Comment #	Chapter	Section	Page	Paragraph	Line	Comments	Reviewed	Complete?	Completed By	Response
	Appendix C		?			Routine Wetlands Management CHT (Project # 343) - What is routine wetlands management? Is this something you can show supports EO 11990?		Addressed	Chris	Can we tie it to the EO? Need more info.
	Appendix D		?			Table D-1. The yellow pondlily is undergoing 12-month status review to determine if listing is warranted. Was scheduled for FY20. Appendix show as Appendix C, not D.		Addressed	Rebecca	
	Appendix D		?			Table D-4. Southern hognose snake no longer considered for listing. A not warranted finding came out on 10/7/19.		Addressed	Rebecca	
	Appendix D		?			Table D-6. The Eastern beard grass skipper (Atrytone arogos arogos) is undergoing a 12-month status review. Determination scheduled for FY22. Same animal?		Addressed	Rebecca	
	Appendix D		?			Table D-6. The monarch butterfly is now a Candidate species.		Addressed	Rebecca	
	Appendix E		E-2			Table E-1. American alligator is no Endangered, it is Threatened due to similarity of appearance T(S/A) to the Endangered American crocodile.		Addressed	Rebecca	
	Appendix E	E.1.1	E-4			Recommendations are good, but what are you committing to do for the conservation of these species? Same with the plants.		Addressed	In meeting/Rebecca	"We will implement these recomnedations as funding and resources allow."
	Appendix E		E-10			Table E-2. The Georgia aster is not an ASR, unless you know something I don't.		Addressed	Rebecca	

From: Hall, C Bryan <HallCB@tag.scmd.state.sc.us>
Sent: Tuesday, June 28, 2022 7:56 AM
To: Hanks, Dwight M Jr LTC USARMY NG SCARNG (USA) <dwight.m.hanks.mil@army.mil>; Bulwinkle, Marion A. <Marion.A.Bulwinkle3.mil@mail.mil>; Bird, Jon L. <BirdJL@tag.scmd.state.sc.us>; Gibson, Alex A MAJ USARMY NG SCARNG (US) <alex.a.gibson.mil@mail.mil>; Addis, Terry L. <Terry.L.Addis.mil@mail.mil>; Messer, Benson G (MAJ) <Benson.G.Messer.mil@mail.mil>
Cc: Stone, Christopher <StoneC@tag.scmd.state.sc.us>; Hicks, Robert M CIV NG SCARNG (USA) <robert.m.hicks.civ@mail.mil>; Boazman, Rebecca <BoazmanR@tag.scmd.state.sc.us>
Subject: [Non-DoD Source] INRMP Concurrence

Good morning,

I am Bryan Hall, the Conserva on Manager for the SC Army Na onal Guard. I need your assistance reviewing the required update to the SC Army Na onal Guard Integrated Natural resources Managment Plan (INRMP) for McCrady and Clarkshill. I have a ached the draft documents along with a concurrence/ review errata sheet. If you could please use the errata sheet for your reviews, comments and/ or concurrence it will help us address your comments.

A few things to note prior to beginning your review, This is an update of an exis ng plan. We are required to review and update our plan every 5 years. Opera onally there are no substan ve changes. Only updates to project list and revisons from our previous Review for Opera on and Effect (ROE).

Please send your reviews to Ms Rebbeca Bozeman at BoazmanR@tag.scmd.state.sc.us. If you have any ques on and or concerns please email me or call me at (803) 299-2349. I would ask that you please complete your reviews by COB Aug 1st. If you need addi onal me for your review please let us know so that we can plan accordingly.

Thank you for your assistance, and please let me know if you have any ques ons.

Bryan Hall
Conserva on Manager
SCARNG
(803) 299-2349
(803) 479-7778
hallcb@tag.scmd.state.sc.us

From: Wright, Kelvin D MAJ USARMY NG SCARNG (USA) <kelvin.d.wright2.mil@army.mil>
Sent: Tuesday, June 28, 2022 3:19 PM
To: Gibson, Alex A MAJ USARMY NG SCARNG (USA) <alex.a.gibson.mil@army.mil>
Cc: Hall, C Bryan <HallCB@tag.scmd.state.sc.us>; Stone, Christopher <StoneC@tag.scmd.state.sc.us>; Barton, Christopher E CIV NG SCANG (USA) <christopher.e.barton.civ@army.mil>
Subject: RE: INRMP Concurrence

CAUTION: This email originated from outside your organization. Exercise caution when opening attachments or clicking links, especially from unknown senders.
MAJ Gibson,

I have no legal objec ons or concerns related to the Resource Management Plans for McCrady and Clarks Hill for the Environmental Management Division.

v/r

Wright

From: Gibson, Alex A MAJ USARMY NG SCARNG (USA) <alex.a.gibson.mil@army.mil>
Sent: Tuesday, June 28, 2022 9:04 AM
To: Wright, Kelvin D MAJ USARMY NG SCARNG (USA) <kelvin.d.wright2.mil@army.mil>
Cc: Bryan Hall <hallcb@tag.scmd.state.sc.us>; Christopher Stone <stonec@tag.scmd.state.sc.us>
Subject: Fw: INRMP Concurrence

Good Morning MAJ Wright,

Please review the a ached Resource Management Plans for McCrady and Clarks Hill for the Environmental Management Division for any legal ma ers that may come at us. An item that you find can be stated within the Review and Concern spreadsheets and returned to Mr. Hall and Mr. Stone for edi ng.

Thank you for your commitment and assistance.

MAJ Alex A. Gibson
Environmental Program Manager
FMO/ENV
SCARNG, MSC

INRMP Concurrence

Hall, C Bryan <HallCB@tag.scmd.state.sc.us>

Tue 6/28/2022 7:56 AM

To: LTC Dwight M. (Marty) Hanks <dwight.m.hanks.mil@army.mil>;Bulwinkle, Marion A. <Marion.A.Bulwinkle3.mil@mail.mil>;Bird, Jon L. <BirdJL@tag.scmd.state.sc.us>;Gibson, Alex A MAJ USARMY NG SCARNG (US) <alex.a.gibson.mil@mail.mil>;Addis, Terry L. <Terry.L.Addis.mil@mail.mil>;Messer, Benson G (MAJ) <Benson.G.Messer.mil@mail.mil>

Cc: Stone, Christopher <StoneC@tag.scmd.state.sc.us>;Hicks, Robert M CIV NG SCARNG (USA) <robert.m.hicks.civ@mail.mil>;Boazman, Rebecca <BoazmanR@tag.scmd.state.sc.us>

4 attachments (8 MB)

CHT INRMP review and Concurrence Errata Sheet.xlsx; MTC INRMP review and Concurrence Errata Sheet.xlsx; INRMP McCrady full final 2020.pdf; INRMP Clarks Hill_full Final.pdf;

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Bryan Hall
Conservation Manager
SCARNG
(803) 299-2349
(803) 479-7778
hallcb@tag.scmd.state.sc.us

Clarks Hill and McCrady INRMP Review
Addis, Terry L SSG USARMY NG SCARNG (USA) <terry.l.addis.mil@army.mil>
Thu 7/7/2022 10:08 AM
To:

- Boazman, Rebecca <BoazmanR@tag.scmd.state.sc.us>

Cc:

- Mcelveen, John W COL USARMY NG SCARNG (USA) <john.w.mcelveen.mil@army.mil>

CAUTION: This email originated from outside your organization. Exercise caution when opening attachments or clicking links, especially from unknown senders.

Ms. Bozeman,
I have reviewed both documents and concur with their contents. No suggestions or corrections are necessary from the State Safety Office.

Terry Addis
SSG, SCARNG
State Safety Office/ Motorcycle Safety
Office-(803)299-6641
Cell-864-364-2199

Office Email: ng.sc.scarng.list.ngscarng-safety-office@army.mil

“Safety is not expensive, it is priceless."

"To work safely simply requires a conscious decision to protect yourself by employing sound safety strategies."

INRMP Concurrence

Hall, C Bryan <HallCB@tag.scmd.state.sc.us>

Tue 6/28/2022 7:56 AM

To: LTC Dwight M. (Marty) Hanks <dwight.m.hanks.mil@army.mil>;Bulwinkle, Marion A. <Marion.A.Bulwinkle3.mil@mail.mil>;Bird, Jon L. <BirdJL@tag.scmd.state.sc.us>;Gibson, Alex A MAJ USARMY NG SCARNG (US) <alex.a.gibson.mil@mail.mil>;Addis, Terry L. <Terry.L.Addis.mil@mail.mil>;Messer, Benson G (MAJ) <Benson.G.Messer.mil@mail.mil>

Cc: Stone, Christopher <StoneC@tag.scmd.state.sc.us>;Hicks, Robert M CIV NG SCARNG (USA) <robert.m.hicks.civ@mail.mil>;Boazman, Rebecca <BoazmanR@tag.scmd.state.sc.us>

4 attachments (8 MB)

CHT INRMP review and Concurrence Errata Sheet.xlsx; MTC INRMP review and Concurrence Errata Sheet.xlsx; INRMP McCrady full final 2020.pdf; INRMP Clarks Hill_full Final.pdf;

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Bryan Hall
Conservation Manager
SCARNG
(803) 299-2349
(803) 479-7778
hallcb@tag.scmd.state.sc.us

Reviewing Office	Document Title	Version
Bulwinkle	Final Draft INRMP McCrady	Jun-22

Concurrence	Select One	
Concur	x	*(Concurred with the current draft of the document)*
Concurred with Comments		*(Concurrence with the documents after the edits below are incorporated)*
Non-Concur		*(Non-concur with the document. If you have significant issues with the document please contact us so that we may work to resolve those issues)*

Comment #	The comment refers to the following location in the						Comment	Reviewer	Office of Reviewer	Action Taken to Address the Comment
	Chapter	Section	Page	Paragraph	Line	Sentence				

INRMP Concurrence

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Cc: Stone, Christopher <StoneC@tag.scmd.state.sc.us>;Hicks, Robert M CIV NG SCARNG (USA) <robert.m.hicks.civ@mail.mil>;Boazman, Rebecca <BoazmanR@tag.scmd.state.sc.us>

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(803) 299-2349
(803) 479-7778
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	Final Draft INRMP McCrady	Jun-22

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1	CFMO Signature Page						LTC Dwight M. Hanks is the CFMO, not COL Andrew Batten	Mark Hicks	CFMO	Concurred with suggestion with correction made.
2	1	1.3.1	2	2	20	1	Recommend sentence is rewritten. "The Adjutant General is responsible for the establishment of facilities engineering and environmental services for the state and its supported installations, including implementation and enforcement of this INRMP."	Mark Hicks	CFMO	Concurred with suggestion with correction made.
3	1	1.3.1	3	5	2	1	Recommend sentence is rewritten. "The Construction & Facilities Management Office is responsible for the management and maintenance of all real property assets at MTC"	Mark Hicks	CFMO	Concurred with suggestion with correction made.

INRMP Concurrence

Hall, C Bryan <HallCB@tag.scmd.state.sc.us>

Tue 6/28/2022 7:56 AM

To: LTC Dwight M. (Marty) Hanks <dwight.m.hanks.mil@army.mil>;Bulwinkle, Marion A. <Marion.A.Bulwinkle3.mil@mail.mil>;Bird, Jon L. <BirdJL@tag.scmd.state.sc.us>;Gibson, Alex A MAJ USARMY NG SCARNG (US) <alex.a.gibson.mil@mail.mil>;Addis, Terry L. <Terry.L.Addis.mil@mail.mil>;Messer, Benson G (MAJ) <Benson.G.Messer.mil@mail.mil>

Cc: Stone, Christopher <StoneC@tag.scmd.state.sc.us>;Hicks, Robert M CIV NG SCARNG (USA) <robert.m.hicks.civ@mail.mil>;Boazman, Rebecca <BoazmanR@tag.scmd.state.sc.us>

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Bryan Hall
Conservation Manager
SCARNG
(803) 299-2349
(803) 479-7778
hallcb@tag.scmd.state.sc.us

MTC INRMP

Bird, Jon L. <BirdJL@tag.scmd.state.sc.us>

Fri 7/29/2022 9:19 AM

To: Boazman, Rebecca <BoazmanR@tag.scmd.state.sc.us>

1 attachments (31 KB)

MTC INRMP review and Concurrence Errata Sheet Environmental.xlsx;

Hi Rebecca,

I reviewed the MTC INRMP and I have no comment on it. I'll try to review the CH INRMP today.

Thanks,

Jon

Reviewing Office	Document Title	Version
	Final Draft INRMP McCrady	Jun-22

Concurrence	*Select One*	
Concur	x	*(Concurred with the current draft of the document)*
Concurred with Comments		*(Concurrence with the documents after the edits below are incorporated)*
Non-Concur		*(Non-concur with the document. If you have significant issues with the document please contact us so that we may work to resolve those issues)*

Comment #	*The comment refers to the*						Comment	Reviewer	Office of Reviewer	Action Taken to Address the Comment
	Chapter	Section	Page	Paragraph	Line	Sentence				
							No Comments- Jon Bird Environmental Compliance			

Good morning Mr. Morrow,

Please see the attached Cover Letter regarding our FY 2020 CHTS INRMP.

The Cover Letter contains further instructions on how to access the CHTS INRMP documents to be reviewed. If you have any comments, questions, or issues, please do not hesitate to contact me via email: boazmanr@tag.scmd.state.sc.us or by phone: (803) 299-1343.

Thank you in advance for your time on this review.

Rebecca Boazman

Natural Resource Field Technician IV

McCrady Training Center

SC Army National Guard

boazmanr@tag.scmd.state.sc.us < Caution-mailto:boazmanr@tag.scmd.state.sc.us >

Ofc: (803) 299-1343

CLASSIFICATION: UNCLASSIFIED

4 March, 2020

To: **Fort Jackson, DPW-ENV**
Mr. Doug Marrow
Building 2563 Essayons Way
Fort Jackson, SC 29207

Re: Update of Integrated Natural Resource Management Plan (INRMP), South Carolina Army National Guard (SCARNG), INRMP for McCrady Training Site, Richland County, South Carolina

The SCARNG is working on completing an update for the INRMP for McCrady Training Center (MTC) in Richland County, South Carolina. There is currently an INRMP for the site as required by the Sikes Act. The INRMP was originally approved by the U.S. Fish and Wildlife Service (USFWS) and the South Carolina Department of Natural Resources (SCDNR) in 2001 and the Review for Operation and Effect (ROE) was completed for MTC in 2019. The INRMP update and review will ensure that all cooperating partners have an opportunity to review updates for the INRMP, provide input on the update, and affirm whether they consider the INRMP is effective for the site. Given the length of time since the original signature, the SCARNG updated INRMP is intended to reflect new data, new policies, and new requirements since 2001.

For this update, we are seeking input from your agency regarding areas of the INRMP that could use improvement, as well as areas that are working well. We are seeking from your agency any new or additional information, new natural resources topics or issues of concern, updates on policies or regulations, updates on rare flora and fauna listings and nearby observations, identification of issues of regional concern, or other new information that your agency thinks should be considered during this review and subsequent updating of the INRMP.

SCARNG will be updating INRMPs for both sites, McCrady Training Center and Clarks Hill Training Sites. The updates will update content (now almost 20 years old) as well as the goals and objectives section which was completed in the 2019 Review for Operation and Effect.

We will be glad to host a meeting if it would be beneficial during the review period. Please review this and reply with any comments or concerns you may have regarding this document by **15 May 2020**. Please send correspondence or questions to me by PHONE or EMAIL.

Sincerely,

Chris Stone
Deputy Conservation Manager
SCARNG Environmental Office
5401 Leesburg Road, Building #3924
Eastover, SC 29044
803-299-2236
stonec@tag.scmd.state.sc.us

RE: [Non-DoD Source] SCARNG INRMP 2020 Update Draft Scoping and Review (UNCLASSIFIED)

Morrow, Douglas M CIV USARMY ID-TRAINING (USA) <douglas.m.morrow.civ@mail.mil>

Wed 9/9/2020 7:45 AM

To: Boazman, Rebecca <BoazmanR@tag.scmd.state.sc.us>

CAUTION: This email originated from outside your organization. Exercise caution when opening attachments or clicking links, especially from unknown senders.

CLASSIFICATION: UNCLASSIFIED

Rebecca, we have comments on the INRMP, but I need a little more time to complete our review. I'll have you our comments by COB Friday.

Doug

Douglas M. Morrow
Branch Chief
DPW, ENV, Wildlife Branch
Fort Jackson, S.C.
(803) 751-4793
DSN: (31) 734-4793

We are Army's Home

IMCOM Civilian Career Planning and Development Sharepoint:
https://army.deps.mil/Army/cmds/imcom_HQ4/G1/CIVPER/C2P2/SitePages/Home.aspx

McCrady Training Center Draft INRMP 2020 Comments

Document Name	Page Number	Line Number	Figure Number	POC for Comment	Comment
Draft MTC INRMP	5	32		Morrow	change to: Endangered Species Management Component for the Red-cockaded woodpecker.
Draft MTC INRMP	5	33		Morrow	change to: endangered species management component for Smooth Coneflower and Rough-leaved Loosestrife.
Draft MTC INRMP	15	12		Morrow	rough-leaved loosestrife is not within the MTC license area.
Draft MTC INRMP	18	15-18		Morrow	I recommend referring to species lists instead of listing just a few of the herps and mammals found in the Sandhills.
Draft MTC INRMP	32	9		Morrow	rough-leaved loosestrife is not within the MTC license area.
Draft MTC INRMP	32	15		Morrow	I would not list precribed fire unless y'all plan to begin doing so. At this point of time, I'm not aware of MTC conducting prescribed burns.
Draft MTC INRMP	34	18		Morrow	I recommend inserting something about MTC's "role" in supporting Fort Jackson's Hunting and Fishing programs, such as making training lands available when not being utillized for military training, etc.
INRMP Appendix B Maps			1	Morrow	Confirm licensed area boundaries between Main Tank Range and Argentan Range. Doesn't look correct to me. All of 14-B is not yet part of the license agreement.
INRMP Appendix B Maps			5	Morrow	New coneflower population along Lundy's Ln. not depicted as a caution area. Coneflower site in 29-B is not identified either.
Draft MTC INRMP	17	31		Maitland	the word "long-leaf" is not hyphenated. It should read "longleaf"
Draft MTC INRMP	29	3-4		Maitland	In addition, it should also refer to Fort Jackson's INRMP, which has a section on Forest Management.
Draft MTC INRMP	29	22		Maitland	"wild land fire" should read "wildland fire"
Draft MTC INRMP	19	18-21		Maitland	Suggested change to the following sentences -Generally, Fort Jackson takes the lead on wildland fire management, game and fish management, hunting and fishing programs, endangered species management, and forest management. SCARNG and SCMD either take the lead or share implementation with Fort Jackson on all other natural resources management on MTC.
Draft MTC INRMP	Exec.Sum	5		Wilcox	In both the American Ornithological Society list (http://checklist.americanornithology.org/taxa/13001), the Cornell Clements list (updated 2019) and the Cornell 'Birds of the World' species account, the scientific name for RCW is *Dryobates borealis*.
Draft MTC INRMP	Exec.Sum	15		Wilcox	This sentence is awkward: "No substantive changes were made to the management programs and philosophies or the goals, objectives, and implementation projects." Maybe change the last 'and' to 'or'?
Draft MTC INRMP	18	21		Wilcox	*Dryobates* replaces *Picoides*
Draft MTC INRMP	32	9		Wilcox	*Dryobates* replaces *Picoides*
Draft MTC INRMP	7	15		Wilcox	Remove the word 'the'
Draft MTC INRMP	8	8		Wilcox	What is O/O? Or is it just part of the quote?
Draft MTC INRMP	8	10		Wilcox	Missing period at end of sentence.
Draft MTC INRMP	13	27		Wilcox	I have always seen it written as fire-dependent instead of fire-depended
Draft MTC INRMP	14	4		Wilcox	Change CCA to CAA
Draft MTC INRMP	15	13		Wilcox	Change 61 active clusters to '62 clusters'. Not all of these 62 are active. But you are right, 36 of them are on MTC.
Draft MTC INRMP	15	14		Wilcox	change 'on the Fort Jackson' to 'on Fort Jackson'
Draft MTC INRMP	15	14		Wilcox	Change this sentence to read 'A cluster is defined as the total area encompassing RCW cavity trees plus a 200-foot restrictive buffer zone.' I make this change because a 'cluster' could include a recruitment cluster, in which no RCW have yet occupied.
Draft MTC INRMP	15	16		Wilcox	Remove 'restrictive' from this sentence. The entire 1/2 mile radius foraging partition is not restricted. It should read, 'There is also a 0.5-mile radius foraging area around each cluster.'
Draft MTC INRMP	15	21		Wilcox	Add 'Another known occurrence of the smooth coneflower is along Lundy's Lane'.
Draft MTC INRMP	15	25		Wilcox	change to: Endangered Species Management Component for the Red-cockaded woodpecker.
Draft MTC INRMP	18	17		Wilcox	change 'sparrow hawk' to 'american kestrel'. Sparrow hawk is not an accepted common name for a bird in Eastern North America.
Draft MTC INRMP	30	18		Wilcox	Can you define ISR the first time it is mentioned? Although this one is in Acronym appendix, so perhaps not?
Draft MTC INRMP	31	1		Wilcox	Change 'Migratory' to 'Monitoring'
Draft MTC INRMP	31	23		Wilcox	Can you define NOV the first time it is mentioned? Not in Acronym appendix.
Draft MTC INRMP	31	27		Wilcox	Can you define PLS the first time it is mentioined. Not in Acronym appendix.
Draft MTC INRMP	31	31		Wilcox	Change 76>41 to 41-76 or similar, typically smaller number comes first
Draft MTC INRMP	31	37		Wilcox	Different font used, what if 15-19 acres are modified?
Draft MTC INRMP	32	10		Wilcox	Add *'Haliaeetus leucocephalus* ' after bald eagle, just to be consistent with the rest of the sentence, unless you are only giving latin name for endangered species.
Draft MTC INRMP	33	9		Wilcox	change 'ecosystems' to 'ecosystem-level'
INRMP Appendix B Maps	1			Wilcox	First page of Appendix B where it lists Table of Contents. Map 6 misspelled the word 'Status'
INRMP Appendix B Maps	Map #3 Water and Wetlands		3	Wilcox	I know you are probably trying to reuse previous maps instead of re-make them, but the purples, browns and greens are so similar that I can't actually tell where each drainage is located. In future could you distiguish the colors more?
INRMP Appendix B Maps	Map #4 Vegetation communities		4	Wilcox	Same issue about color differentiation trouble
INRMP Appendix B Maps	Map #4 Vegetation communities		4	Wilcox	In 'Threatened and Endangered Plant Species McCrady FY16 Final Report' Gaddy pointed out a very unique community called 'Sandstone Barrens' on the southern edge of MTC in TA 27F. This should be distinguished separately on this map. Or, perhaps add a map similar to Map 2A from above report pointing out noteworthy plant communities? Or, I perhaps this is not the place for this? Additionally, shouldn't this report be cited in section H?
INRMP Appendix C	est and Vegeta	2nd objective		Wilcox	change 'high diversity plant' to 'high diversity of plants'
INRMP Appendix C	data maintena	Project #10		Wilcox	repeated twice
INRMP Appendix C	Plant list			Wilcox	I think it is more common to see 'rough-leaf loosestrife' rather than 'rough-leaf yellow-loosestrife' but not a big deal.
INRMP Appendix C	Bird list			Wilcox	Change *Picoides borealis* to *Dryobates borealis.* I saw a juvenile Bald Eagle perched on a snag at Davis pond this year. But neglected to photograph or post on ebird, didn't realize you didn't have official record yet.
INRMP Appendix C	Mammal list			Wilcox	No Gray Fox? Rebecca Boazman has one documented on I-naturalist. I have a Southern Flying Squirrel documented with photo on McCrady posted on I-naturalist. Not sure if these count?
INRMP Appendix E	otential Plant species			Wilcox	change 'baldina' to 'balduina'
INRMP Appendix F	F.1.1.	1rst paragraph		Wilcox	change 'summer months July' to 'summer month of July'

SCARNG INRMP 2020 Update Draft Scoping and Review

Boazman, Rebecca <Rebecca.Boazman@scmd.sc.gov>

Tue 8/4/2020 3:09 PM

To: Caldwell, Mark <mark_caldwell@fws.gov>

Cc: Stone, Christopher <StoneC@tag.scmd.state.sc.us>;Anderson, Layne L. <AndersonLL@tag.scmd.state.sc.us>

Good morning Mr. Caldwell,

Please see the attached Cover Letter regarding our FY 2020 CHTS INRMP.

The Cover Letter contains further instructions on how to access the CHTS INRMP documents to be reviewed. If you have any comments, questions, or issues, please do not hesitate to contact me via email: boazmanr@tag.scmd.state.sc.us or by phone: (803) 299-1343.

Thank you in advance for your time on this review.

Rebecca Boazman
Natural Resource Field Technician IV
McCrady Training Center
SC Army National Guard
boazmanr@tag.scmd.state.sc.us
Ofc: (803) 299-1343

4 March, 2020

To: US Fish and Wildlife Service
Ecological Services Field Office
Mr. Mark Caldwell 1
76 Croghan Spur Road, Suite 200
Charleston, SC 29407-7558

Re: Update of Integrated Natural Resource Management Plan (INRMP), South Carolina Army National Guard (SCARNG), INRMP for McCrady Training Site, Richland County, South Carolina

The SCARNG is working on completing an update for the INRMP for McCrady Training Center (MTC) in Richland County, South Carolina. There is currently an INRMP for the site as required by the Sikes Act. The INRMP was originally approved by the U.S. Fish and Wildlife Service (USFWS) and the South Carolina Department of Natural Resources (SCDNR) in 2001 and the Review for Operation and Effect (ROE) was completed for MTC in 2019. The INRMP update and review will ensure that all cooperating partners have an opportunity to review updates for the INRMP, provide input on the update, and affirm whether they consider the INRMP is effective for the site. Given the length of time since the original signature, the SCARNG updated INRMP is intended to reflect new data, new policies, and new requirements since 2001.

For this update, we are seeking input from your agency regarding areas of the INRMP that could use improvement, as well as areas that are working well. We are seeking from your agency any new or additional information, new natural resources topics or issues of concern, updates on policies or regulations, updates on rare flora and fauna listings and nearby observations, identification of issues of regional concern, or other new information that your agency thinks should be considered during this review and subsequent updating of the INRMP.

SCARNG will be updating INRMPs for both sites, McCrady Training Center and Clarks Hill Training Sites. The updates will update content (now almost 20 years old) as well as the goals and objectives section which was completed in the 2019 Review for Operation and Effect.

We will be glad to host a meeting if it would be beneficial during the review period. Please review this and reply with any comments or concerns you may have regarding this document by **15 May 2020**. Please send correspondence or questions to me by PHONE or EMAIL.

Sincerely,

Chris Stone
Deputy Conservation Manager
SCARNG Environmental Office
5401 Leesburg Road, Building #3924
Eastover, SC 29044
803-299-2236
stonec@tag.scmd.state.sc.us

From: McCoy, Thomas <thomas_mccoy@fws.gov> on behalf of Charleston Regulatory, FW4 <charleston_regulatory@fws.gov>
Sent: Monday, August 17, 2020 10:14 AM
To: Boazman, Rebecca <BoazmanR@tag.scmd.state.sc.us>
Cc: Caldwell, Mark <mark_caldwell@fws.gov>
Subject: SCARNG INRMP 2020 Update Draft Scoping and Review

CAUTION: This email originated from outside your organization. Exercise caution when opening attachments or clicking links, especially from unknown senders.

Hello.
Attached is the Service's response letter for the draft scoping and review of the INRMP. If you have any questions, please let us know.
Tom

United States Department of the Interior
FISH AND WILDLIFE SERVICE
176 Croghan Spur Road, Suite 200
Charleston, South Carolina 29407

August 17, 2020

Rebecca Boazman
Natural Resource Technician IV
SCARNG Environmental Office
5401 Leesburg Road, Building #3924
Eastover, SC 29044

Re: Review of Draft INRMP, South Carolina Army National Guard, McCrady and Clarks Hill Training Sites, FWS Log No. 2019-CPA-0028

Dear Ms. Boazman:

The U.S. Fish and Wildlife Service (Service) has reviewed the South Carolina Army National Guard's (SCARNG) draft Integrated Natural Resources Management Plans (INRMP) for two training facilities in South Carolina, the McCrady Training Center in Richland County and Clarks Hill Training Center in McCormick County. The SCARNG is seeking comments to fulfill the requirements of the Sikes Act (16 U.S.C. §670a *et seq*.) regarding natural resources issues that must be addressed in the INRMPs such as, updates on policies or regulations or rare flora and fauna listings.

The Service is providing our comments separated by installation.

<u>McCrady Training Center (MTC) draft INRMP</u>

- Section 3.10, page 32, line 29 - the Green criteria has a description that does not make sense for the Success Criteria of Objective 1. It appears this is duplicate language from the Program Management Criteria of Section 3.1 (page 20, line 2). Please clarify or revise.
- This section provides for monitoring of existing populations of T&E Species. However, it is not clear whether there will be efforts to survey MTC for to locate additional individuals or populations of protected species. We recommend that new surveys be conducted periodically to locate unknown populations..
- Section 3.10 also specifies Special Status Species. Do Special Status Species include the Service's list of At-Risk species (ARS)? ARS are those species of concern that are currently under review by the Service to determine if listing under the ESA is warranted. We recommend that surveys for possible ARS at the MTC be conducted along with T&E species.
- Appendix E, Table E-1 lists the Carolina heelsplitter. While the heelsplitter is indeed a critically endangered species, it is considered extirpated from Richland County. The heelsplitter can be removed from this list.

Clark's Hill Training Center (CHTC) draft INRMP

- Recommend changing the SCDNR signatory from Alvin Taylor to Robert H. Boyles. Robert Boyles is the new director of SCDNR.
- Section 3.10, page 27, line 23 - the Green criteria has a description that does not make sense for the Success Criteria of Objective 1 (Similar to MTC INRMP). It appears this is duplicate language from the Program Management Criteria of Section 3.1 (page 14, line 1). Please clarify or revise.
- Section 3.10 also specifies Special Status Species. Do Special Status Species include the Service's list of At-Risk species (ARS)? ARS are those species of concern that are currently under review by the Service to determine if listing under the ESA is warranted. We recommend that surveys for possible ARS at the CHTC be conducted along with T&E species.

Please visit our Web site: https://www.fws.gov/southeast/pdf/fact-sheet/south-carolina-species-list-by-county.pdf for a list of species that have been petitioned for listing under the ESA, as well as Candidate Species or collectively referred to as "At-Risk Species" (ARS) for South Carolina. Although there are no Federal protections afforded to ARS, please consider including them in your project planning. Incorporating proactive measures to avoid or minimize harm to ARS may improve their status and assist with precluding the need to list these species. Additional information on ARS can be found at:

http://www.fws.gov/southeast/candidateconservation

The Service appreciates the opportunity to provide our comments for consideration in development of the two installation's INRMPs. If you have any questions on this matter, please contact Mark Caldwell at (843) 727-4707 ext. 215 or email at mark_caldwell@fws.gov and reference FWS Log No. 2019-CPA-0028.

Sincerely,

Thomas D. McCoy

Thomas D. McCoy
Field Supervisor

TDM/MAC

Re: SCARNG INRMP 2020 Update Draft Scoping and Review

Boazman, Rebecca <Rebecca.Boazman@scmd.sc.gov>

Tue 8/18/2020 8:36 AM

To: Charleston Regulatory, FW4 <charleston_regulatory@fws.gov>

Cc: Caldwell, Mark <mark_caldwell@fws.gov>

Mr. McCoy,
Good morning, we have reviewed your comments and recommendations made for our McCrady Training Center and Clarks Hill Training Site INRMPS. Below is a bulleted list addressing each comment/question you provided.

McCrady Training Center (MTC) draf t INRMP:

- Section 3.10, page 32, line 29: We have revised the Objective 1 Green Criteria to reflect the appropriate description for the Success Criteria.
- In regards to the recommendation for ARS/T&E Surveys, we are currently wrapping up a survey for currently listed ARS/T&E faunal species on McCrady. It should be completed at the end of the Federal FY for 2020.
- Section 3.10 Special Status Species: In the case of the MTC INRMP "Special Status Species" does include At-Risk Species, as listed and described by the USFWS. These species and their listing status can be found in Appendix E, Table E-1.
- We have edited the Appendix E, Table E-1, and have removed the Carolina heelsplitter from the list.

Clark's Hill Training Center (CHTC) draf t INRMP:

- We have corrected the signature block for SCDNR to display Robert H. Boyles as the correct signatory authority.
- Section 3.10, page 27, line 23: We have revised the Objective 1 Green Criteria to reflect the appropriate description for the Success Criteria.
- Just as it is for MTC, when the CTHS INRMP says "Special Status Species" this does include At-Risk Species, as listed and described by the USFWS. These species and their listing status can be found in Appendix E, Table E-1.

Again, we would like to thank you for your swift response and review, we greatly appreciate it.

The links to the documents provided in the Cover letter should still be correct and allow you to further access the documents if need be. If you have any further questions, comments, and/or concerns, please let me know.

Much obliged,
Rebecca Boazman
Natural Resource Field Technician IV
McCrady Training Center
SC Army National Guard
boazmanr@tag.scmd.state.sc.us
Ofc: (803) 299-1343

RE: [EXTERNAL] Re: SCARNG INRMP 2020 Update Draft Scoping and Review

Caldwell, Mark <mark_caldwell@fws.gov>

Tue 8/18/2020 9:06 AM

To: Boazman, Rebecca <BoazmanR@tag.scmd.state.sc.us>

Cc: McCoy, Thomas <thomas_mccoy@fws.gov>

CAUTION: This email originated from outside your organization. Exercise caution when opening attachments or clicking links, especially from unknown senders.

Rebecca,

Thank you for your quick action. At this time we have no additional comments and look forward to assisting the SCANG in the future.

Mark

Mark A. Caldwell
Deputy Field Supervisor
US Fish and Wildlife Service
South Atlantic-Gulf Region
South Carolina Ecological Services
176 Croghan Spur Road, Suite 200
Charleston, SC 29407
843-300-0426 (direct line)
843-870-0041 (cell)
843-300-0189 – facsimile

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SCARNG INRMP 2020 Update Draft Scoping and Review

Boazman, Rebecca <Rebecca.Boazman@scmd.sc.gov>

Tue 8/4/2020 3:09 PM

To: SimmonsW@dnr.sc.gov <SimmonsW@dnr.sc.gov>

Cc: Stone, Christopher <StoneC@tag.scmd.state.sc.us>;Anderson, Layne L. <AndersonLL@tag.scmd.state.sc.us>

Good morning Mr. Simmons,

Please see the attached Cover Letter regarding our FY 2020 CHTS INRMP.

The Cover Letter contains further instructions on how to access the CHTS INRMP documents to be reviewed. If you have any comments, questions, or issues, please do not hesitate to contact me via email: boazmanr@tag.scmd.state.sc.us or by phone: (803) 299-1343.

Thank you in advance for your time on this review.

Rebecca Boazman
Natural Resource Field Technician IV
McCrady Training Center
SC Army National Guard
boazmanr@tag.scmd.state.sc.us
Ofc: (803) 299-1343

4 March, 2020

To: South Carolina Department of Natural Resources
Alvin A. Taylor
Rembert C. Dennis Building
1000 Assembly Street
Columbia, SC 29201

Re: Update of Integrated Natural Resource Management Plan (INRMP), South Carolina Army National Guard (SCARNG), INRMP for McCrady Training Site, Richland County, South Carolina

The SCARNG is working on completing an update for the INRMP for McCrady Training Center (MTC) in Richland County, South Carolina. There is currently an INRMP for the site as required by the Sikes Act. The INRMP was originally approved by the U.S. Fish and Wildlife Service (USFWS) and the South Carolina Department of Natural Resources (SCDNR) in 2001 and the Review for Operation and Effect (ROE) was completed for MTC in 2019. The INRMP update and review will ensure that all cooperating partners have an opportunity to review updates for the INRMP, provide input on the update, and affirm whether they consider the INRMP is effective for the site. Given the length of time since the original signature, the SCARNG updated INRMP is intended to reflect new data, new policies, and new requirements since 2001.

For this update, we are seeking input from your agency regarding areas of the INRMP that could use improvement, as well as areas that are working well. We are seeking from your agency any new or additional information, new natural resources topics or issues of concern, updates on policies or regulations, updates on rare flora and fauna listings and nearby observations, identification of issues of regional concern, or other new information that your agency thinks should be considered during this review and subsequent updating of the INRMP.

SCARNG will be updating INRMPs for both sites, McCrady Training Center and Clarks Hill Training Sites. The updates will update content (now almost 20 years old) as well as the goals and objectives section which was completed in the 2019 Review for Operation and Effect.

We will be glad to host a meeting if it would be beneficial during the review period. Please review this and reply with any comments or concerns you may have regarding this document by **15 May 2020**. Please send correspondence or questions to me by PHONE or EMAIL.

Sincerely,

Chris Stone
Deputy Conservation Manager
SCARNG Environmental Office
5401 Leesburg Road, Building #3924
Eastover, SC 29044
803-299-2236
stonec@tag.scmd.state.sc.us

RE: SCARNG INRMP 2020 Update Draft Scoping and Review

Willie Simmons <SimmonsW@dnr.sc.gov>
Tue 9/8/2020 3:15 PM

To: Boazman, Rebecca <BoazmanR@tag.scmd.state.sc.us>

CAUTION: This email originated from outside your organization. Exercise caution when opening attachments or clicking links, especially from unknown senders.

Rebecca,
I have reviewed the document and I don't have any comments. Please let me know if you need anything else from me on the document.

Sincerely,

Willie

Re: SCARNG INRMP 2020 Update Draft Scoping and Review

Boazman, Rebecca <Rebecca.Boazman@scmd.sc.gov>
Wed 9/9/2020 8:56 AM

To: Willie Simmons <SimmonsW@dnr.sc.gov>

Mr. Simmons,

Thank you for your time on this review, we greatly appreciate it at this time we do not need anything else.

Obliged,
Rebecca Boazman
Natural Resource Field Technician IV
McCrady Training Center
SC Army National Guard
boazmanr@tag.scmd.state.sc.us
Ofc: (803) 299-1343

The State of South Carolina
Military Department

VAN MCCARTY
MAJOR GENERAL
THE ADJUTANT GENERAL

OFFICE OF THE ADJUTANT GENERAL
1 NATIONAL GUARD ROAD
COLUMBIA, S.C. 29201-4766

20 October 2022

Transmittal Letter

SUBJECT: SC Army National Guard Coordination for Signing the Integrated Natural Resource Management Plan, McCrady Training Center (MTC), Eastover, Richland County, South Carolina, and Clarks Hill Training Site (CHTC), Plum Branch, McCormick County, South Carolina

The South Carolina Army National Guard (SCARNG) is completing its update of its Integrated Natural Resource Management Plans (INRMP) for both McCrady Training Center (MTC) and Clarks Hill Training Center (CHTC) as required and described in Section 101(b)(2) of the Sikes Act [16 U.S.C. 670a(b)(2)].

These documents describe and set forth the guidelines by which the natural resources at MTC and CHTC are conserved and protected in coordination with the ongoing training mission.

In 2019, SCARNG completed an INRMP Review for Operation and Effect (ROE). Each INRMP was developed based on that ROE and has been coordinated and reviewed by all signatory agencies and stakeholders. The final drafts of each INRMP are based on those comments and input.

At this time, we are requesting final concurrence and signatures from each agency.

The SC Army National Guard requests your signature on the enclosed FY 2022 INRMP draft, to achieve a mutually agreed-upon plan that provides for the conservation, protection, and management of fish and wildlife resources on the MTC and CHTC.

Attached to this transmittal email, is a copy of 1) McCrady Training Center's 2022 INRMP, 2) Clark's Hill Training Center's 2022 INRMP, and 3) your signatory page for each INRMP. Please review the plans, if your agency concurs please sign each provided signatory page and return it to us. All signatory agencies will be provided with final signed copies of the documents in a digital format.

If you are unable to concur with the document please let us know.

We are grateful for your participation in this process.

If you have any questions about this project, please contact me at (803) 299-2343, or via e-mail at c.hall@scmd.sc.gov

Sincerely,

Digitally signed by Bryan Hall
Date: 2022.10.20 11:49:33 -04'00'

Bryan Hall
Conservation Manager
SC ARNG Environmental Office
5401 Leesburg Road, Building #3924
Eastover, SC 29044

FINDING OF NO SIGNIFICANT IMPACT

For
Implementation of an
Integrated Natural Resources Management Plan at
South Carolina Army National Guard's
Mccrady Training Center

Richland County, South Carolina

The South Carolina Army National Guard (SCARNG) has prepared an Integrated Natural Resources Management Plan (INRMP) and Environmental Assessment (EA) for Mccrady Training Center (MTC), a 15,200-acre military training installation located within the boundaries of Fort Jackson in Richland County, South Carolina. The INRMP is a comprehensive management plan designed to guide natural resources management at the installation for fiscal years 2002-2006 in support of the military training mission and in accordance with applicable environmental laws and regulations. The EA was prepared in accordance with the National Environmental Policy Act, the Council on Environmental Quality (CEQ) Regulations, and Army Regulation 200-2 *Environmental Effects of Army Actions.*

A. DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

Proposed Action.-The SCARNG proposes to manage natural resources at the MTC (formerly known as the Leesburg Training Site) through the development and implementation of an INAMP. The purpose of the INRMP is to preserve, improve, and enhance natural resources system integrity and ensure that natural resources' conservation measures and Army activities on mission lands are integrated and consistent with federal stewardship requirements. The INRMP ensures that the SCARNG can meet its mission needs at MTC now and into the future, and that the natural resources that provide the training environment are ecologically sustainable over the long-term.

The Sikes Act (Title 16, United States Code 670a *et seq.)* as amended, Department of Defense Instruction 4715.3 *Environmental ConseNation Program* (03 May 96), and Army Regulation 200-3 *Natural Resources - Land, Forest and Wildlife Management* (28 Feb 95) require the development and implementation of an INRMP. The Sikes Act provides the primary legal basis for the Secretary of Defense to carry out a program that provides for the conservation and rehabilitation of natural resources on military installations.

Alternatives Consldered.-In addition to the Proposed Action, two alternatives for implementing the INRMP at MTC were identified:

1. No-Action. In accordance with regulations promulgated by the CEQ 43 Code of Federal Regulations (CFR), Part 1500, Section 1502.14(d), a "No-Action" alternative must be evaluated. Th No-Action alternative would not immediately change MTC's management direction or the level of management intensity. Although MTC would continue to operate under existing natural resources management programs, existing programs do not currently meet the requirements of the Sikes Act, AA 200-3, or DoD Instruction 4715.3. The No-Action alternative would not provide an integrated approach to natural resources management in the immediate future, but would, for the most part, continue traditional management of individual

components of natural resources that are designed to protect selected aspects of the ecosystem.

2. *Limited Implementation of the fNRMP:* This alternative would develop an INRMP that meets requirements of the Sikes Act and Army policy, but does not provide an integrated approach to natural resources management. It would be implemented on an extended schedule. The Limited Implementation alternative did not meet the needs of natural resources management at MTC in a timely manner nor did it adopt an integrated approach to management; therefore, the Limited Implementation Alternative was not carried forth for analysis in the Environmental Assessment.

B. ENVIRONMENTAL IMPACT ANALYSIS

The EA indicates that implementation of the INRMP would result in beneficial effects or no significant adverse effects to the following resources: land use, air quality, noise, geology and soils, water resources, biological resources, cultural resources, facilities, socioeconomics, environmental justice, protection of children, and hazardous wastes/materials. Although no significant impacts are expected from implementing the No Action alternative, continuation of existing management procedures has the potential to result in adverse effects over the long-term from not establishing a comprehensive approach for natural resources management and evaluation. The No Action alternative would also res-ult in violating the Sikes Act requirements.

C. MITIGATION

No mitigation measures will be required as a result of implementing the INRMP at the MTC. Implementation of the INRMP is predominantly a management decision that will not of itself cause any negative impacts to MTC's natural resources, and will result in better protective measures for those natural resources. Individual projects undertaken at a later date in compliance with the procedures outlined in the INRMP may result in actions that could require mitigation measures. Appropriate mitigation measures will be identified and implemented at that time, as warranted.

D. REGULATIONS

There are no indications that implementation of the proposal will violate any federal, state, or local environmental laws or regulations. The proposed action would not violate the National Environmental Policy Act (42 USC § 4321 to 4370e), its regulations as promulgated by the Council on Environmental Quality (40 CFR Parts 1500-1508), Army Regulation 200-2, *Environmental Effects of Army Actions* or any other federal, state, or..local environmental laws or regulations. The EA documents the status of project compliance with applicable federal environmental statutes and executive orders.

E. PUBLIC REVIEW

The draft INRMP and EA were made available for public review from September·11-October 2, 2001. No public comments were received.

The final INRMP, EA and FNSI are available for review at Richland County Public Library, 1431 Assembly Street, Columbia, South Carolina, 29201 [Tel. (803) 799-9084) during normal business hours.

Written comments on the final INRMP, EA and this Finding of No Significant Impact by any interested party may be submitted within 15 days of the Notice of Availability's publication. Send comments to: South Carolina Army National Guard, Adjutant General's Office (Attn: Bryan Hall), 1 National Guard Road, Columbia, South Carolina, 29210.

F. FINDING OF NO SIGNIFICANT IMPACT

Careful review of the EA has indicated that implementation of an INRMP at the MTC will not have any adverse significant impact on the quality of the existing natural or human environment. The Proposed Action will allow SCARNG to achieve its primary mission of maintaining military readiness while balancing the sustainability of desired military training area conditions and ecosystem viability at MTC. The requirements of the National Environmental Policy Act and the Council on Environmental Quality regulations have been satisfied, and an Environmental Impact Statement will not be prepared.

Date: 7 JUL 01

AVIO.BARNO
Brigadier General, US ARMY
Commanding

Date: 30 MAY 01

DINH.MUR.7
Colonel, NGB
Chief, Environmental Programs
Division

REC and Check: To be inserted once scoping of draft is complete

J. RELEVANT LAWS, REGULATIONS, AND GUIDANCE

J.1 FEDERAL LAWS

American Indian Religious Freedom Act of 1978 (Public Law 95-341; 42 United States Code [USC] §1196) – requires the US, where appropriate, to protect and preserve religious rights of the American Indian, Eskimo, Aleut, and Native Hawaiians, including but not limited to access to sites, use and possession of sacred objects, and the freedom to worship through ceremonials and traditional rites.

Animal Damage Control Act of 1931 (7 USC §426 *et seq*.) – provides broad authority for investigation, demonstrations and control of mammalian predators, rodents and birds.

Anti-Deficiency Act of 1982 (31 USC §1341 *et seq.*) - provides that no federal official or employee may obligate the government for the expenditure of funds before funds have been authorized and appropriated by Congress for that purpose.

American Antiquities Act of 1906 (Public Law 59-209; 16 USC §431-433) – authorizes the President to designate historic and natural resources of national significance, located on federal lands, as National Monuments for the purpose of protecting items of archeological significance.

Archeological and Historical Preservation Act of 1974 (Public Law 95-96; 16 USC §469 *et seq*.) – provides for the preservation of historical and archeological data, including relics and specimens, threatened by federally funded or assisted construction projects.

Archeological Resources Protection Act of 1979 (16 USC §470 *et seq*.) – prohibits the excavation or removal from federal or Indian lands any archeological resources without a permit.

Bald Eagle Protection Act of 1940 (Public Law 87-884; 16 USC §668a-d) – prohibits the taking or harming (i.e. harassment, sale, or transportation) of bald eagles or golden eagles, including their eggs, nests, or young, without appropriate permit.

Clean Air Act of 1970 (42 USC §7401 *et seq*.) – regulates air emissions from stationary, area, and mobile sources. This law authorizes the US Environmental Protection Agency (USEPA) to establish National Ambient Air Quality Standards (NAAQS) to protect public health and the environment.

Clean Water Act of 1972 (Public Law 92-500; 33 USC §1251 *et seq*.) – aims to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. Under Section 401, states have authority to review federal permits that may result in a discharge to wetlands or water bodies under state jurisdiction. Under section 404, a program is established to regulate the discharge of dredged or fill material into the Nation's waters, including wetlands.

Coastal Zone Management Act of 1972 (Public Law 92-583; 16 USC §1451 *et seq.*) – provides incentives for coastal states to develop coastal zone management programs. Federal actions that impact the coastal zone must be consistent to the maximum extent practicable with the state program.

Conservation and Rehabilitation Program on Military and Public Lands (Public Law 93-452; 16 USC §670 *et seq*.) – provides for fish and wildlife habitat improvements, range rehabilitation, and control of off-road vehicles on federal lands.

Conservation Programs on Military Reservations (Public Law 90-465; 16 USC §670 *et seq.*) – Requires each military department to manage natural resources and to ensure that services are provided which are necessary for management of fish and wildlife resources on each installation; to provide their personnel

with professional training in fish and wildlife management; and to give priority to contracting work with federal and state agencies that have responsibility for conservation or management of fish and wildlife. In addition, it authorizes cooperative agreements (with states, local governments, non-governmental organizations, and individuals) which call for each party to provide matching funds or services to carry out natural resources projects or initiatives.

Defense Appropriations Act of 1991 (Legacy Program) – establishes the "Legacy Resource Management Program" for natural and cultural resources with emphasis is on inventory and stewardship responsibilities.

Emergency Wetlands Resources Act of 1986 (16 USC §3901-3932) – requires reporting of wetland loss by the Secretary to Congress; authorizes the purchase of wetlands; requires the Secretary to establish a National Wetlands Priority Conservation Plan; and requires states to include wetlands in their Comprehensive Outdoor Recreation Plans, among others.

Endangered Species Act of 1973, as amended (16 USC §1531 *et seq.*) – provides for the identification and protection of threatened and endangered plants and animals, including their critical habitats. Requires federal agencies to conserve threatened and endangered species and cooperate with state and local authorities to resolve water resources issues in concert with the conservation of threatened and endangered species. This law establishes a consultation process involving federal agencies to facilitate avoidance of agency action that would adversely affect species or habitat. Further, it prohibits all persons subject to US jurisdiction from taking, including any harm or harassment, endangered species.

Federal Insecticide, Fungicide, and Rodenticide Act of 1947 (Public Law 92-516; 7 USC §136 *et seq*.) – governs the use and application of pesticides in natural resource management programs. This law provides the principal means for preventing environmental pollution from pesticides through product registration and applicator certification.

Federal Land Policy and Management Act of 1976 (43 USC §1701) – establishes public land policy and guidelines for its administration and provides for the management, protection, development, and enhancement of the public lands.

Fish and Wildlife Conservation Act of 1980 (Public Law 96-366; 16 USC §2901 *et seq.*) – encourages management of non-game species and provides for conservation, protection, restoration, and propagation of certain species, including migratory birds threatened with extinction.

Fish and Wildlife Coordination Act of 1934 (16 USC §661 *et seq*.) – provides a mechanism for wildlife conservation to receive equal consideration and coordinate with water-resource development programs.

Military Reservations and Facilities: Hunting, Fishing and Trapping (an update to the Military Construction Authorization Act; 10 USC §2671) – dictates that the Secretary of Defense require that all hunting, fishing, and trapping on military installations be in accordance with the fish and game laws of the State in which it is located, that license be obtained (except with respect to members of the armed forces), and that safety protocols be enacted.

Land and Water Conservation Act of 1965 (16 USC §4601 *et seq*.) – assists in preserving, developing, and assuring accessibility to outdoor recreation resources.

Migratory Bird Conservation Act of 1929 (16 USC §715 *et seq*.) – establishes a Migratory Bird Conservation Commission to approve areas recommended by the Secretary of the Interior for acquisition with Migratory Bird Conservation Funds.

Migratory Bird Treaty Act of 1918 (Public Law 65-186; 16 USC §703 *et seq.*) – provides for regulations to control taking of migratory birds, their nests, eggs, parts, or products without the appropriate permit and provides enforcement authority and penalties for violations.

National Environmental Policy Act of 1969 (Public Law 91-190; 42 USC §4321 *et seq.*) – mandates federal agencies to consider and document environmental impacts of proposed actions and legislation. In addition, it mandates preparation of comprehensive environmental impact statements where proposed action is "major" and significantly affects the quality of the human environment.

National Historic Preservation Act of 1966, as amended (PL 89-665; 16 USC §470 et seq.) – directs federal agencies to take into account the effect of any undertaking (a federally funded or assisted project) on historic properties.

Native American Graves Protection and Repatriation Act of 1990 (Public Law 101-601; 25 USC §3001-3013) – addresses the recovery, treatment, and repatriation of Native American and Native Hawaiian cultural items by federal agencies and museums. It includes provisions for data gathering, reporting, consultation, and issuance of permits.

Non-Indigenous Aquatic Nuisance Prevention and Control Act of 1990 – created the Aquatic Nuisance Species Task Force which is committed to preventing and controlling aquatic nuisance species and implementing the act.

Noxious Plant Control Act (PL 90-583) – provides for the control and management of nonindigenous weeds that injure or have the potential to injure the interests of agriculture and commerce, wildlife resources, or the public health.

Plant Protection Act of 2000[1] (7 USC §7701 et seq.) (replaces Federal Noxious Weed Act of 1973 [PL 93-629] – authorizes the USDA to prohibit or restrict the importation or interstate movement of any plant, plant product, biological control organism, noxious weed, article, or means of conveyance if the Secretary of Agriculture determines it is necessary to prevent introduction or spread of plant pests or noxious weeds.

Plant Quarantine Act (7 USC §151-167) – regulates the importation and interstate movement of nursery stock and other plants that may carry pests and diseases that are harmful to agriculture.

Readiness and Environmental Protection Initiative (within Section 2811, FY 2003 National Defense Authorization Act) (10 USC §2684a) – outlines agreements to limit encroachments and other constraints on military training, testing, and operations.

Resource Conservation and Recovery Act of 1976 (42 USC §6901 *et seq.*) – establishes a comprehensive program which manages solid and hazardous waste. Subtitle C, Hazardous Waste Management, sets up a framework for managing hazardous waste from its initial generation to its final disposal. Waste pesticides and equipment/containers contaminated by pesticides are included under hazardous waste management requirements.

Sikes Act Improvement Act of 1997 (Public Law 105-85; 16 USC §670a *et seq.*) – amends the Sikes Act of 1960 to mandate the development of an integrated natural resources management plan through cooperation with the Department of the Interior (through the US Fish and Wildlife Service [USFWS]),

[1] Replaces Federal Noxious Weed Act of 1974 (Public Law 93-629; 7 USC §2801).

Department of Defense, and each state fish and wildlife agency for each military installation supporting natural resources.

Soil Conservation Act of 1935 (16 USC §590a *et seq*.) – provides for soil conservation practices on federal lands.

Watershed Protection and Flood Prevention Act (PL 84-566; 16 USC §1001-1009) – the Soil Conservation Service at the Department of Agriculture provides planning assistance and construction funding for projects constructed by local sponsors, often in the form of flood control districts.

J.2 FEDERAL REGULATIONS

15 Code of Federal Regulations [CFR] 930 – Federal Consistency with Approved Coastal Management Programs

32 CFR 190 – Natural Resources Management Program

40 CFR 6 – USEPA Regulations on Implementation of NEPA Procedures

40 CFR 162 – USEPA Regulations on Insecticide, Fungicide, and Rodenticide Use

40 CFR 1500-1508 – Council on Environmental Quality (CEQ) Regulations on Implementing National Environmental Policy Act (NEPA) Procedures

50 CFR 17 – USFWS list of Endangered and Threatened Wildlife

50 CFR 10.13 – List of Migratory Birds

32 CFR 651 – Environmental Effects of Army Actions

J.3 FEDERAL EXECUTIVE ORDERS (EOS)

Environmental Safeguard for Activities for Animal Damage Control on Federal Lands (EO 11870) - restricts the use of chemical toxicants for mammal and bird control.

Exotic Organisms (EO 11987) – restricts federal agencies in the use of exotic plant species in any landscape and erosion control measures.

Floodplain Management (EO 11988) – specifies that agencies shall encourage and provide appropriate guidance to applicant to evaluate the effects of their proposals in floodplains prior to submitting applications. This includes wetlands that are within the 100-year floodplain and especially discourages filling.

Off-Road Vehicles on Public Lands (EO 11989[2]) – establishes criteria for designating public lands as open, limited or closed to the use of off-road vehicles (ORVs) and establishes rules for use and operation of ORVs in order to protect the resources of the public lands, to promote safety, and to minimize conflicts among various users.

Protection of Wetlands: Amends Executive Order 11990 (EO 12608) – directs all federal agencies to take action to minimize the destruction loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands. This applies to the acquisition, management, and disposal of federal lands and facilities; to construction or improvements undertaken, financed, or assisted by the

[2] Amends Executive Order 11644.

federal government; and to the conduct of federal activities and programs which affect land use.

Protection and Enhancement of Environmental Quality: Amends Executive Order 11514 (EO 11991) – provides for environmental protection of federal lands and enforces requirements of NEPA.

Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (EO 12898) – requires environmental protection for all communities by focusing federal attention on the environmental and human health effects of federal actions on minority and low-income populations.

Energy Efficiencies and Water Conservation at Federal Facilities (EO 12902) – federal agency use of energy and water resources is directed towards the goals of increased conservation and efficiency.

Indian Sacred Sites (EO 13007) – provides for the protection of and access to Indian sacred sites.

Protection of Children from Environmental Health Risks and Safety Risks (EO 13045) – requires that the USEPA evaluate the effects of a planned regulation on children and explain why the regulation is preferable to potentially effective and reasonably feasible alternatives.

Invasive Species (EO 13112) – directs federal agencies to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause.

Greening the Government through Leadership in Environmental Management (EO 13148) – requires the head of each federal agency to be responsible for ensuring that all necessary actions are taken to integrate environmental accountability into agency day-to-day decision making and long-term planning processes across all agency missions, activities, and functions.

Consultation and Coordination with Indian Tribal Governments (EO 13175) – ensures that all federal departments and agencies consult with Indian tribes and respect tribal sovereignty as they develop policy on issues that impact Indian communities.

Responsibilities of Federal Entities to Protect Migratory Birds (EO 13186) – directs all federal agencies taking actions that have a potential to negatively affect migratory bird populations to develop and implement a Memorandum of Understanding with the USFWS by January 2003 that shall promote the conservation of migratory bird populations.

Strengthening Federal Environmental, Energy, and Transportation Management (EO 13423) – requires federal agencies to lead by example in advancing the nation's energy security and environmental performance by establishing new and updated goals, practices, and reporting requirements for environmental, energy, and transportation performance and accountability.

Facilitation of Hunting Heritage and Wildlife Conservation (EO 13443) – directs the Department of the Interior and its component agencies, bureaus and offices facilitate the expansion and enhancement of hunting opportunities and the management of game species and their habitat.

Executive Order 13148: Greening the Government Through Leadership in Environmental Management (2000). – requires federal laboratories, testing facilities, maintenance facilities, hospitals, and others with operations that interact with the environment across all federal departments and agencies to implement an Environmental Management System (EMS) by December 31, 2005.

Presidential Memorandum, Government-to-Government Relations with Native American Tribal Governments (1994)– outlines principles that federal executive departments and agencies must follow in their interactions with Native American tribal governments such that the federal government operates within a government-to-government relationship with federally-recognized Native American Tribes.

J.4 DEPARTMENT OF DEFENSE DIRECTIVE (DODD), DEPARTMENT OF DEFENSE INSTRUCTION (DODI), ARMY REGULATION (AR), & ARMY NATIONAL GUARD REGULATION (ARNG)

DoDD 4150.7, DoD Pest Management Program

DoDD 4700.4, Natural Resources Management Program[3]

DoDD 4710.1, Archaeological and Historic Resources Management

DoDD 4715.1E, Environment, Safety, and Occupational Health

DoDD 6050.1, Environmental Effects in the US of DoD Actions

DoDD 6050.2, Use of Off-Road Vehicles on DlD Lands

DoDI 4150.07, Pest Management Program

DoDI 4165.57, Air Installations Compatible Use Zones

DoDI 4715.03, Natural Resources Conservation Program

DoDI 4715.1, Environmental Security

DoDI 4715.9, Environmental Planning and Analysis

DoDI 6055.06, Fire and Emergency Services Program

Department of Defense, American Indian and Alaska Native Policy

AR 200-1 Environmental Protection and Enhancement dated 13 December 2007

AR 210-9 – Use of Off-Road Vehicles on Army Lands

AR 215-1 – Morale, Welfare, and Recreation Activities and Non-Appropriated Fund Instrumentalities

AR 315-19 – The Army Sustainable Range Program

AR 405-80 – Management of Title and Granting Use of Real Estate

AR 420-40 – Historic Preservation

AR 420-90 – Fire and Emergency Services

ARNG Guidance for the Creation, Implementation, Review, and Revision and Update of INRMPs dated 9 April 2012

J.5 DEPARTMENT OF DEFENSE MEMORANDA

Memorandum, Assistant Deputy Under Secretary of Defense (Environment, Safety and Occupational Health), 20 Sept 11, Subject: *Interim Policy on Management of White Nose Syndrome in Bats*.

[3] Cancels DoD Directive 4700.1. Replaced by 32 CFR 190 – Natural Resources Management Program.

Memorandum, Assistant Deputy Under Secretary of Defense (Environment, Safety and Occupational Health), 3 Apr 07, Subject: *Guidance to Implement the Memorandum of Understanding to Promote the Conservation of Migratory Birds*.

Memorandum, Assistant Deputy Under Secretary of Defense (Environment, Safety and Occupational Health), 14 Aug 06, Subject: *Integrated Natural Resource Management Plan (INRMP) Template*

Memorandum, Assistant Deputy Under Secretary of Defense (Environment, Safety and Occupational Health), 17 May 05, Subject: *Implementation of Sikes Act Improvement Amendments: Supplemental Guidance concerning Leased Lands*

Memorandum, Assistant Deputy Under Secretary of Defense (Environment, Safety and Occupational Health), 1 Nov 04, Subject: *Implementation of Sikes Act Improvement Amendments: Supplemental Guidance concerning INRMP Reviews*

Memorandum, Deputy Under Secretary of Defense (Installations and Environment), 10 Oct 02, Subject: *Implementation of Sikes Act Improvement Act: Updated Guidance*

Memorandum, Assistant Deputy Under Secretary of Defense (Environment), 5 Aug 02, Subject: *Access to Outdoor Recreation Programs on Military Installations for Persons with Disabilities*.

Memorandum, Assistant Secretary of Army (Environment, Safety and Occupational Health), Deputy Assistant Secretary of the Navy (Environment), Deputy Assistant Secretary of the Air Force (Environment, Safety and Occupational Health), 20 Sep 11, *Subject: Interim Policy on Management of White Nose Syndrome in Bats*.

Memorandum, DAIM-ED Guidance for Implementation of the Sikes Act Improvement Act (SAIA) (Updated), 25 May 2006, Subject: *USFWS and State involvement in developing INRMPs; defining "mutual agreement" with the USFWS and the appropriate State agency; and coordinating INRMPs with other planning statutes.*

Memorandum, DAIM-ZA (200-3), 04 September 2002, Subject: *Army Wildland Fire Policy Guidance*.

Memorandum, US Army, 21 March 1997, Subject: *Army Goals and Implementing Guidance for Natural Resources Planning Level Surveys (PLS) and INRMP ("Army INRMP Policy")*.

Memorandum, Army National Guard Directorate, Environmental Programs Division (ARNG-ILE), 9 April 2012, Subject: *Guidance for the Creation, Implementation, Review, and Revision and Update of INRMPs*.

J.6 U.S. FISH AND WILDLIFE SERVICE (USFWS) GUIDANCE

USFWS Guidelines for Coordination on Integrated Natural Resource Management Plans (June 2015). Provides updated guidance to USFWS personnel for implementing the requirements of the Sikes Act. It replaces the following memorandum: *Guidance for Coordination of Department of Defense Sikes Act Integrated Natural Resource Management Plans (June 8, 2001).*

K. NEPA

Document 1. 2001 FONSI

FINDING OF NO SIGNIFICANT IMPACT

For

Implementation of an
Integrated Natural Resources Management Plan at
South Carolina Army National Guard's
Mccrady Training Center

Richland County, South Carolina

The South Carolina Army National Guard (SCARNG) has prepared an Integrated Natural Resources Management Plan (INRMP) and Environmental Assessment (EA) for Mccrady Training Center (MTC), a 15,200-acre military training installation located within the boundaries of Fort Jackson in Richland County, South Carolina. The INRMP is a comprehensive management plan designed to guide natural resources management at the installation for fiscal years 2002-2006 in support of the military training mission and in accordance with applicable environmental laws and regulations. The EA was prepared in accordance with the National Environmental Policy Act, the Council on Environmental Quality (CEQ) Regulations, and Army Regulation 200-2 *Environmental Effects of Army Actions.*

A. DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

Proposed Action.-The SCARNG proposes to manage natural resources at the MTC (formerly known as the Leesburg Training Site) through the development and implementation of an INRMP. The purpose of the INRMP is to preserve, improve, and enhance natural resources system integrity and ensure that natural resources conservation measures and Army activities on mission lands are integrated and consistent with federal stewardship requirements. The INRMP ensures that the SCARNG can meet its mission needs at MTC now and into the future, and that the natural resources that provide the training environment are ecologically sustainable over the long-term.

The Sikes Act (Title 16, United States Code 670a *et seq.)* as amended, Department of Defense Instruction 4715.3 *Environmental Conservation Program* (03 May 96), and Army Regulation 200-3 *Natural Resources - Land, Forest and Wildlife Management* (28 Feb 95) require the development and implementation of.an INRMP. The Sikes Act provides the primary legal basis for the Secretary of Defense to carry out a program that provides for the conservation and rehabilitation of natural resources on military installations.

Alternatives Consldered.-In addition to the Proposed Action, two alternatives for implementing the INRMP at MTC were identified:

1. *No-Action*. In accordance with regulations promulgated by the CEQ 43 Code of Federal Regulations (CFR), Part 1500, Section 1502.14(d), a "No-Action" alternative must be evaluated. Th No-Action alternative would not immediately change MTC's management direction or the level of management intensity. Although MTC would continue to operate under existing natural resources management programs, existing programs do not currently meet the requirements of the Sikes Act, AR 200-3, or DoD Instruction 4715.3. The No-ActioA alternative would not provide an integrated approach to natural resources management in the immediate future, but would, for the most part, continue traditional management of individual

components of natural resources that are designed to protect selected aspects of the ecosystem.

2. *Limited Implementation of the INRMP:* This alternative would develop an INRMP that meets requirements of the Sikes Act and Army policy, but does not provide an integrated approach to natural resources management. It would be implemented on an extended schedule. The Limited Implementation alternative did not meet the needs of natural resources management at MTC in a timely manner nor did it adopt an integrated approach to management; therefore, the Limited Implementation Alternative was not carried forth for analysis in the Environmental Assessment.

B. ENVIRONMENTAL IMPACT ANALYSIS

The EA indicates that implementation of the INRMP would result in beneficial effects or no significant adverse effects to the following resources: land use, air quality, noise, geology and soils, water resources, biological resources, cultural resources, facilities, socioeconomics, environmental justice, protection of children, and hazardous wastes/materials. Although no significant impacts are expected from implementing the No Action alternative, continuation of existing management procedures has the potential to result in adverse effects over the long-term from not establishing a comprehensive approach for natural resources management and evaluation. The No Action alternative would also result in violating the Sikes Act requirements.

C. MITIGATION

No mitigation measures will be required as a result of implementing the INRMP at the MTC. Implementation of the INRMP is predominantly a management decision that will not of itself cause any negative impacts to MTC's natural resources, and will result in better protective measures for those natural resources. Individual projects undertaken at a later date in compliance with the procedures outlined in the INRMP may result in actions that could require mitigation measures. Appropriate mitigation measures will be identified and implemented at that time, as warranted.

D. REGULATIONS

There are no indications that implementation of the proposal will violate any federal, state, or local environmental laws or regulations. The proposed action would not violate the National Environmental Policy Act (42 USC § 4321 to 4370e), its regulations as promulgated by the Council on Environmental Quality (40 CFR Parts 1500-1508), Army Regulation 200-2, *Environmental Effects of Army Actions* or any other federal, state, or..local environmental laws or regulations. The EA documents the status of project compliance with applicable federal environmental statutes and executive orders.

E. PUBLIC REVIEW

The draft INRMP and EA were made available for public review from September-17-October 2, 2001. No public comments were received.

The final INRMP, EA and FNSI are available for review at the Richland County Public Library, 1431 Assembly Street, Columbia, South Carolina, 29201, (803) 799-9041, during normal business hours.

Written comments on the final INRMP, EA and this Finding of No Significant Impact by any interested party may be submitted within 15 days of the Notice of Availability's publication. Written comments to: South Carolina Army National Guard, Adjutant General's Office (SCAG-EV), 1 National Guard Road, Columbia, South Carolina, 29210.

F. FINDING OF NO SIGNIFICANT IMPACT

Careful review of the EA has indicated that implementation of an INRMP at the MTC will not have any adverse significant impact on the quality of the existing natural or human environment. The Proposed Action will allow SCARNG to achieve its primary mission of maintaining military readiness while balancing the sustainability of desired military training area conditions and ecosystem viability at MTG. The requirements of the National Environmental Policy Act and the Council on Environmental Quality regulations have been satisfied, and an Environmental Impact Statement will not be prepared.

DAVID W. BARNO
Brigadier General, USJS ARMY
Commanding

Date: 7/1/Jlt' 0 (

RICHARD O. MURPHY
Colonel, NGB
Chief, Environmental Programs
Division

Date: 30 (t-;r: 01

US ARMY GARRISON,
FORT JACKSON, SOUTH CAROLINA

INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

2025–2029

INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN
Fort Jackson, South Carolina

ENDORSEMENT

This Integrated Natural Resources Management Plan meets the requirements of the Sikes Act (16 United States [US] Code [USC] 670a et seq.) as amended.

_____ _____

TIMOTHY R. HICKMAN
COL, CA
COMMANDING

Date

_____ _____

Field Supervisor
Charleston Field Office
US Fish and Wildlife Service
Charleston, South Carolina

Date

_____ _____

Director
South Carolina Department of Natural Resources
Columbia, South Carolina

Date

EXECUTIVE SUMMARY

ES.1 Type of Document - This is an Integrated Natural Resources Management Plan (INRMP).

ES.2 Purpose of Document - The purpose of this document is to meet statutory requirements under the Sikes Act Improvement Amendment, Public Law 105-85, Div. B. Title XXIX, 18 Nov 1997, 111 Stat 2017-2019, 2020-2022, and to ensure that natural resource conservation measures and military activities on mission lands are integrated and are consistent with federal stewardship requirements. The US Army Garrison, Fort Jackson (FJ) has prepared this INRMP for all lands controlled by FJ.

ES.3 Goals and Objectives of the INRMP - The goal of the INRMP is to guide the implementation of an ecosystem-based conservation program that provides for conservation of natural resources in a manner consistent with the military mission; integrates and coordinates all natural resources management actions with military mission activities in order to maintain high-quality lands for military training; provides for sustainable multipurpose uses of natural resources; and provides access for use of natural resources subject to safety and military security considerations. FJ has identified four broad goals with multiple objectives. These are:

ES.3.1 Mission Sustainability

1. Ensure no net loss in the capability of installation lands to support existing and projected military training and operations on FJ.

2. Maintain quality training lands through management, monitoring, and rehabilitation.

3. Manage for biodiversity to help ensure lands are maintained to facilitate greater flexibility in land use for military training requirements.

ES.3.2 Stewardship

1. Use ecosystem-based management philosophies to protect, conserve, and enhance native fauna and flora with an emphasis on biodiversity enhancement.

2. Ensure biologically significant or sensitive natural resources are monitored and managed for long-term sustainability.

3. Monitor and manage soils, water, vegetation, and wildlife on FJ with a consideration for all biological communities and human values.

4. Provide economic and other human-valued products of renewable natural resources when such products can be produced in a sustainable fashion without significant negative impacts on the military training mission or other natural resources.

5. Ensure the natural resources conservation program is coordinated with other agencies and conservation organizations with similar interests.

6. Utilize an adaptive management approach to natural resources management that will result in modifications to plans and practices should monitoring indicate that progress is not being made as planned, or when new scientific information is discovered.

ES.3.3 Compliance

1. Manage natural resources within the spirit and letter of environmental laws, particularly the Sikes Act upon which this INRMP is predicated.

2. Protect, restore, and manage sensitive species, species listed under the Endangered Species Act, and wetlands.

3. Use procedures within the National Environmental Policy Act (NEPA) to make informed decisions that include natural resources considerations and mitigation.

4. Ensure FJ 's natural resources program is consistent with the protection of cultural and historic resources.

5. Implement this INRMP within the framework of Army policies and regulations.

ES.3.4 Integration

1. Ensure the integration of, and consistency among, various activities, organizations and agencies identified within this INRMP.

2. Integrate all land management activities to ensure compatibility of military training and natural resources management.

3. Coordinate implementation of natural resources management with the overall FJ environmental program.

4. Provide command elements with information needed to make decisions which include natural resources related values.

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1. OVERVIEW

1.1 PURPOSE - The purpose of this plan is to integrate natural resources management actions on FJ with other land uses or affecting activities, which assures good stewardship of Department of Defense (DoD) lands and complies with applicable Federal laws and regulations while supporting the sustainment of the lands needed for the military's missions. The plan is designed to provide necessary guidance for the orderly, economical maintenance of the lands and natural resources contained within FJ. The plan provides documentation for enhancing and restoring ecosystem integrity and biodiversity, as well as the utilization of water resources, forest, fish and wildlife resources, while supporting multiple use of installation lands.

This update of the FJ INRMP has been prepared in accordance with the Department of the Army's INRMP template (6 November 2017).

1.2 SCOPE - The scope of the INRMP includes all lands controlled by FJ. FJ is operated under the jurisdiction of the US Army Installation Management Command (IMCOM). The US Army Training and Doctrine Command (TRADOC) is the senior tenant and mission commander at the installation. The plan also has a dual purpose of complying with various natural resources related laws while supporting the military mission on FJ.

1.3 GOALS AND OBJECTIVES - FJ's identification and prioritization of current and future projects are guided by several interrelated items including a vision statement, a mission statement, issues, goals, objectives, and desired future ecosystem processes.

FJ's approach to natural resources management is captured in the installation's vision of the relationship between its military mission and the natural resources upon which that mission depends. The installation also has developed a natural resources management mission statement that provides an overarching premise for how FJ will manage its lands.

1.3.1 FJ Natural Resources Management Vision Statement - Support the Soldier and FJ's military mission while promoting the ecological integrity of the FJ landscape.

1.3.2 FJ Natural Resources Management Mission Statement - Through a collaborative effort between military personnel and natural resources professionals, FJ will promote the long-term ecological sustainability of its lands for military training and multiple-use opportunities. FJ will apply sound land management practices and adaptive management strategies that conserve ecological integrity through the restoration, maintenance, and conservation of natural biotic communities. This management approach will encompass stakeholder interests, regulatory requirements, and fiscal constraints.

1.3.3 Goals and Objectives - The management goals define the broad, overall natural resources management direction for FJ. In the context of this plan, goals are defined as the general target or end result desired to be achieved through integrated resource management. Objectives are defined as more specific targets of which attainment will contribute to the accomplishment of management goals. Goals and objectives will be adjusted over time using an adaptive management approach and as FJ's military mission and ecological conditions change.

FJ has identified four broad goals with multiple objectives within each of the program element action plans. The following are the goals of FJ's ecosystem-based management approach.

1. Mission Sustainability

a. Ensure no net loss in the capability of installation lands to support existing and projected military training and operations on FJ.

b. Maintain quality training lands through management, monitoring, and rehabilitation.

c. Manage for biodiversity to ensure lands are maintained to facilitate greater flexibility in land use for military operations.

2. Stewardship

a. Use ecosystem management philosophies to protect, conserve, and enhance native fauna and flora with an emphasis on biodiversity enhancement.

b. Identify and maintain or restore native ecosystem types (i.e., longleaf pine [*Pinus palustris*]) across their range of variation within FJ.

c. Monitor and manage soils, water, vegetation, and wildlife on FJ with a consideration for all biological communities and human values.

d. Provide economic and other human-valued products of renewable natural resources when such products can be produced in a sustainable fashion without significant negative impacts on the military training mission or other natural resources.

e. Ensure the FJ natural resources program is coordinated with other agencies and conservation organizations with similar interests.

f. Utilize an adaptive management approach to modify and improve plans, goals and objectives, and actions should monitoring indicate that progress is not being made as planned.

3. Compliance

a. Manage natural resources within the spirit and letter of environmental laws, particularly the Sikes Act upon which this INRMP is predicated.

b. Protect, restore, and manage endangered and other sensitive species and wetlands.

c. Use procedures within the NEPA to make informed decisions that include natural resources considerations and mitigation.

d. Ensure FJ's natural resources program is consistent with the protection of cultural and historic resources.

e. Implement this INRMP within the framework of Army policies and regulations.

4. Integration

a. Ensure the integration of, and consistency among, various activities identified within this INRMP.

b. Integrate all land management activities to ensure compatibility of critical military training and natural resources management.

c. Provide command elements with information needed to make decisions which include natural resources related values.

1.4 RESPONSIBILITIES

1.4.1 Installation Stakeholders - The US Army Garrison, FJ, is directly responsible for operations and maintenance of FJ, including the implementation and enforcement of the INRMP. This involves the cooperation of many different organizations on FJ, as well as outside agencies.

1.4.1.1 Directorate of Public Works - Much of the responsibility for implementation of the INRMP is within the Directorate of Public Works (DPW), which acts as the primary caretaker for the lands of FJ.

1. Environmental Division (ENV) - The preparation and most of the implementation of the INRMP are the responsibilities of the DPW ENV's Forestry and Wildlife Branches at FJ.

2. Wildlife Branch - Below are responsibilities specific to the Wildlife Branch:

- Plan and carry out fish and wildlife management tasks through biologically sound, science-based management techniques.
- Provide expertise and support to the Garrison Commander to ensure compliance with the Endangered Species Act (ESA) of 1973, as amended, and other applicable laws.
- Set FJ specific hunting seasons, bag limits, and other regulations governing the harvest of wildlife resources in cooperation with the South Carolina (SC) Department of Natural Resources (SCDNR).
- Disseminate information to hunters and fishermen related to areas available for hunting and fishing each day via iSportsman, in coordination with Directorate of Plans, Training, Mobilization and Security (DPTMS).
- Coordinate with state and Federal fish and wildlife management agencies in fulfillment of installation fish and wildlife management responsibilities.
- Coordinate with the Conservation Law Enforcement personnel to ensure Federal, state and installation laws and regulations pertaining to fish and wildlife are enforced. Develop and implement the Endangered Species Management Component (ESMC) by identifying

and prioritizing habitat improvement needs; providing direction on forest and fire management activities conducted in endangered species habitat; and providing personnel and equipment resources to assist the Forestry Branch with implementation of the wildland fire management plan and other forest management actions.

3. Forestry Branch - Below are the responsibilities specific to the Forestry Branch:

- Maintain an inventory of FJ's forest resources.
- Restore and manage for longleaf pine on suitable sites.
- Prepare and manage the sale of FJ's marketable forest resources.
- Implement and manage a wildland fire program to reduce forest fuels and support ecosystem management.
- Implement portions of the ESMC pertaining to forest management.
- Implement and incorporate SC Best Management Practices (BMPs) for Forestry.

1.4.1.2 DPTMS - DPTMS via its Range Operations Section is a vital component in the implementation of portions of this plan. Below are responsibilities of DPTMS, relative to the implementation of the INRMP:

- Coordinate with and inform DPW of military training requirements and objectives as they relate to the implementation of short and long-term range development and utilization plans.
- Coordinate with DPW on upcoming military training activities that may affect natural resources.
- Provide a weekly range and training area utilization schedule to the ENV Wildlife Branch for control of hunting, angling, and other outdoor recreational access via iSportsman. The Wildlife Branch must also be provided with any changes to the schedule throughout the week, including same day changes, so that the iSportsman system can be updated.
- Provide coordination and support for providing access to training lands for the conduct of natural resources management and monitoring.
- Integrated Training Area Management (ITAM) Program implementation.

1.4.1.3 Directorate of Family, Morale, Welfare, and Recreation (DFMWR) - DFMWR is responsible for outdoor recreation activities and facilities on the installation. Programs that particularly affect FJ natural resources include hiking, picnicking, boating, and camping. DFMWR will coordinate its natural resources related activities with the Wildlife Branch to ensure compatibility with this INRMP. Below are specific responsibilities of the DFMWR:

- Plan and conduct organized group hunting and fishing activities, such as fishing tournaments.
- Operate and maintain the FJ archery range and other recreational shooting ranges.
- Participate in national and state-sponsored hunting and fishing events such as youth hunting days and the National Hunting and Fishing Day.

1.4.1.4 Directorate of Emergency Services (DES) - The Provost Marshal Office is responsible for enforcement systems and protection of natural resources and enforcement of hunting and fishing laws and regulations on FJ. They will provide resources for these purposes and cross-train Military Police and/or civilian wardens to accomplish this mission.

The FJ Fire and Emergency Services (FJ FES) is responsible for performing wildfire suppression actions as the primary responders for initial attack. In addition, ENV Forestry and Wildlife Branches provide wildfire suppression support when requested, and are available for 24-7 callback duty outside of normal duty hours.

1.4.2 External Stakeholders - The US Fish and Wildlife Service (USFWS) and SCDNR cooperate in the development of the INRMP and will participate in the annual review. Furthermore, the USFWS and SCDNR participate in the formal 5-year review or revision of this plan.

1.5 AUTHORITY - This plan was prepared to meet statutory requirements under the Sikes Act Improvement Amendment, Public Law 105-85, Div. B. Title XXIX, 18 Nov 1997, 111 Stat 2017-2019, 2020-2022. In November 1997, the Sikes Act, 16 USC § 670a et seq., was amended to require the Secretary of Defense to carry out a program to provide for the conservation and rehabilitation of natural resources on military installations. To facilitate such programs, the Sikes Act requires the secretary of each military department to prepare and implement an INRMP at appropriate military installations throughout the US under their respective jurisdictions, unless the secretary determines the absence of significant natural resources on a particular installation makes the preparation of such a plan inappropriate. In addition, the Sikes Act requires that the INRMP is prepared in cooperation with, and reflects the mutual agreement of, the Secretary of the Interior (acting through the Director of the USFWS) and the head of each appropriate state fish and wildlife agency for the state(s) in which the military installation concerned is located.

Army Regulation (AR) 200-1 (Environmental Quality – Environmental Protection and Enhancement, dated August 2007 [AR 200-1]) is the implementing regulation that ensures the policies, procedures, and standards for the conservation, management, and restoration of natural resources on military installations are consistent with and in support of the military mission and in consonance with national policies. Additionally, the AR provides general requirements for the content of installation INRMPs, as well as criteria for achieving integration with the installation's mission and other activities. Cooperative agreements with Federal and state fish and wildlife agencies set forth in this regulation are superseded, under the amended Sikes Act, by agency's approval of the INRMP.

1.6 STEWARDSHIP AND COMPLIANCE DISCUSSION - The responsibilities of the natural resources management program at FJ as provided by the US Army can be classified as either meeting stewardship needs or compliance requirements. Stewardship projects (e.g., erosion reduction) are based upon the land management responsibility of the US Army and are not required to be implemented to meet regulatory needs. Compliance projects (e.g., endangered and threatened species conservation) are mandatory and are required to be implemented to meet laws and regulations that apply to the operations of FJ.

FJ considers its stewardship responsibilities during the planning and analyses of natural resources and military training actions. For example, potential erosion and mitigation measures to eliminate or reduce erosion would be considered when planning for the construction of a new range or facility. By considering its stewardship responsibilities during the planning and analysis phase, FJ would eliminate or minimize potential soil erosion and sedimentation in streams and other water bodies on the installation.

1.7 REVIEW AND REVISION PROCESS - In accordance with the Sikes Act, DoD Instruction [DoDI] 4715.03, and US Army policy (AR200-1), FJ will review the INRMP annually in cooperation with the USFWS and SCDNR. The annual review of the goals and objectives and project implementation schedules will generate annual assessments of the natural resources conservation metrics. FJ will review the INRMP no less often than every 5 years for operation and effect in coordination with the USFWS and SCDNR. The INRMP will be evaluated annually in the following six performance areas:

1. INRMP Implementation
2. Partnership/Cooperation and Effectiveness
3. Team Adequacy
4. INRMP Impact on the Installation Mission
5. Status of Federally Listed Species
6. Fish and Wildlife Management and Public Use

Annual reviews of the FJ INRMP will include annual revisions so that the review and revision processes are integrated. IMCOM must approve each updated version of the INRMP prior to implementation.

1.8 MANAGEMENT STRATEGY - The purpose of natural resources management at FJ is to support the military mission while maintaining the integrity and biodiversity of the natural resources. Natural resources management at FJ relies on an ecosystem-based management philosophy. This strategy blends multiple use needs and provides a consistent framework to managing military installations, while ensuring the integrity of the ecosystem. The principles, policies, and goals of this type of management system are provided below.

1.8.1 Ecosystem-Based Management Approach

1.8.1.1 Ecosystem Management and Biodiversity Conservation - It is the policy of the Army and the DoD to utilize an ecosystem management approach for land use management and planning on Army installations DoDI 4715.03 (Natural Resources Management). DoDI 4715.03 describes ecosystem-based management as, “a process that considers the environment as a complex system functioning as a whole, not a collection of parts, and recognizes that people and their social and economic needs are a part of the whole.” The DoD ecosystem management goal is “to ensure that military lands support present and future training and testing requirements while preserving, improving, and enhancing ecosystem integrity. Ecosystem-based management includes a shift from single species to multiple species conservation, the formation of partnerships necessary to consider and manage ecosystems that cross boundaries, the use of best available scientific information in decision making, and the use of adaptive management

techniques in natural resources management. Over the long term, the ecosystem management approach shall maintain and improve the sustainability and biological diversity of terrestrial and aquatic ecosystems, while supporting sustainable economies, human use, and the environment required for realistic military training operations."

Biodiversity refers to the variability among living organisms and the ecological complexes of which they are part. Biodiversity includes ecosystem diversity, species diversity, and genetic diversity. Ecosystem diversity refers to the variety of habitats and biotic communities. Species diversity refers to the number, types, and distribution of species within an ecosystem; and genetic diversity refers to the variation in genes that enables organisms to evolve and adapt to new conditions. Biodiversity conservation involves the maintenance or restoration of native ecosystems, maintenance or reestablishment of viable populations of all native species that occur in an installation's natural habitats, and maintenance of evolutionary and ecological processes. The DoD identifies the following five reasons for conserving biodiversity on military lands (The Keystone Center 1996):

- Sustain natural landscapes required for the training and testing that are necessary to maintain military readiness.
- Provide the greatest return on the Defense investment to preserve and protect the environment.
- Expedite the compliance process and help avoid conflicts.
- Engender public support for the military mission.
- Improve the quality of life for military personnel.

The Keystone Center report notes that the challenge is "to manage for biodiversity in a way that supports the military mission". This strategy relies on the INRMP as the primary vehicle for implementing biodiversity conservation on military installations. This strategy for conserving biodiversity includes the following principles:

- Support the military mission.
- Use joint planning between natural resource managers and military operations personnel.
- Integrate biodiversity conservation into INRMP, ITAM, and other planning protocols.
- Involve internal and external stakeholders up front.
- Emphasize the regional (ecosystem) context.
- Use adaptive management.
- Involve scientists and use the best science available.
- Concentrate on results.

FJ will use ecosystem management principles to guide its program over the next five years and beyond. This management strategy enables the installation to conduct military training while simultaneously conserving natural resources. Ultimately, the maintenance of quality training areas depends on the maintenance of natural landscapes through conservation of the installation's natural resources.

1.8.1.2 Natural Community Management - DoDI 4715.03 states that ecosystem management involves "conducting installation programs and activities in a manner that identifies, maintains, and restores the composition, structure, and function of natural communities that comprise ecosystems, to ensure their sustainability and conservation of biodiversity at landscape and other relevant ecological scales to the maximum extent that mission needs allow." Management systems that focus on natural communities are particularly efficient because they focus efforts on entire communities rather than individual species. Natural communities are valuable elements of natural diversity; and the protection, restoration, and maintenance of natural communities provides protection for most species without the requirement for intensive attention to individual species (Schafale and Weakley 1990). Management at the natural community scale not only protects and maintains populations of listed species, but also promotes expansion and recovery by improving habitat conditions throughout the ecosystem.

Conserving Biodiversity on Military Lands – A Handbook for Natural Resource Managers (NatureServe 2021) recommends that management efforts on military installations focus on native communities and species with particular conservation importance, as determined primarily by their level of rarity and imperilment. This INRMP focuses on natural communities that comprise the imperiled longleaf pine ecosystem. The longleaf pine ecosystem supports tremendous biodiversity, and a multitude of species identified as rare at the state and federal levels. Longleaf pine savannas support some of the greatest species' richness in temperate North America (up to 52 species of plants in a single square meter) and contain more rare species than any other community type in the state (Schafale and Weakley 1990). The level of imperilment is high, with longleaf pine forests and savannas being listed as one of the 21 most endangered ecosystems in the US (NatureServe 2021).

1.8.2 Ecosystem Management Goals – FJ has established four broad management goals discussed in detail in Section 1.3.3 of this document. Additional goals related to an ecosystem approach of management include:

- Manage natural resources to maintain or restore essential ecological processes integral to species interactions and ecosystem resiliency.
- Manage large areas over sufficiently long time periods to allow biological evolution and changing system dynamics.
- Represent, maintain, or reestablish viable populations and genetic diversity of target species, especially rare or endemic species.
- Monitor target species, communities and conduct research to guide management and identify progress toward goals as part of the adaptive management process.
- Identify and maintain or restore native ecosystem components (eg. longleaf pine) across their range of variation within FJ.

1.9 OTHER PLAN INTEGRATION - The INRMP is integrated with other FJ plans to include the: Integrated Pest Management Plan (IPMP, Fort Jackson 2019), Integrated Wildland Fire Management Plan (IWFMP, Fort Jackson 2024), Installation Master Plan (Fort Jackson 2022, 2022b), Range Complex Master Plan and the ITAM Work Plan (Fort Jackson 2025).

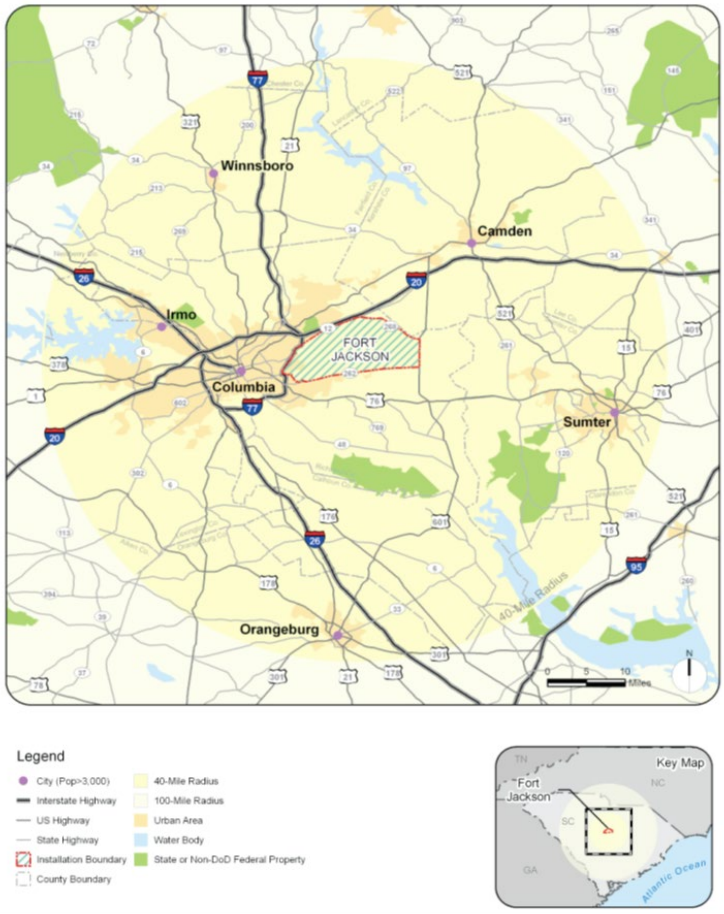
2. CURRENT CONDITIONS AND USE

2.1 INSTALLATION INFORMATION

2.1.1 General Description - FJ, which spans more than 52,000 acres, is located in central SC in Richland County and is adjacent to and part of the city of Columbia, the capital of SC (Figure 2.1).

The installation is approximately five miles east of the Columbia business district. Columbia is the second largest city in the state with a population of more than 136,000 according to the 2020 US census, followed by North Charleston in size and superseded by Charleston as the largest city by population.

Figure 2.1. General location of Fort Jackson in South Carolina.



2.1.2 Regional Land Uses

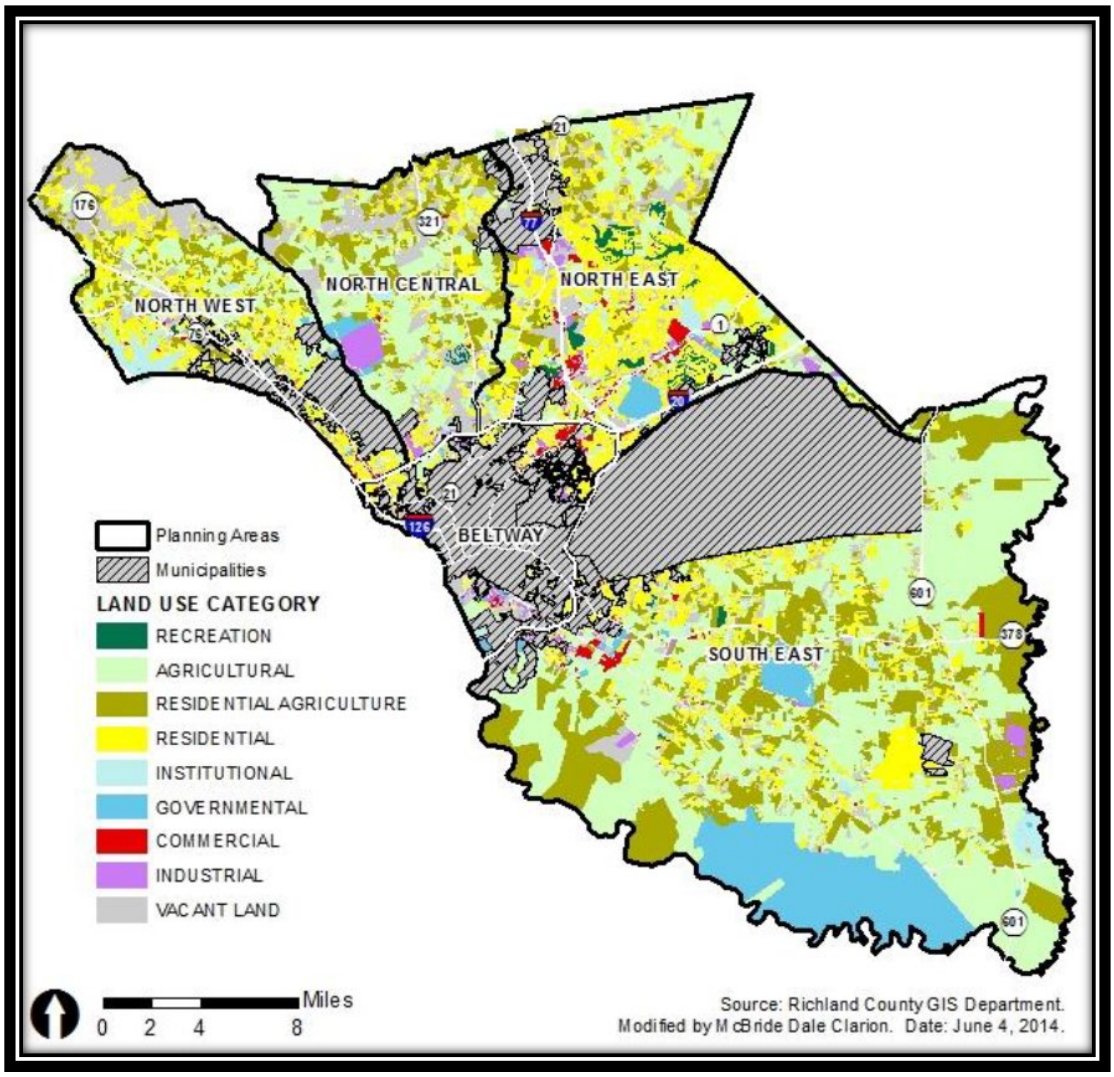
2.1.2.1 Richland County - Most of the following information in this section was taken from the 2015 Richland County Comprehensive Plan (Richland County 2015).

FJ is located entirely in Richland County, SC. The county covers 771.74 square miles: 756.54 land and 15.21 water. Approximately 24.3% is located in a flood plain. There are three categories used to identify current land use in the county: urban, suburban, and rural. Currently, most of Richland County is classified as rural, with each planning area containing some rural character. Suburban land uses are prevalent throughout the Beltway and extend well into the northeast and northwest. Note FJ is located east of the Beltway in the southeast planning area (Figure 2.2).

Richland County is divided into five planning areas: northwest, north central, northeast, beltway, and southeast. Over half of the County's agricultural land is located in the south east (66.32%), and the north east contains the highest percentage of recreational uses (71.94%). Please note these percentages include both unincorporated and incorporated areas.

The southeast covers approximately 316.84 square miles, containing portions of Columbia, Cayce, and Eastover, bordering Sumter, Calhoun, and Lexington Counties, and including FJ, McEntire Joint National Guard Base (JNGB), and the Congaree National Park. The majority is designated as rural , with the remainder designated as suburban. The largest percentage of land in the southeast is comprised of agricultural uses (47.3%).

Figure 2.2. Richland County SC Unincorporated Land Use – From Richland County Comprehensive Plan 2015. Fort Jackson is the black/white striped area to the right of Columbia's beltway.



2.1.2.2 FJ/McEntire Joint Land Use Study (JLUS, Central Midland Council of Governments 2009) - The JLUS is an ongoing effort between the US DoD, US Air Force (USAF), US Army, SC Army National Guard (SCARNG), SC Air National Guard (SCANG), Central Midlands Council of Governments, Richland County, the City of Columbia, Kershaw County, FJ, McCrady Training Center (MTC), and McEntire JNGB to identify solutions to suburban encroachment around the County's military installations. The Richland County Comprehensive Plan (Richland County 2015) references the JLUS, and in concurrence with the City of Columbia, and recommendations from the DoD, has placed a buffer on the Future Land Use Map around FJ, MTC and McEntire JNGB. The buffer is there to help identify areas around the base that could be affected by noise, smoke, or other issues associated with military training and the mission of the installations. It is not the intent of the JLUS to discourage growth and

development but rather to create a balance between the needs of the military and the needs of the surrounding communities. More details can be found in Section 3.6.

2.1.3 Abbreviated History and Pre-Military Land Use

2.1.3.1 Pre-Army History of the FJ Area - The land that became FJ was originally home for pre-contact Native Americans who came and went as the seasons changed. Beginning in the eighteenth century, Euro-Americans began settling in the region, most being white yeoman farmers whose small farms were scattered among modest plantations whose owners hoped for large profits from cash crops. Although the soils were characteristically excessively well drained and nutrient poor across the Sandhills, there were fertile spots where corn and cotton thrived. In those locations, a few antebellum planters were able to successfully compete against the lower Richland County planters whose rich lands were linked to the Congaree River. After the Civil War, the plantation system was disrupted and a dispersed mostly poor white and black farm population attempted to subsist on the land. But still scattered among them were yeoman farmers with sizable tracts and comfortable if not thriving farms. During the summer, wealthy Columbia residents would temporarily increase the population as they moved into the Sandhills to escape the city heat. There was also some light industry in the area, mostly saw and grist mills. Like the rest of the South, the Sandhills suffered the fortunes of a reliance on cotton. To ease the economic downturns, Sandhill farmers turned to their timber resources, which they could sell to Columbia residents. Then just prior to World War I, the City of Columbia Chamber of Commerce saw the land's potential for a military installation. In 1917 the Army came to the Sandhills. Overall, these Sandhills had not been the most desirable lands for a nineteenth and twentieth century agricultural nation. Still, it was home to some tenacious planters, yeoman farmers and tenants. (Plaag and Smith 2009).

2.1.3.2 History of the Army at FJ - The installation originally opened with Congressional approval of the 6th National Army Cantonment on 17 June 1917 on a 1,156-acre tract of land donated by the citizens of Columbia. This property was part of the Lordly estate, comprising about 20,000 acres originally owned by General Wade Hampton. The federal government later acquired an additional 19,742 acres and leased thousands of acres more. Camp Jackson was established on 18 July 1917 as a World War I training camp. It was named for Andrew Jackson, seventh President of the US who was born in New Lancaster, SC. One year after its establishment, 45,000 officers and enlisted men were training as the 30th and 61st divisions at Camp Jackson. With the Armistice in 1918, Camp Jackson was demobilized as a full-time training site. However, from 1925 to 1940, it was state-controlled and used as an encampment and training area for troops of the SCARNG.

During World War II, FJ became a permanent military installation, used primarily for infantry training. Additional property was acquired on the eastern and northern sides of the installation until the acreage included 52,562 acres. The famed 8th Infantry Division was activated here on 1 July 1940, and later the same year the 30th "Old Hickory" Division, also named in honor of Andrew Jackson, moved to FJ. A program to erect mobilization type buildings began, and a $500,000 small arms range, with 400 targets, was placed in operation. More than 100 miles of hard surfaced roads were constructed. These roads were named for Revolutionary War and Civil War heroes from SC; in 2023 many of these road names were changed. General construction on

the installation continued until May 1943, with a total expenditure of $29,445,281 for all facilities.

Several Army divisions, destined to become famous during action in World War II, trained on FJ. Included in this "saga" of FJ divisions were the 4th, 6th, 8th, 26th, 30th, 77th, 87th, 100th, and 106th. In addition, troops of the I and XIX Corps trained here. An estimated 500,000 American fighting men received some part of their World War II training on FJ. The Army Services Personnel Replacement Depot was located here in May 1945, and FJ became a replacement training center in November 1946. In June 1947, FJ was designated as one of the four permanent replacement training centers in the US. The famous 5th Infantry Division was subsequently reactivated on the post as a training organization. The 5th Division was then moved to Indiantown Gap Military Reservation, Pennsylvania in April 1950 and FJ was prepared for a "standby" status. In January 1951 the 31st Infantry Division, the "Dixie Division", made up of National Guard units from Alabama and Mississippi, was ordered to active duty on FJ. The 31st was transferred to Camp Atterbury, Indiana, in April 1952 after participating in "Exercise Longhorn" in Texas.

On 15 May 1954 the 8th Infantry Division was transferred to Camp Carson, Colorado and replaced by the famous 101st Airborne, "Screaming Eagle" Division. That Division was moved to Fort Campbell, Kentucky in March 1956, and FJ was designated as the US Army Training Center, Infantry.

FJ grew over the years, but most of the buildings were temporary. Finally, in 1964 construction began on permanent steel and concrete buildings to replace wooden barracks that had housed the Fort's troops since the early 1940s.

With the establishment of the modern volunteer Army in 1970 and the need to promote the attractiveness of service life, construction peaked in an effort to modernize facilities and improve services. In June 1973 FJ was designated as a US Army Training Center. Changes to enhance training have occurred over the years. Victory Tower, an apparatus designed to complement Basic Combat Training, was constructed to reinforce the skills and confidence of the individual soldier. Field training exercises (FTX) were incorporated into Advanced Individual Training so soldiers would have an opportunity to practice a military occupational specialty and common skills in a field environment. By 1988, Initial Entry Training strategy was implemented. Training focused on hands-on skill development. As a result of Base Realignment and Closure actions during the early 1990s, FJ received additional missions and personnel, including the Soldier Support Institute (consisting of the Adjutant General School, Finance School, and Recruiting and Retention School), Armed Forces Chaplaincy Center, and the National Center for Credibility Assessment. In 2007 FJ transferred 583.77 acres of land to the US Department of Veterans Affairs for a National Veterans Cemetery (see Section 5.3). Since 2017 FJ has welcomed Civil Affairs/Psychological Operations courses and other training units expanded, such as the Drill Sergeant Academy, Leader Training Brigade, and the Defense Counterintelligence and Security Agency.

2.1.3.3 History of Natural Resources Management on FJ – FJ expanded in 1939 from the 1,200-acre Camp Jackson of World War I to approximately 52,000 acres. Most of the acreage

was acquired from private landowners who utilized the land for agricultural and silvicultural purposes. The landscape consisted of terraced pastures, farmlands, and timberlands not intensively managed that relied primarily on natural regeneration of longleaf and loblolly pine (*Pinus taeda*).

Training during World War II through the Vietnam War brought large scale range construction that required clearing of thousands of acres of land. The focus during this period was wildfire suppression with little silvicultural or wildlife management activities.

2.1.3.4 History of Forest Management on FJ - An emphasis on forest management began with the establishment of a Forestry Section in 1952. Prior to 1952, FJ had not been properly managed or protected from fire. Much of FJ was dominated by scrub oak and less than half of the property was satisfactorily stocked with pine. Between 1953 and 1969, more than 5,300,000 pine trees were planted or direct seeded as part of a reforestation program (Fort Jackson 1969). During the 1950s, 1960s and 1970s , forest management priorities included reforestation resulting in approximately 7,200 acres of slash pine (*Pinus elliottii*) being planted (Fort Jackson 1984). Wildfire suppression continued, and initial prescribed burning activities began. In addition, 326 miles of firebreaks were constructed along with 375 miles of secondary dirt roads to aid in wildfire prevention and suppression.

The 1990s through the 2000s brought intensive silvicultural and wildlife management practices. This included conversion of mainly offsite slash pine to longleaf pine, planting of 7,534 acres of longleaf pine plantations, prescribed burning in both dormant and growing seasons, and control of undesirable vegetation with chemical and mechanical treatments. From 2014-2020, total tree chipping, fuel wood, operations were conducted on almost 10,000 acres. Fuel wood harvesting was done to remove midstory vegetation, reduce the severity of wildfires, as well as row thinning longleaf pine pre commercial plantations. These efforts, driven by the need to enhance the endangered Red-cockaded woodpecker (RCW) habitat, continue today.

2.1.3.5 History of Fish and Wildlife Management on FJ - Prior to 1957, a rod and gun club were in existence which accomplished only minor natural resources management actions. Most actions were directed toward fish and game management.

During 1957, FJ's Provost Marshal was assigned the responsibility for game management, fish pond improvement and conservation law enforcement. In addition, the Fish and Wildlife Conservation Committee was formed. This committee received technical guidance from the USFWS and SCDNR. Management emphasis was related to stocking fish ponds and planting food plots for game species (Fort Jackson 1969b).

Between 1957 and 1964, the USFWS provided 250,000 bass, bream and catfish for pond stocking. During this period, the SCDNR furnished 60,000 fish for stocking, 20,000 bicolor lespedeza plants, 20 pounds of bicolor seed and 28 pen-reared turkeys for release (Fort Jackson 1969b).

In 1965, a Wildlife Unit was established under the Post Engineer, and a professional forester with a degree in fish and wildlife management was hired in 1966. The primary responsibilities of

this unit were to improve recreational fishing and habitat for white-tailed deer (*Odocoileus virginianus*), northern bobwhite quail (*Colinus virginianus*), and other game species (Fort Jackson 1969b). From 1966 to the mid-1980s the bulk of wildlife management activities were directed at game management. Prior to 1986, the only records of non-game and endangered species management actions include records of surveys for the RCW, and the subsequent inventories and protection of individual colony sites.

During the late 1980s, a professional wildlife biologist and wildlife technician were hired. Beginning in 1989, management emphasis was shifted from game management to endangered species management. An RCW conservation plan was prepared, and planning level surveys for rare and endangered species were initiated. Support and guidance from the USFWS and SCDNR was obtained, and a new era of natural resources conservation began on FJ. Cooperative support from the USFWS and SCDNR continue today.

2.1.4 Military Mission - FJ's primary mission is Army Basic Combat Training (BCT). The installation is one of five BCT installations in the nation. After Soldiers complete BCT they progress to Advanced Individual Training (AIT) at FJ and many other installations across the US. There is limited AIT training offered on FJ.

FJ provides for the training of approximately 50% of all Soldiers and 60% of the women entering the Army each year. FJ trains approximately 57,000 BCT and AIT Soldiers every year. On the 51,316 acres, there are more than 100 ranges and field training areas and 1,160 buildings. More than 3,500 active-duty Soldiers and their 12,000 family members are assigned to the installation at any one time and make this area their home. FJ employs approximately 3,500 civilians and provides services for more than 46,000 retirees and their family members and FJ contributes $2.4 billion to the local economy. In addition, more than 250,000 family members visit FJ each year to attend basic training graduation activities.

The installation mission statement is:

"FJ trains and develops Soldiers in order to build readiness at scale for our Army and provides a community where our Soldiers, Army Civilians, and Families have every opportunity to excel."

The installation vision is:

"FJ is the Army's training center of choice for basic combat training and an installation consistently recognized for excellence."

The Army Training Center and FJ executes BCT and AIT; enhances Drill Sergeant and Cadre Leader Training; and synchronizes Service Support Operating Systems to effectively transform civilians, train Soldiers, and develop leaders who live the Warrior Ethos. Soldiers are trained to be physically tough, mentally adaptive, and able to contribute to the success of their first unit of assignment.

FJ is the BCT Center of Excellence and home to the US Army 81st Regional Support Command, US Army Recruiting Battalion (Columbia), US Army Institute for Religious Leadership, US

Army Soldier Support Institute, Army Drill Sergeant School, National Center for Credibility Assessment, the SCARNG's MTC, The US Army Reserve Readiness Command, Navy Reserve Center, and Marine Corps Detachment.

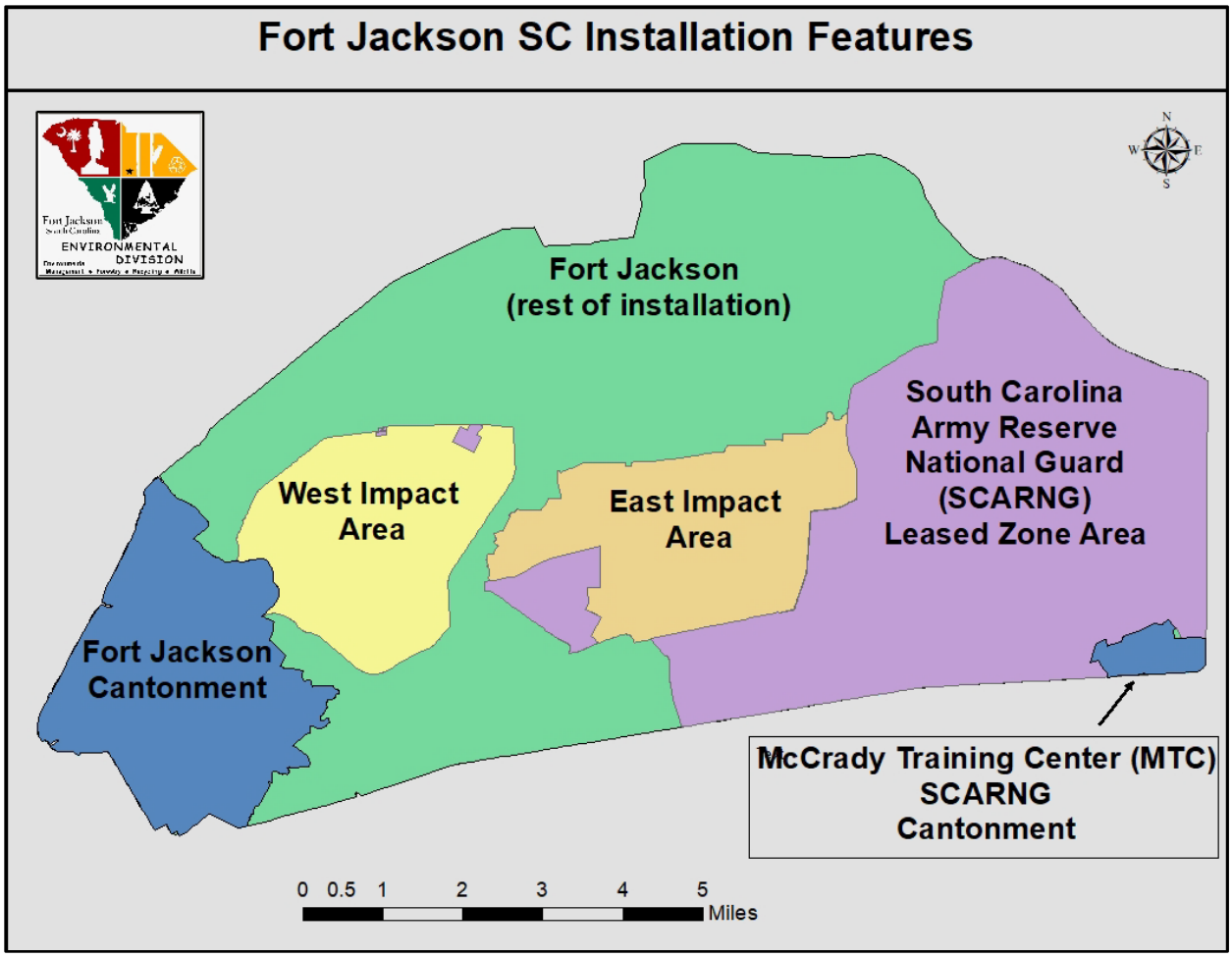
Military training organizations on the installation support the TRADOC mission to conduct initial entry training for BCT/AIT Soldiers, noncommissioned officer academy Soldiers, chaplains, and support basic and advanced officer training courses at Finance and Adjutant General schools. FJ is also the home station for a myriad of active, reserve, and National Guard units like the 157th Brigade Headquarters Infantry Brigade, 108th Training Command, 17th Military Police detachment and the 80th Training Command.

FJ provides ranges and maneuver training areas principally designed to support the institutional training organizations and units garrisoned on the installation. FJ is also tasked with supporting reserve component unit training and, the mobilization and demobilization of Army reserve/Navy component units and personnel. Installation mobilization requirements consist of in-processing and trans-shipment of all personnel processed for assignment and released from duty.

Coalition training is supported upon mission assignment and in accordance with approved Program of Instruction requirements. Currently, the ranger unit from Fort Stewart schedules training requirements at McEntire JNGB , annually. FJ allows use of its Restricted Airspace R6001, ranges, and training land in support of these training units.

The SCARNG is licensed to use 15,633.94 acres of FJ. This area is known as the MTC (Figure 2.3).

Figure 2.3. Fort Jackson with major installation features. FJ and McCrady Training Center cantonment areas on far west and east, with National Guard (SCARNG Leased area) on the east side.

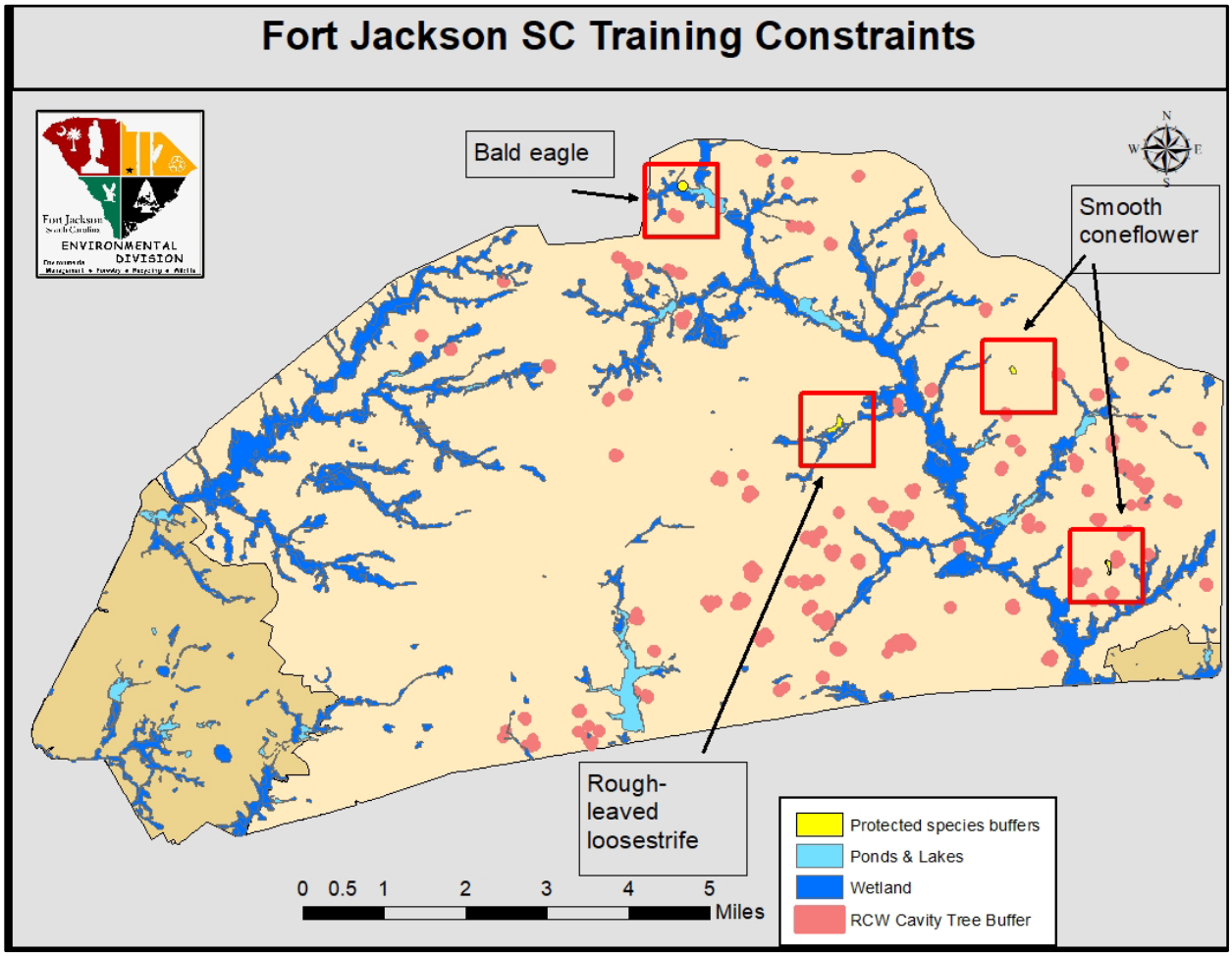


2.1.5 Operations and Activities - The military mission and management of natural resources in support of the military mission have the potential to affect the natural environment on FJ. Military training has the potential to disturb the soil surface thus resulting in increased soil erosion and sedimentation of surface waters on the installation. Timber harvesting practices associated with forest and wildlife conservation actions have the potential to disturb soils and increase soil erosion and sedimentation. In addition, roads and firebreaks are a major source of erosion, especially in training areas. Further, the construction of infrastructure to support the military mission can result in the permanent loss of natural habitats.

2.1.6 Military Training Constraints and Opportunities - Coordination between the environmental staff and range planners, and proper management of resources can prevent constraints to training. There are minor constraints to military training activities in certain training areas (Figure 2.4). For example, RCW clusters and wetlands can limit training activities in some training areas. Current maps and descriptions of constraints to training are available from the Wildlife Branch and from the DPTMS's Range Operations and ITAM Office.

Utilization of the most current constraints maps and information will facilitate the identification of areas for training opportunities (Figure 2.4).

Figure 2.4. Fort Jackson Natural Resources-Related Constraints to Training. Wetlands and protected species areas have minor training constraints.



2.2 GENERAL PHYSICAL ENVIRONMENT AND ECOSYSTEMS

2.2.1 Climate - FJ is in a humid continental area. Predominant climatic factors are the installation's location in the lower latitudes and its proximity to the Appalachian Mountains to the west, which block the approach of unseasonable cold weather in winter. This southern temperate region can experience temperatures ranging from below freezing to greater than 100º

Fahrenheit (ºF); however, there is a relatively narrow annual temperature range, from a mean daily temperature of 82.6ºF in July to 46.1ºF in January.

The Bermuda high, a semi-permanent high-pressure cell centered in the Atlantic Ocean, dominates summer weather. The influx of warm moist air from the south causes days to be hot and humid. The average high temperature in July, the hottest month of the year, is 92.7ºF. Temperatures greater than 90ºF are experienced an average of 80 days per year. Winters are generally mild, and January, the coldest month, has an average daily minimum temperature of about 34.9ºF. Temperatures below freezing are experienced an average of 46 days a year. The average frost-free growing season is approximately 229 days, with the average first frost occurring in late November and the last frost usually occurring in late March.

The average annual precipitation is 45-46 inches, with summer constituting 32.87% of annual rainfall. Average monthly rainfall for July and August is 4-6 inches. Minimum amounts of rainfall occur during October and November when monthly averages are about 2-3 inches. Approximately every 5-10 years an ice storm occurs, severe enough to cause some timber damage. Every few years a tropical storm will cause heavy rains for multiple days. In rare instances, tropical storm or hurricane winds will come inland far enough to cause damage, such as occurred during Hurricane Hugo in 1989.

2.2.2 Topography - Gently to moderately rolling, moderately dissected high plains occupy most of FJ. These high plains are interrupted by the nearly flat alluvial plains of Gill's, Cedar, and Colonel's creeks and their tributaries and an irregularly distributed, gently sloping, low relief area in the central portion of the installation near the headwaters of Cedar Creek. Local relief in the high plains is largely 165-250 feet. Slopes are predominately 3-8%; however, along narrow stream valleys, slopes commonly exceed 15%.

Elevations in the high plains are mostly 295-459 feet above sea level. The lowest elevation in the high plains is about 200 feet, adjacent to the alluvial plain of Colonels Creek in the eastern portion of the installation. The highest elevation, 545 feet, is at Weir Tower in the west-central portion of the installation.

Flat to gently rolling low plains characterize the extreme western portion of the installation, including a major portion of the cantonment area and the alluvial plains occupied by southwesterly flowing Gills and Mill creeks. Local relief around the valley of Gills Creek and its tributaries is generally less than 60 feet. Slopes are predominately between 0-3% on the alluvial plains, and slopes in the cantonment area are predominately between 3-8%.

Upper valleys of Mill and Cedar Creeks occupy low plains along the southern boundary of FJ. Local relief is generally less than 40 feet, and slopes are usually less than 3%.

In the eastern portion of FJ, flat to gently sloping, alluvial plains are occupied by Colonels Creek and its tributaries. Local relief is less than 20 feet, and slopes are generally less than 3%. Local relief of 100 feet and 3-8% slopes characterize a gently rolling upland area in the extreme southeastern corner of the installation, adjacent to Colonels Creek. Elevations in the low plains are generally 180-280 feet above sea level. The lowest elevation in the low plains is less than 160

feet, occurring in the flood plain of Colonels Creek in the extreme southeastern portion of FJ The highest elevation in the low plains is about 340 feet at the head of Gills Creek.

2.2.3 Geology - FJ is on the northwestern edge of the Atlantic Coastal Plain Province, a region of low to moderate relief and gently rolling plains, known as the Sandhills. The Fall Line, a zone that marks the boundary between younger softer sediments of the province and ancient crystalline rocks of the Piedmont Plateau Province, is about 4 miles west of the cantonment area (Gene Stout and Associates 2004).

The principal geologic formation in the Sandhills is the Tuscaloosa, which consists of marine deposits of light-colored sands and kaolin clays. Most soils on FJ are formed from Tuscaloosa sediment. A Quaternary sand terrace layer overlies the Tuscaloosa formation, which lies on a complex of old metamorphic and igneous rock. The Tuscaloosa complex generally consists of clay strata overlying unconsolidated sands. The Upper Cretaceous-age Tuscaloosa formation outcrops over most of FJ and consists of unconsolidated, crossbedded, kaolinitic, and arkosic sands. It lies uncomformably on the peneplained surface of crystalline rocks. Near the northern boundary of the installation, older crystalline rocks of the Carolina Slate Group outcrop at the surface. In the northwest portions of FJ, Pleistocene sands and gravel are at the ground surface (Gene Stout and Associates 2004).

2.2.4 Wetlands and Deep-Water Habitats

2.2.4.1 Wetlands - The Sandhills region is characterized by well-drained, sandy hills that are dissected by a dendritic system of wetlands and small streams. Typical jurisdictional waters and wetlands on FJ include sandhill seeps, stream head pocosins, small stream swamps, vernal pools, and open water habitats consisting of streams, and impoundments.

The USFWS wetland classification program has developed a national Wetlands Geodatabase. This database provides spatial data in the form of National Wetland Inventory (NWI) Maps. Table 2.1 lists the NWI acreages of wetlands on FJ. Wetlands, as depicted on NWI maps, are shown on Figure 2.5. NWI maps often underestimate or overestimate wetland acreage due to coarse scale interpretation. Small scale wetlands (e.g., sandhill seeps, small depression ponds, and vernal pools) are found on FJ; therefore, the actual acreage and distribution of wetlands on the installation is likely greater than estimates based on NWI maps.

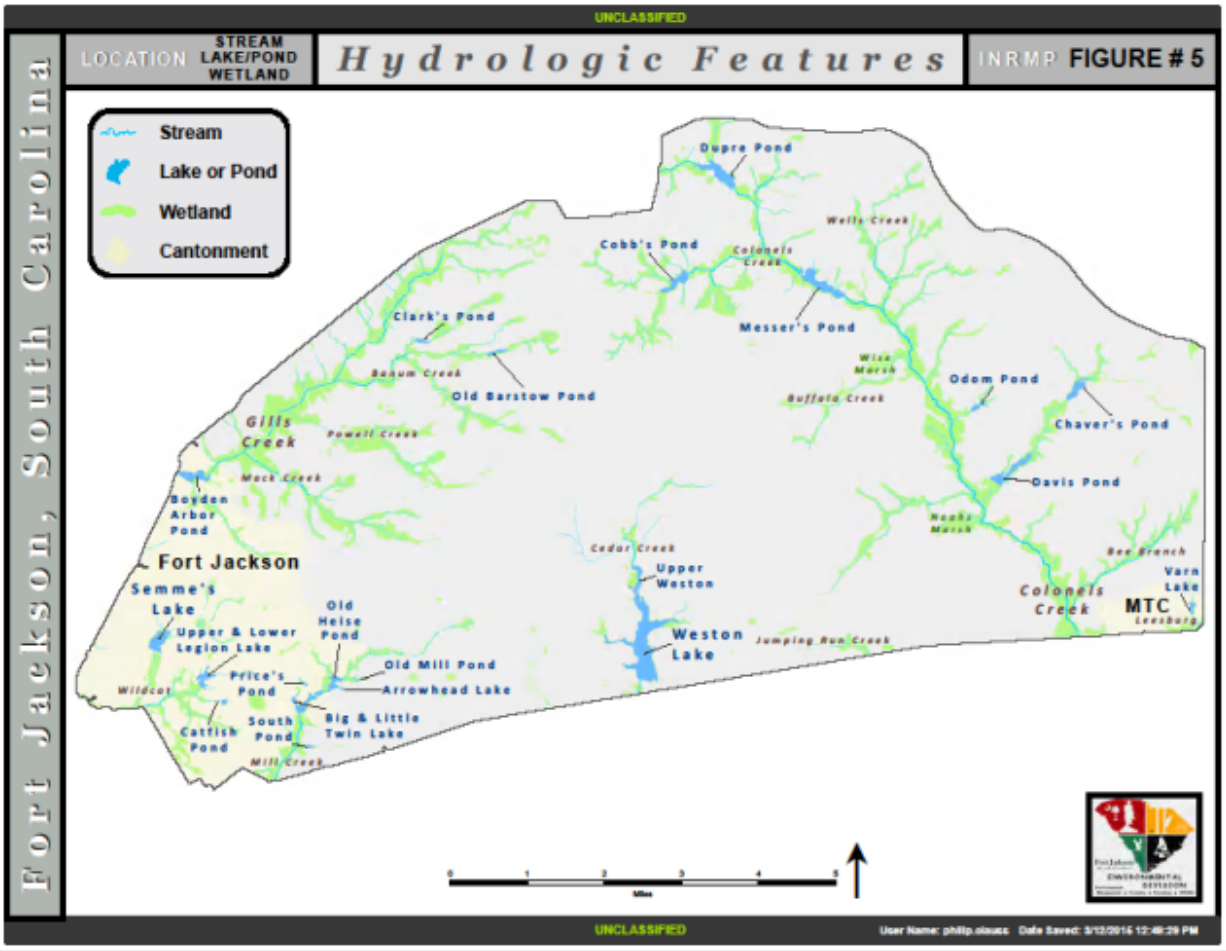
Table 2.1. NWI wetland estimates for FJ

NWI Wetland	Acres
Palustrine	3,795
Lacustrine	262
Total	4,057

FJ's four major drainage systems and their associated tributaries drain into watersheds of the Wateree and Congaree Rivers. Hydrologic conditions within these systems have created a variety of aquatic and wetland biotic communities. These include, but are not limited to; Open Water (Ponds, Lakes, and streams), Wetland Mixed Hardwoods, Wetland Mixed Hardwoods-Pine,

Wetland Mixed Hardwoods-Shrub, Pine-Shrub, Pine-Wetland, Mixed Hardwoods, Marsh, and Floating Aquatic.

Figure 2.5. Fort Jackson hydrologic features including wetlands, ponds, lakes, creeks and streams.



2.3 GENERAL BIOTIC ENVIRONMENT

2.3.1 Fauna - The fauna found on FJ is typical of the sandhills region of SC's Upper Coastal Plain physiographic province. Over the years, baseline and Planning Level Surveys have been performed for various classifications of fauna. These include herpetological surveys, butterfly surveys, fish population surveys, raptor surveys, migratory bird surveys, benthic

macroinvertebrate surveys, and installation-wide surveys for threatened and endangered fauna. Incidental observations by natural resources personnel contribute to the inventory of fauna and herpetofauna on FJ. In addition, surveys and monitoring efforts are performed for white-tailed deer, furbearer species, game birds, and invasive and nuisance species such as feral pigs and beavers. Detailed reports and species lists are available at the ENV office.

Endangered species management receives priority over other forms of natural resources management. Endangered, threatened and sensitive flora and fauna and their management are discussed in Section 4.1.

2.3.2 Flora - The flora found on FJ is typical of the sandhills region of SC's Upper Coastal Plain physiographic province. Twelve vegetation cover types have been recognized for the purpose of cover type mapping, with at least 30 plant community types and 11 subtypes (Gaddy 2003).

The high diversity of plant communities includes the presence of some rare plant communities. These include the Sandstone Gravel Longleaf Pine Woodland and the SC Central Longleaf Pine Woodland.

Detailed reports and species lists are available at the ENV office.

3. ENVIRONMENTAL MANAGEMENT STRATEGY AND MISSION SUSTAINABILITY

3.1 SUPPORTING SUSTAINABILITY OF THE MILITARY MISSION AND THE NATURAL ENVIRONMENT - Sustainability is defined as the ability to provide for the needs of the current mission without damaging the ability of future missions to maintain their needs. When a process is sustainable, it can be carried out over and over without any negative environmental impacts or impossible high costs to anyone involved.

Monitoring and measurement are fundamental to adaptive management and mission sustainability. It ensures the effectiveness of the management, plans, controls, and training. Furthermore, it enables FJ to identify its progress toward achieving objectives and targets, and the reasons for the installation's level of achievement. Without effective monitoring and measurement, it would be impossible for FJ to continually improve, which is the basis of sustainability.

3.1.1 Integration of the Military Mission and Sustainable Land Use - The US Army's ITAM program is an integral part of the implementation of an INRMP on an installation. ITAM is a comprehensive approach to land management on all US Army installations. It is the US Army's standard for sustaining the capability of installation land units to support their military training missions. The goals of the ITAM program include the following:

1. Achieve optimal sustained use of lands for the execution of realistic training, by providing a sustainable core capability, which balances usage, condition, and level of maintenance.

2. Implement a management and decision-making process which integrates US Army training and other mission requirements for land use with sound natural and cultural resources management.

3. Advocate proactive conservation and land management.

4. Align US Army training land management priorities with US Army training, testing, and readiness priorities. Through the ITAM and its constituent elements (e.g., Range and Training Land Assessment [RTLA]) and Land Rehabilitation and Maintenance [LRAM]) FJ integrates the use of its lands for meeting the current and future military mission and ensuring the conservation of the natural resources on which effective training rely.

3.1.2 Impact to the Military Mission - The military mission on FJ requires available land for the training of military units. However, the installation must comply with environmental regulations and strive to conserve the natural resources on which effective training rely. Through the coordination of the various environmental programs (e.g., Forest Management, Fish and Wildlife Management) and the ITAM program managers, FJ ensures the availability of quality training lands and the protection of the natural resources on these lands. During the planning phase of natural resources management or military training the DPW and DPTMS's ITAM Coordinator closely coordinate to ensure the compatibility between the military mission and training requirements, and natural resources. During this planning process, resolutions are established to ensure environmental regulations are being satisfied while still providing sufficient land use to meet the military mission. Further, the DPW coordinates all natural resources management activities with DPTMS Range Operations and the SCARNG MTC to ensure there is no conflict with military training and training areas are enhanced as a result of the natural resources management activity.

3.1.3 Relationship to Range Complex Master Plan - Through the INRMP, planning for both military training activities and natural resources activities are coordinated between DPW and DPTMS. This ensures the military mission is not compromised and FJ is meeting the mandated environmental regulatory requirements. Through ITAM, environmental resources are considered during the planning of future sites to support the military's missions. Additionally, DPW considers future range plans when developing natural resources projects, such as establishing habitat management units for the RCW.

3.2 NATURAL RESOURCES CONSULTATION REQUIREMENTS - The ESA requires Federal agencies to ensure that their activities do not have an adverse impact on any species listed as threatened or endangered by the USFWS. It further requires that Federal agencies implement measures to conserve, protect, and, where possible, enhance any listed species and their habitat.

FJ coordinates with the USFWS on actions that may affect threatened and/or endangered species. The installation maintains a dialogue with USFWS and conducts numerous informal ESA Section 7 consultations each year. Early informal consultation with the USFWS is the key to

resolving potential problems, addressing issues in a proactive and positive manner, and is the preferred method of consultation.

FJ may determine, through the informal consultation process or simply by the nature of the proposed action, that formal consultation is required for an action. If FJ determines that an activity may affect a listed species, the installation is required to enter into formal consultation with USFWS to determine whether a proposed action is likely to jeopardize the continued existence of the listed species, destroy or adversely modify designated critical habitats, or potentially result in the incidental take of a species.

The consultation process begins with FJ's written request and submittal of a complete initiation package and concludes with USFWS's issuance of a biological opinion (BO) and "incidental take" statement, if applicable.

3.3 NEPA COMPLIANCE - The NEPA of 1969 (42 USC 4371 et seq.) requires federal agencies to assess the environmental effects of proposed federal actions that could impact the quality of the human and natural environment. NEPA also requires federal agencies to inform the public about their decision-making process. The Army implements NEPA through 32 CFR Part 651, Environmental Analysis of Army Actions, and AR 200-1, Environmental Protection and Enhancement.

Two types of NEPA analyses are used to review projects on FJ. A Record of Environmental Consideration (REC) is used for projects that fall under a categorical exclusion (CX). CXs are categories of actions with no individual or cumulative effect on the environment, and for which an Environmental Assessment (EA) is not required. The REC request for a proposed action is reviewed by ENV Program Managers for potential impacts to water, land, and air quality; fish and wildlife resources; cultural resources; and other natural resources under FJ stewardship. For proposed actions not covered under a CX, an EA will be completed, and a Finding of No Significant Impact will be issued.

Proposed actions reviewed under NEPA include building renovations, military construction projects, roads and grounds projects, FTXs, and plans (e.g. the INRMP). The FJ NEPA Coordinator maintains a database of all completed RECs, tracks submittals, and conducts site visits to ensure environmental requirements are followed. All EA documents and administrative records are maintained by ENV.

3.4 BENEFICIAL PARTNERSHIP AND COLLABORATIVE RESOURCE PLANNING

3.4.1 USFWS - The USFWS has a field office at Charleston, SC and provides technical advice for management of natural resources on FJ, particularly involving federal-listed species. In addition, Endangered Species Act consultations are performed with the Charleston Field Office. The USFWS is a signatory cooperator in implementation of this INRMP in accordance with the Sikes Act.

3.4.2 SCDNR- The SCDNR is a signatory cooperator in the implementation of this plan in accordance with the Sikes Act. It is the primary state agency regarding fish and wildlife

management on FJ. Specific cooperation with SCDNR generally involves fish and wildlife management, including game, non-game, and threatened and endangered species management. SCDNR provides technical assistance for the game, non-game, threatened and endangered species, and fisheries management programs. Technical assistance is also available for conservation law enforcement.

3.4.3 SCFC - The SCFC assists the installation by providing forest fire suppression assistance, and consulting services on forest management issues, such as forest pest management.

3.4.4 SC Department of Parks, Recreation & Tourism, and Palmetto Trails - A Memorandum of Understanding (MOU) between FJ, the SCARNG, the SC Department of Parks, Recreation & Tourism, and Palmetto Trails was established in 1996 to guide the collaborative efforts of establishing and maintaining a section of The Palmetto Trail that traverses FJ and a part of FJ licensed to the SCARNG MTC (see Section 3.5.1 for more details). The Palmetto Trail offers public access for natural resources related outdoor activities on FJ. This collaboration guides the use of and any improvements to the trail to avoid duplication of efforts by the interested parties.

3.4.5 Conservation Organizations - The Longleaf Alliance acts as a clearinghouse of information on longleaf pine, which has been valuable to the installation. The SC Wildlife Federation has shown interest in FJ's programs and has presented awards for the installation's management efforts.

3.4.6 Universities - The University of SC houses the state herbarium including the FJ collection, and has performed numerous planning level surveys, botanical inventories, and studies on water quality on FJ. The herbarium is often consulted with on issues related to the flora of FJ. Additionally, Clemson University has conducted assessments of biological integrity of FJ's watersheds.

3.5 PUBLIC ACCESS AND OUTREACH

3.5.1 Public Access - A basic tenet of ecosystem management is the "human values and use" component. FJ's natural resources based outdoor recreation program uses ecosystems in terms of both products (i.e. game species) and disturbance associated with persons in the outdoors. FJ is aware of the over-riding need to ensure these activities do not significantly impact overall ecosystem integrity. Special consideration is given to protection of critical areas (endangered species habitat, highly erodible areas, etc.) from negative impacts due to outdoor recreation.

The military mission has priority over outdoor recreation involving range access. If outdoor recreational activities are to continue to thrive on FJ, this military mission priority must not be compromised. If recreational or management activities conflict with military activities, the military mission comes first.

DoDI 4715.03 states, “DoD installations shall be available to the public for hunting where such programs exist and when not in conflict with mission or environmental and natural resources conservation program goals”.

Paragraph 4-3, d. (9)(e) of AR 200-1, *Environmental Protection and Enhancement*, states: Provide access to uniformed personnel, family members, and the public to hunting, fishing, and trapping, consistent with security requirements and safety concerns.

FJ limits access for hunting and fishing to authorized personnel only. While unsupervised use by the general public is prohibited, FJ does allow non-affiliated civilians of the general public to participate in hunting and fishing activities when sponsored and supervised by an authorized participant. Authorized participants include: All active-duty personnel, military retirees, DoD appropriated funded and non-appropriated funded personnel, reservists, National Guard, and family members of the above, DoD contractor employees, technical representatives and employees of military banking facilities working on FJ as determined by the Installation Commander, and the general public to participate in specific supervised hunting and fishing events as organized by DFMWR.

Limiting public access for hunting and fishing is necessary for various safety reasons. Non-affiliated civilians are relatively un-initiated with respect to military-specific safety concerns and are at a greater risk. There are numerous safety hazards including:

- Live fire of small arms and large weapons on ranges, the use of high explosives for demolition training, and artillery live-fire from firing points within training areas into designated impact areas. These ranges, firing points and impact areas have no physical barriers to prevent entry down-range into the hazardous areas.
- Numerous off-limits areas totaling approximately 6,000 acres that contain unexploded ordnance (UXO). These UXO areas are insufficiently marked and lack physical barriers to prevent entry.
- Day and night-time heavy tracked and wheeled vehicle movement on and off-road.
- Unmarked military training areas, unmarked concertina wire from military training, and a network of unmarked roads that are often washed out and impassable.

Furthermore, there is no separation of the hunting and fishing areas from areas designated and utilized for various military training activities. These factors further warrant restricting the general public from utilizing these lands for the safety reasons listed above.

In addition, FJ’s primary mission of Initial Entry (Basic) Training results in large numbers of Soldiers-in-Training occupying the ranges and training areas each day. There is a high likelihood of hunters and anglers encountering these Soldiers-in-Training. This presents greater opportunities for illegal associations, as defined by FJ Regulation 600-3. Illegal associations are harmful to mission accomplishment and degrade the ability to develop military skills, motivation, discipline and confidence in Soldiers-in-Training.

Finally, allowing general public access to FJ for hunting and fishing would require additional efforts for background checks, weapons registrations, and administration of hunters and anglers.

FJ's current staffing, funding, and resources necessary to perform these requirements cannot accommodate the increased demand.

Public access for non-consumptive natural resources related activities is also available on the section of the Palmetto Trail which traverses FJ along the southern boundary. The Palmetto Trail will eventually run across the breadth of SC, connecting the mountains to the coast. The section of the Palmetto Trail that traverses FJ offers the public access for hiking, mountain biking, bird and other wildlife viewing, and access to a spur trail named the Harry J. Vann Interpretive Trail. This spur was constructed by the SCARNG, in celebration of National Public Lands Day, in September 2000. This project was made possible by a grant from the *National Environmental Education & Training Foundation* and the work of several volunteers and agencies. The purpose of this trail is to help educate and provide recreational opportunities to the citizens of SC. This trail provides an opportunity to share this land and our conservation ethic. The trail contains several interpretive signs and an outdoor classroom. The trail is open to individual hikers 1 hour after sunrise to 1 hour before sunset. The Palmetto Trail is currently upgrading this section of the Boyd Passage with a wooden platform amphitheater with concrete seating and picnic tables.

3.5.2 Public Outreach - To increase awareness of the importance of ecosystem management, FJ fosters citizen participation in ecosystem education and stewardship and participates in regional stewardship/research programs. This includes educational activities with local organizations such as scout troops, environmental groups, conservation clubs, and school groups.

Every other month ENV conducts an Environmental Compliance Officer's Course that includes natural resource presentations. Approximately 300 individuals receive this training annually. ENV also sponsors Earth Day activities each April with litter clean-up days, natural resource presentations, and other activities. The Wildlife Branch has hosted meetings of the SC Chapter of The Wildlife Society on FJ with approximately 100 members in attendance. A children's fishing rodeo has been held annually at the Heise's Pond recreation area in cooperation with the FJ DFMWR. ENV personnel also give interviews for natural resource articles for local television and newspapers as well as update a division Facebook page with natural resource items.

3.5.3 Native American Access – FJ maintains an 'Integrated Cultural Resources Management Plan (Fort Jackson 2008)' to ensure all laws, statutes, policies, and executive orders protecting cultural resources are complied with. FJ has conducted eight formal consultations with 14 federally recognized Native American Tribes and Nations between 2001 and 2015. There have been no sites or resources of religious importance identified on FJ by Native Americans, thus no requests for access have been received to visit such sites or collect such resources. Resulting from these consultations, Native American Tribes have expressed some minor interest in certain native plants found on FJ. Access for the purpose of collecting botanical materials is accommodated by granting a license approved by the installation's Garrison Commander, and by providing an escort for the individuals entering FJ. Prior to the collection of any botanical materials, a Minor Forest Products License will be granted by FJ. The proposed collection of any botanical materials will be assessed for potential adverse effects to the local populations of the target species. No species listed as at-risk, candidate, threatened or endangered will be collected unless authorized and or permitted by the SCDNR and the USFWS.

3.6 ENCROACHMENT PARTNERING - The DoD's presence in the Midlands of SC is significant. There are five military installations: three active duties and two National Guard. Active and reserve components of the Army, Navy, USAF, and Marines utilize these bases. To reduce development related pressure, the installations are working together to leverage our presence in regional decision-making. Specifically, the SC Military Department, FJ, and Shaw USAF Base have joined together with local governments and Non-Governmental Organizations to form the Midlands Area Joint Installation Cooperative (MAJIC). The purpose of the consortium is to facilitate collaboration on projects including a region-wide JLUS or the implementation of a Joint Compatible Use Buffers (JCUB) program.

3.6.1 JLUS - Members of regional and local governments, along with US Army, USAF, SCANG, and SCARNG representatives joined in initiating this effort to study current development issues, growth trends, and evolving mission needs and to strengthen land use planning around the installations (Central Richland Council of Governments 2009).

3.6.2 Conservation Strategies - As part of regional strategy, the MAJIC has partnered with the DoD and the Congaree Land Trust and Conservation Fund to explore the purchase of conservation easements from willing property owners within 670-square mile priority acquisition areas identified by the JCUB study completed in September 2007. As of 2024 the priority acquisition area has grown to 1077-square miles. MAJIC has identified priority areas northeast and south of FJ and around McEntire JNGB. The Army Compatible Use Buffers (for purposes of the Midlands initiative the program is referred to as JCUB) program has emerged as one of the most effective of the DoD sustainability initiatives in preventing encroachment around installations. The core implementation strategy of the program is to acquire conservation easements and fee-simple purchases that prohibit incompatible development in perpetuity, while allowing the land to remain in private hands. While the restrictive covenant prohibits urban development, it accommodates low impact uses such as farming and forestry that do not pose a risk of interference with nearby training activities. MAJIC has encumbered over 25,000 acres so far in the focus area. MAJIC is a strong alliance promoting the conservation of the local environment and the sustainability of the regional installations. Local governments and the individual installations can also participate in the conservation process by acting as direct cost-sharing partners in conservation easement purchases. Jurisdictions can also align their infrastructure and land use policies to reinforce the rural/agricultural character of areas near or within the designated JCUB, thus reducing development pressures and limiting price escalation of the land.

FJ is part of the 'Area of Partnership and Cooperation' for the Congaree Biosphere Reserve which earned its 'Man and Biosphere Reserve' designation in 1983 from the United Nations Educational, Scientific and Cultural Organization. This program combines natural and social science with economics and education to improve human livelihoods and safeguard natural and managed ecosystems. The program shares information, knowledge and experience on biodiversity, climate adaptation and sustainable development via cooperation on research and development, capacity-building and networking.

3.7 STATE WILDLIFE ACTION PLAN (SWAP) – FJ is part of the Sandhills Ecoregion as identified in SC's SWAP (SCDNR 2015). The actions identified in the FJ INRMP complement the priorities established in the SWAP for this ecoregion. Longleaf pine restoration, endangered species conservation, and the use of prescribed fire all contribute to the objectives identified in the SWAP. FJ will continue its cooperative relationship with the SCDNR in identifying, prioritizing, monitoring and conserving to the extent practicable the high priority species and habitats identified in the SC SWAP that may be found on FJ (see Section 4.1).

3.8 CLIMATE CHANGE IMPACTS TO NATURAL RESOURCES

3.8.1 Adaptive Management – Adaptive management approaches are the foundation for sustainable use of natural resources to support mission needs, meet stewardship requirements, and contribute to ecosystem resilience in the face of climate change. Maintaining ecosystem resilience is a key adaptation strategy given the uncertainty of potential climate change impacts.

As climate science advances, the DoD will regularly reevaluate climate change risks and opportunities to develop policies and plans to manage its effects on the DoD's operating environment, missions, and facilities. The DoD will review and as needed, make changes to existing plans, policies, programs, and operations to incorporate climate change considerations. FJ will stay current with all regulations, policies, and guidelines on climate change and will adjust natural resource management to comply.

FJ will be involved with agencies and organizations to address climate changes. The installation natural resource management staff will particularly work closely with the USFWS and the SCDNR on climate change issues. For instance, the SCDNR (2014) has developed a document entitled *"Climate Change Impacts to Natural Resources in SC"*. This document provides a look into how climate change may affect management of habitats and species in the state and is applicable to FJ.

3.8.2 Climate Change Hazards - The DoD (2014) Climate Change Adaptation Roadmap provides insight into how climate change may affect missions worldwide. Initial analysis indicates that four primary climate change phenomena are likely to affect the DoD's activities:

- Rising global temperatures
- Changing precipitation patterns
- Increasing frequency or intensity of extreme weather events
- Rising sea levels and associated storm surge (not applicable to FJ)

The US Department of Army Climate Strategy (2022) states that the Army will be a resilient and sustainable land force able to operate in all domains with effective mitigation and adaptation measures against the key effects of climate change, consistent with Army modernization efforts. The goals to achieve this include

- Achieve 50% reduction in Army net greenhouse gas pollution by 2030, compared to 2005 levels
- Attain net-zero Army greenhouse gas emissions by 2050
- Proactively consider the security implications of climate change in strategy, planning,

acquisition, supply chain, and programming documents and processes

Based on information within this document, climate change on FJ may affect natural resources and their management along with military training. Increased temperature trends are anticipated along with changes in the fire regime. There may be an increased number of 'black flag' (suspended outdoor training) or fire hazard days. Drought conditions may increase the number of wildfires and limit the number of days prescribed burns can be conducted.

Climate change may stress threatened and endangered species and related ecosystems, on and adjacent to the installation, which may result in increased endangered species and land management requirements. In addition, species movements and habitat shifts may occur which will influence the monitoring and management of plants and animals on FJ.

Increased dust may result during drought conditions; and there is also the possibility of erosion and flooding damage during high rainfall events such as hurricanes. These changes will increase maintenance/repair requirements for training lands, forested lands, roads, ranges, and ponds.

Increased ecosystem, wetland, sensitive species, and non-native invasive species management challenges are also anticipated. This includes the management of natural infrastructure assets, including unique landscapes, ecosystems and habitats, particularly those supporting sensitive species. FJ's longleaf ecosystem which supports the endangered RCW, and a diversity of other plant and animal species may be affected.

The DoD (2023) Climate Assessment Tool has modeled the projected climate risks on FJ. During the model run in May 2023 the three main hazards were predicted to be drought, heat and increased wildfires. The potential effect of these three hazards and their impacts to sensitive species will be discussed in Section 4.1.

4. PROGRAM ELEMENTS

4.1 SENSITIVE SPECIES MANAGEMENT

4.1.1 Threatened and Endangered Species - FJ has seven species of plants and animals that are listed by the USFWS as either threatened, endangered, candidates for listing, or proposed to be listed (Table 4.1). This includes the bald eagle which has a specific law protecting it, the Bald and Golden Eagle Protection Act (BGEPA, 1940). Figure 2.4 shows the population locations of endangered species on FJ and their management buffers.

Table 4.1. Seven species found on Fort Jackson, SC and listed by U.S. Fish and Wildlife Service as threatened, endangered, candidates, proposed, or protected by law.

Common Name	Scientific Name	Federal Status	Installation Presence	Existing USFWS Consultation/Conference with FJ	Location of ESMC or INRMP discussion

American wood stork	*Mycteria americana*	Threatened, Proposed delisted	Transient		
Bald eagle	*Haliaeetus leucocephalus*	BGEPA	Resident	Bald and Golden Eagle Protection Act	
Monarch butterfly	*Danaus plexippus*	Candidate	Resident		
Red-cockaded woodpecker	*Picoides borealis*	Endangered	Resident	BO 2013	ESMC Appendix 1
Rough-leaved loosestrife	*Lysimachia asperulaefolia*	Endangered	Resident	ESMC, BO 2007	ESMC Appendix 2
Smooth coneflower	*Echinacea laevigata*	Threatened	Resident	ESMC, BO 2007	ESMC Appendix 2
Tricolored bat	*Perimyotis subflavus*	Proposed Endangered	Resident	ESMC, Conference Opinion (CO) for Machine gun range 2024	ESMC Appendix 3

Critical habitat is defined in the ESA as "specific geographic area that contains features essential for the conservation of a threatened or endangered species and that may require special management and protection." An area can only be established as 'critical habitat' after the USFWS has published it in the Federal Register. The ESA also states that "the secretary shall not designate as critical habitat any lands or other geographic areas owned or controlled by the Department of Defense, or designated for its use, that are subject to an INRMP prepared under section 101 of the Sikes Act, if the Secretary determines in writing that such plan provides a benefit to the species for which critical habitat is proposed for designation." This INRMP helps FJ fulfil its obligations so that no area on the installation is considered critical habitat for any listed species.FJ will manage its lands with an ecosystem approach, and in accordance with the Red-cockaded Woodpecker recovery Plan (USFWS 2003), the Army Management Guidelines for RCWs (US Department of Army 2007), and the ESMCs of this INRMP.

The conservation of the listed (and potentially listed) species is described in the ESMC for the RCW (Appendix 1), the ESMC for Smooth Coneflower and Rough-leaved Loosestrife (Appendix 2), and the ESMC for the Tricolored bat (Appendix 3). The seven species are briefly described below with a mention of current USFWS consultations and potential climate change impacts.

American wood stork - These long-legged wading birds show up rarely on water bodies of FJ to forage, they do not nest on the installation. This species was downlisted to threatened in 2014 and was proposed to be delisted in 2023, but delisting is still pending. They forage in shallow, calm freshwater or estuarine wetlands for small fish. They nest in colonies which historically have been close to the coastline of SC, but colonies have been moving inland in the last few decades. The predicted climate change hazard of drought could, at first, concentrate fish into smaller areas of water and benefit foraging, but in the long-term will decrease reproduction of fish. An increase in heat might have been influencing this species to move nesting colonies inland in the past few decades and might increase that spread in the future. This might cause

nesting colonies to become established in trees over FJ water bodies and wetlands. If that were to happen and they were still listed as threatened, we could implement minor restrictions on disturbing the nesting colony during breeding season.

Bald eagle - In 2010 the first nesting pair of bald eagles was documented on FJ on the edge of Dupre Pond and has been active every subsequent breeding season. The nest typically produces two fledglings per year. These birds, which require open water habitats for foraging, are no longer on the endangered species list but are protected by the BGEPA and state laws. A 300-foot buffer is preserved around the nest and the airspace above it is restricted as a no-fly zone. The nest is monitored yearly and reported to SCDNR. The increase in violent storms as a result of the climate change hazard of increased heat could damage nests. The hazards of drought and/or flooding could interfere with foraging in ponds and lakes.

Monarch butterfly - Monarch butterflies occur on FJ during fall and spring migration and during the spring breeding season. They use flowering plants for nectar and milkweed for larval support. FJ has three species of milkweed and is documenting milkweed locations as future sites of preservation and propagation. The USFWS has deemed Monarchs a candidate for listing that is 'warranted but precluded' due to their wide range and impacts. The threats to Monarchs include habitat loss, herbicides, insecticides and climate change. The dominant climate change hazards of increased heat and drought might alter their breeding and migration routes and interfere with timing of their link with milkweed phenology. Heat has been shown to impact Monarch fecundity, mating success and survival during migration and temperatures consistently above 91-95°F are unsuitable for Monarchs (USFWS 2020). The climate change hazard of increased wildfires might harm milkweed at sensitive times of year for larvae.

RCW - This species requires old-growth pine forests with a diverse ground cover and sparse midstory maintained by frequent fire. RCW are intensively managed on FJ according to our ESMC (Appendix 1). Our most recent BO (USFWS 2013) requires that we continue to protect and buffer territories, prevent cavity trees from burning while managing with prescribed fire, and support growth with artificial recruitment clusters and nest boxes. An increase in wildfires due to climate change might burn cavity trees before they can be protected, but FJ has a rapid response plan for wildfires which includes protecting RCW cavity trees when it is safe for humans to do so. Climate change poses the threat of earlier nesting due to heat which may disassociate the feeding of chicks with proliferation of insect prey. The climate change hazard of drought could also negatively affect insect (i.e. prey) production. In the long term, changes in temperature and precipitation can influence the distribution of longleaf pine vegetative communities upon which RCWs depend. The intensity and frequency of hurricanes are predicted to increase further in response to future climate warming, which can threaten populations of RCWs (USFWS 2020b).

Rough-leaved loosestrife - This small yellow-flowering rhizomatous perennial herb is located along Buffalo Creek in the impact area, but nowhere else in the state (USFWS 1995). Preferred wetland habitats typically have acidic soils with a sand component. It reproduces mostly through asexual rhizomatous growth. Sexual reproduction is limited by low seed production and dispersal. This species has decreased precipitously since 1997. Since 2000 FJ has struggled with the timing and intensity of fire requirements for this species. The ESMC for this species (Appendix 2) received a BO (USFWS 2007) which is still in effect. In addition, in 2015 FJ

received a concurrence letter from the USFWS concurring with our plan to revert to a one or two-year burn rotation in the late winter or early spring. Climate change hazards of either drought or heavy rainstorms due to increased heat, or increased wildfires can potentially threaten this species. The timing of flowering and pollinators might also be negatively affected by increased drought or heat.

Smooth coneflower - This species is a rhizomatous perennial herb with purple ray flowers that reach up to 3.3 feet tall. They typically occur on high-pH calcium-rich soils with areas of bare ground and high amounts of sunlight (USFWS 1995b). Two populations of coneflower have been found on FJ even though typical habitat for this species does not occur on the installation. The populations may have been planted by humans near a homestead and spread from there. Smooth Coneflower was downlisted to threatened in 2022. The ESMC for this species (Appendix 2) received a BO (USFWS 2007) which is still in effect. FJ has a 2015 concurrence letter from the USFWS concurring with our plan to burn the habitat on a two-year rotation in the late winter or early spring. The dominant climate change hazard of increased heat might alter the link between the timing of flowering and the presence of pollinators. Increased heat and wildfires might interfere with plant seed production and survival at sensitive times of the year.

Tricolored bat - This species is wide-spread in SC but is listed as proposed-endangered due to White-nose syndrome in the northern parts of its range. USFWS expects it to be listed as endangered soon, so an ESMC (Appendix 3) has been prepared. Adults roost in clumps of dead needles or leaves in trees and change roosts regularly. In a 2024 CO for the construction of a new range (USFWS 2024), FJ agreed to avoid vegetation clearing during possible winter torpor dates (15 Dec-15 Feb) and maternity season (1 May-15 Jul), leave snags standing when possible, and monitor known bat roosts along with other measures. Climate change hazards of heat and drought may decrease the insect prey of bats while increased wildfires might burn roost trees. Temperature affects important processes of bats such as hibernation, reproduction and growth, so increased heat could have unknown effects in addition to making southern hibernation sites unsuitable.

4.1.2 Species of Concern – Species of concern are any species that are not yet listed by USFWS but are declining or appear to be in need of conservation in order to sustain the military mission in the future. This list (Table 4.2) includes flora and fauna that are Army species-at-risk, federal at-risk species, state-listed species or other rare species. FJ will keep an eye on these populations and contribute to data collection projects by federal or state partners as they arise. The habitat conservation efforts currently being implemented to support the mission also benefit these species of concern. Prescribed fire, the NEPA review process, forest management, preservation of snags, retention of mature, large-diameter trees for bat roosts, and protecting riparian buffer zones as part of best-management practices during forestry operations all allow for a diverse understory for development of prey species. These practices contribute to insect, plant, salamander and bat survival and fitness.

Table 4.2. Species of Concern on Fort Jackson, SC. Eleven flora and fauna that are at-risk species, state-listed species or other rare species that are declining or appear to be in need of conservation.

Common Name	Scientific Name	Species Status and Rank*	SWAP Priority‡	Installation Presence	Installation Priority†
American Bumble Bee	*Bombus pensylvanicus*	At-risk species G3G4/SNR		Undocumented but likely	Low
Bog Spicebush	*Lindera subcoriacea*	At-risk species; G3/S3	High	Historic occurence	Low/mod
Chamberlain's dwarf salamander	*Eurycea chamberlaini*	At-risk species; G4/S3	Highest	Resident	Moderate
Chapman's triodia	*Tridens chapmanii*	G5T3/S2	High	Resident	Low
Eastern Arogos Skipper	*Atrytone arogos arogos*	At-risk species; G2G3/SH	Unranked priority insect	Historic occurrence	Low/mod
Henslow's sparrow	*Centronyx henslowii*	Army Species at Risk; G4/S1?N	Highest	Undocumented but likely	Low/mod
Little brown bat	*Myotis lucifugus*	At-risk species; G3G4/S2	Highest	Undocumented	Low/mod
Piedmont water-milfoil	*Myriophyllum laxum*	G3/S2	High	Resident	Low
Purple balduina	*Balduina atropurpurea*	At-risk species; G2/S1	High	Historic occurrence	Moderate
Rafinesque's big-eared bat	*Corynorhinus rafinesquii*	State endangered; G3G4/S2	Highest	Resident	Low/mod
Rusty blackbird	*Euphagus carolinus*	Army Species at Risk; G4/S3N	Highest	Undocumented but likely	Low

*Species status: G (Global rank) or S (State rank) 1- critically imperiled, 2- imperiled, 3- vulnerable, 4- apparently secure, 5- secure. H- possibly extirpated, N-non-breeding population, NR-not ranked, ?-inexact rank.
‡SWAP priority: Highest- imperiled species that may become extirpated in SC, High- imperiled species that may continue to decline, Moderate-currently stable species but of concern to do increasing threats.†Installation priority based on level of decline and impact to mission: low, low-mod and moderate.

4.2 WETLANDS, FLOODPLAINS AND DEEP-WATER HABITATS MANAGEMENT - The discussions on Wetlands and Deep-Water Habitat, and Floodplains have been consolidated into one discussion for the purpose of this INRMP.

4.2.1 Objectives - Wetlands, floodplains, and stream buffers are critical in the protection and maintenance of living resources. Wetlands are also important in the protection of surface waters in accordance with the Rivers and Harbors Act of 1899; Executive Order (EO) 11990, Protection of Wetlands; Sections 401 and 404 of the Clean Water Act (CWA); and presidential policy mandating "no net loss" of wetlands (National Policy Issuance #91.01, Wetlands). Meeting the President's challenge, the US Army has a mandate to protect wetlands, to the maximum extent practicable. The following regulations, laws and EOs are pertinent to wetlands, floodplains, and stream buffers for the FJ area of the state of SC:

- EO 11990 Protection of Wetlands (amended by EO12608, Codified at Chapter 40)
- Section 401 of the CWA
- Section 404 of the CWA
- EO 11988—Floodplain Management (amended by EO 12148, Codified at Chapter 40)
- SC Stormwater Management and Sediment Reduction Act of 1991

US Army policy is to avoid adverse impacts to existing aquatic resources and offset those that are unavoidable. The US Army's goal is no net loss of values and functions to existing wetlands and no overall net loss of wetlands on US Army controlled lands. Furthermore, the US Army takes a progressive approach to protecting existing wetlands, rehabilitating degraded wetlands, restoring former wetlands, and creating wetlands to increase the quality and quantity of the Nation's wetlands resource base. Similarly, EO 11988–Floodplain Management addresses floodplain impacts.

4.2.2 Wetland Management – FJ will identify and maintain a current inventory of wetlands and surface water resources through Planning Level Surveys. A Memorandum dated 21 March 1997, 'Army Goals and Implementing Guidance for Natural Resources Planning Level Surveys and INRMP' provides guidance for planning level surveys. The following steps will be taken by FJ to mitigate the effects of specific projects on wetlands:

1. Through early planning, coordination, and NEPA reviews, decide whether alternatives are available that do not impede wetlands. Avoiding or reducing the amount of wetlands affected by the action often economically benefits the US Army.

2. The US Army Corps of Engineers (USACE) Charleston District will determine the boundaries of affected wetlands through wetland delineations.

3. When all wetland information is assembled, request that the USACE determine whether the wetland is jurisdictional and whether a Section 404 Permit is required. If the site requires a Section 404 Permit, a detailed design and permit application will be prepared before performing any work associated with the discharge of dredged or fill material into the wetland.

4. During the planning stages and NEPA process, the environmental staff determines whether any other laws or regulations apply to a proposed action in a wetland. This focuses on the ESA and Migratory Bird Treaty Act (MBTA). Regarding the ESA, if an action may affect a listed species, consultation with the USFWS is initiated.

5. The environmental staff determines whether a Nationwide Permit might apply to the intended action. They also determine whether the state requires a Section 401 Water Quality Certification and or the locality has individual permit requirements related to watershed, wetland, or stream quality.

If the project requires Section 404 permits, the environmental staff will demonstrate avoidance and minimization of wetland impacts followed by mitigation as a last resort, per the Memorandum of Agreement (MOA) between Department of the Army and the Environmental Protection Agency (EPA, 1990).

In addition to complying with regulatory requirements related to jurisdictional wetlands, FJ will, to the greatest extent practicable, identify and conserve small isolated ephemeral wetlands which serve to enhance biodiversity and may serve as critical areas for amphibians and reptiles.

4.2.3 Floodplains Management - EO 11988 requires all Federal agencies to provide leadership and take action to reduce the risk of flood loss; minimize the impacts of floods on human safety, health, and welfare; and restore and preserve the natural and beneficial values of floodplains when acquiring, managing, or disposing of Federal lands. Prior to implementing a proposed action, FJ's planners consult the National Flood Insurance Program (NFIP) maps distributed by the Federal Emergency Management Agency (FEMA) to determine if the proposed action occurs in a floodplain. If NFIP maps do not cover the affected area, a professional engineer prepares floodplain map contours. FJ implements the floodplain requirements through planning review and stormwater management programs. The erosion and sediment programs of the state and local issuing authorities review all development and prevent construction of structures within critical floodplains. Additionally, FJ hydrologic/hydraulic study maps and the project's storm magnitude severity are reviewed to determine potential impacts to floodplains. The following steps are taken to minimize impacts to floodplains:

1. Through NEPA and early project planning stages, decide if projects are located in a floodplain. Investigate alternatives that are available to relocate the project.

2. FJ will determine the boundaries of the floodplain in accordance with the FJ hydrologic/ hydraulic study or the FEMA floodplain maps.

3. Assemble all pertinent associated material, including aerial images and maps (topographical, etc.).

4.2.4 Deep-water Habitat - A total of 29 impoundments have historically been located on FJ. A few of these ponds have been lost due to dam breeching and a few more have been created by beaver activity over the past few decades. The FJ Wildlife Branch is responsible for the management of natural resources associated with impoundments on the installation, and management guidelines are provided Section 4.4.6 of this INRMP.

4.2.5 Stream Buffer Management Zones - The SC Stormwater Management and Sediment Reduction Act of 1991 establishes minimum standards and procedures for a statewide stormwater management and sediment reduction program. While it has no specific provisions for

riparian forest buffers, it does establish that land disturbing activities one acre and greater must submit a stormwater management and sediment control plan and obtain a permit to proceed from SC Department of Environmental Services (SCDES). This Act does not include agricultural, or forest land used for timber harvest.

Land disturbing projects on FJ are reviewed through the NEPA evaluation process to determine if a stormwater management and sediment control plan is needed. If needed, one is prepared and a permit to proceed is obtained from the SCDES.

Timber harvesting actions performed on FJ comply with practices outlined in the BMPs for SC's Forest Wetlands and requirements of Section 404 of the CWA.

4.3 ENFORCEMENT OF NATURAL RESOURCES LAWS AND REGULATIONS - The installation's Garrison Commander has the authority and responsibility to enforce natural resource laws under 16 USC § 670a (b) (3) (A), 10 USC § 2671(c), and AR 200-1.

Enforcement of natural and cultural resources laws are a vital aspect of management. Rules and regulations are developed to protect rare or unique species, protect sensitive areas and keep sportsmanship an active part of hunting, trapping and fishing.

Pursuant to the Garrison Commander's inherent responsibility to provide for the safety and security of the installation, FJ Conservation Law Enforcement Officers (CLEOs) are duly commissioned law enforcement officers specially trained and delegated the authority to enforce all natural and cultural resource laws, statutes and regulations on FJ. CLEOs are assigned to the DES.

CLEOs support FJ's mission by conducting law enforcement patrols and investigations; providing for the safety of recreationists and military users of the land; conducting federal and state license compliance inspections to ensure recreational users are properly authorized to hunt and fish on the installation and comply with all wildlife related laws and regulations; maintaining a proactive environmental and wildlife education program to deter intentional or inadvertent violations of the law; and assisting the installation's requirement to meet natural resource objectives as outlined within this Plan. DoDI 5525.17 lists the responsibilities and procedures of CLEOs on FJ.

Natural resources enforcement on FJ occurs year-round, with particular emphasis on the various hunting and fishing seasons.

4.4 FISH AND WILDLIFE MANAGEMENT

4.4.1 Management Plan - FJ's fish and wildlife management actions contained in this plan are based on sound scientific research and history of past management success on FJ. Biodiversity and ecosystem management strategies are incorporated in this multiple land use management plan.

4.4.2 Management History - A detailed discussion of the history of natural resources management on FJ is provided in Section 2.1.3.3 of this INRMP.

4.4.3 Management Goals – FJ aims to maintain viable populations of all native fish and wildlife species that occur on the installation. This includes maintaining and managing all populations of wildlife, game, nongame, threatened and endangered species as well as fisheries.

4.4.4 Fish and Wildlife Resources

4.4.4.1 Fisheries - Abundant fishing opportunities exist both in the cantonment area and the training areas of FJ. Water bodies in the training areas include these ponds: Boyden Arbor, Upper Barstow, Lower Barstow, Clark, Cobb, Messer's, Odom, Davis, Chaver's, Dupre, and South. These ponds are all fed by Colonel's Creek or Gill's Creek, or a tributary associated with one of these streams. The primary fish species in these ponds are largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), and redear sunfish (*Lepomis microlophus*), but many other species are present. Other fish that are routinely caught include redbreast (*Lepomis auritus*), crappie (*Pomoxis annularis, Pomoxis nigromacalatus*), and chain pickerel (*Esox niger*). These fisheries are not intensively managed, but supplemental fish stocking and aquatic vegetation control occur as the need arises and when resources are available. Some of these ponds are also utilized as waterfowl areas and undergo water level manipulations as a result. Cantonment area waters include Inchon Lake, Upper Legion Lake, Lower Legion Lake, Arrow head Pond, Old Mill Pond, Golf Course Ponds 1, 2, and 3, Catfish Pond, Price's Pond, Old Heise Pond, and Varn Lake. These fisheries are more intensely managed because they are more accessible to anglers and, therefore, more heavily utilized. Ponds are stocked with bluegill (bream), redear sunfish (shellcracker), largemouth bass, and channel catfish (*Ictalurus punctatus*). Stocked ponds are closed to fishing until the fishery is established, and then creel limits are used to prevent over-fishing. Heavier emphasis is also placed on aquatic vegetation management in these ponds. One large lake is also located on the installation; Weston Lake is considered a self-sustaining fishery due to its size.

4.4.4.2 Streams and Creeks - In addition to the lakes and ponds there are also two major creek systems on FJ, Colonel's Creek and Gill's Creek. These creeks offer fishing opportunities for redbreast, bass and other species including bluegill, warmouth (*Lepomis gulosus*), and chain pickerel.

4.4.4.3 Potential for Fisheries - Experience has shown that managing fisheries associated with large stream systems is very difficult as a result of high flow rates and the presence of native predatory fish associated with the streams. Due to limited resources and a lack of success in the past, fishery management on training area waters will continue to be less than that of cantonment area waters. Since cantonment area waters are also much more heavily utilized by anglers, fish stocking and aquatic vegetation management efforts will be focused in these areas. The need for stocking will be determined through balance checks conducted with seine nets and/or fish traps. Creel limits and re-stocking rates will be applied accordingly. Vegetation management will be achieved primarily through aquatic herbicide applications and the introduction of sterile grass carp. Supplemental feeding may also be used as a management

tool on these ponds. These waters have and will continue to provide the opportunity for successful fishing.

4.4.4.4 Hunting for Game Species - FJ is inhabited by wildlife species typical of the sandhills and upper coastal plain regions of SC. Many of these species are actively managed for sport hunting. The most commonly pursued game species on the installation are white-tailed deer, eastern wild turkey (*Meliagris gallopavo*), wood duck (*Aix sponsa*), Canada goose (*Branta canadensis*), mourning dove (*Zenaida macroura*), northern bobwhite quail, eastern gray squirrel (*Sciurus carolinensis*), and racoon (*Procyon lotor*). Other species that are taken occasionally (normally while in pursuit of one of the commonly pursued species) include ring-necked duck (*Aytha collaris*), mallard (*Anas platyrhynchos*), green-winged teal (*Anas crecca*), rabbit (*Sylvilagus aquaticus, Sylvilagus floridanus*), fox squirrel (*Sciurus niger*), opossum (*Didelphis marsupialis*), and beaver (*Castor canadensis*).

4.4.4.5 Non-Game Species - SC state law prohibits the taking of most non-game wildlife. Armadillos (*Dasypus novemcinctus*), coyotes (*Canas latrans*), and feral hogs (*Sus scrofa*) are not considered game animals in SC or on FJ. These animals may be harvested on FJ during any hunting season within the legal parameters of that season. In addition, hunting for these species is allowed outside of game seasons as defined in the FJ Hunting and Fishing Regulation (FJ 28-4; Appendix 8).

Enforcement of regulations, prescribed burning, forest management, and management of wildlife openings are some of the tools used for management of non-game species on FJ. Other actions that benefit non-game species include the placement and maintenance of artificial nest structures and the planting of vegetation that benefit both game and non-game wildlife. FJ maintains nesting structures (see Section 4.4.7.9) for American kestrel (*Falco sparverius*), purple martin (*Progne subis*), and eastern bluebird (*Sialia sialis*.) and participates in non-game bird surveys and monitoring (see Section 4.7 and Appendix 4). Habitat conservation and management, especially the use of prescribed burning, benefits pollinator species as well.

4.4.5 Hunting and Fishing Program

4.4.5.1 FJ Access for Hunting and Fishing - The regulations regarding the Hunting and Fishing Program are defined in FJ Regulation 28-4 (Appendix 8): Authorized Patrons**.** Safety, security, and the sustainability of natural resources are the primary concerns of the Hunting and Fishing Program. Therefore, fishing and hunting access is restricted to the following groups of individuals: all active-duty personnel, military retirees, DoD appropriated fund and non-appropriated fund personnel, retired civilian employees, reservists, National Guard, family members of the above, DoD contractor employees, and others as determined by the Installation Commander. The general public may participate in specific hunting and fishing events or programs as organized by DFMWR, or when sponsored by an individual listed above. All iSportsman users are required to acknowledge a Hold Harmless Agreement in the system prior to hunting, scouting or fishing on FJ.

4.4.5.2 License Sales - As set forth in The Sikes Act and AR 200-1 fees are collected in the form of FJ hunting and fishing permits. All fees collected will be accounted for in

accordance with guidance provided for the appropriation titled Wildlife Conservation Military Installations, Army account 21X5095 (AR 37-100 and 37-108). These funds (21X funds) may be used only for fish and wildlife management on the installation where they were collected. Permits are sold through the FJ iSportsman program. Qualified personnel must possess both applicable state and FJ licenses to legally hunt or fish on the installation.

4.4.6 Fisheries Management

4.4.6.1 Lime and Fertilizer - Lime and fertilizer may be applied to increase productivity of certain ponds. Most ponds on FJ exist on streams that have a relatively high rate of flow. Maintaining a good phytoplankton bloom with the application of lime and fertilizer can be difficult and expensive. Only a few ponds have characteristics which make them suitable for lime and fertilizer applications.

4.4.6.2 Aquatic Weed Control - Aquatic weeds will be controlled using the integrated pest management approach. This approach implements the most effective, inexpensive and most current scientific methods available. Aquatic weeds are recognized as a natural and necessary part of a lake ecosystem and will only be treated when their growth becomes excessive. Several methods under the integrated pest management philosophy will be used to help control the aquatic vegetation in the ponds. A brief description of methods to be used follows:

1. Winter Draw Down - In the fall of the year, water levels may be reduced to expose the weeds to freezing and drying conditions. This will also help in driving small baitfish out into open water and increase the food source for game fish over the winter months. Levels will be restored in the spring of the year as fishing pressure begins to increase in the ponds and as spawning seasons begin. Water bodies utilized as waterfowl areas will not undergo this type of treatment. Instead, a moist soil management program may be implemented.

2. Chemical – Chemical herbicide applications should be used as early in the spring as possible to bring aquatic vegetation under control before a complete infestation has occurred. Appropriate aquatic herbicides will be applied as needed to control weeds during the spring and summer months. Product label instructions will be followed, and the chemical application will comply with all DoD and EPA requirements. Usually only a small portion of the lake will be treated at any one time to protect against lowering oxygen levels and causing fish kills. Treated lakes will be closed to fishing during the application and for the required time in accordance with the herbicide label.

3. Biological control (grass carp) – Triploid grass carp (*Ctenopharyngodon idella*) may be added to some ponds on a limited basis to reduce aquatic vegetation. Triploid fish are stocked preventing the natural reproduction of the species. Fish are purchased from a local certified supplier who can provide certificate of triploidy.

4.4.6.3 Cover\Fish Attractors - Fish attractors in ponds can benefit all species of fish. Benefits include the aggregation of baitfish, additional substrate for aquatic invertebrate production, increased spawning habitat, and shelter. Some of the cantonment area ponds on FJ

lack structure that would be used as cover by fish species. Several types of fish attractors may be used on FJ including sunken Christmas trees, PVC structures, and pallets. Attractors will be marked with buoys anchored near the attractor site to allow anglers to locate and fish on the sites. Fish attractor site selection is based on the amount of naturally occurring structure, water depth, pond size and angler use.

4.4.6.4 Population Census - Fish population sampling has traditionally emphasized ponds and lakes under management. Sampling is conducted from April to September to evaluate the presence and relative abundance of largemouth bass and bream reproduction; the presence and relative abundance of intermediate-sized bream and bass; the condition of all species; and the presence and relative abundance of competitive nongame species.

Several methods will be used to estimate the number, species composition, and age class of fish in FJ lakes and ponds. This is required to make decisions on management of the fisheries resources. Some of the following methods may be used:

1. Creel surveys - these surveys can be an integral component of managing recreational fishing. Creel surveys can assess:

- Quality of sport fishing, expressed as species caught and number and weight of fish caught per unit of fishing effort
- Fishing pressure, expressed as angler-hours of fishing effort for all species or separate species
- Total yield of fish in terms of species numbers and weights for specific segments of time
- Composition of the catch, as a percentage of total numbers, and weights for various species and classes of fish
- Characteristics of the fishery, such as socioeconomic information about the angling population and value of the fishery to surrounding communities
- Statistics about the fishing population, such as annual exploitation rate of various year classes of selected species, appraisal of new year classes recruited into the fishery, and population estimates and mortality rates for selected species

Creel surveys must be repeated periodically to observe trends and record changes that may impact the fishery. Changes in fisheries management may be required to keep abreast of changes in fishing pressure, catch rates, etc. as determined from survey results. Creel surveys can also measure effects of management techniques, such as drawdown, fish population control actions or fishing regulations. Finally, creel surveys furnish information of interest to anglers that may aid them in their own fishing efforts. The creel survey must be statistically valid and cost effective. Survey design should be based on random sampling. The survey should incorporate a stratified sampling scheme to increase the homogeneity of each sampling unit. Because of time, cost, and logistical constraints, it may be necessary to divide the fishery into smaller units with different sampling probabilities. Such a design can minimize cost and labor and increase survey precision. Survey types include roving creel or access point surveys, telephone surveys, questionnaires, iSportsman harvest forms, or combinations thereof.

2. Basket Survey - Baskets or traps may be used by biologists to catch species not usually caught in other survey methods. This helps to alert them to the presence of unwanted species.

3. Seine Net Survey - The balance between predator and prey species may be monitored by biologists using seine nets. A seine haul consists of anchoring one end of the seine at the bank and pulling the other end straight out into the water to full length and sweeping back to shore in an arc, thus sampling a quadrant. Fish in the sample are identified to species and counted and weighed.

4.4.6.5. Drain and Restock - When survey results indicate that the fish population of a lake is extremely out of balance or when the number of game species becomes too low, the lake may be drained and restocked. The cost and required resources of draining and restocking will have to be considered due to various factors, including the condition of water control structures. For stocking of bass, bream, and catfish lakes the rates of stocking are determined by management practices to be carried out. The recommended rates for initial stocking for fertilized vs. unfertilized lakes are listed in Table 4.3.

Table 4.3 Stocking Rates for Fertilized and Unfertilized Ponds on Fort Jackson, SC.

Species	Rate per surface Acre for a Fertilized Pond	Rate per surface acre for an Unfertilized Pond
Bream (Bluegill 70 percent) (Redear sunfish 30 percent)	1000	500
Largemouth bass	100	50
Channel catfish	100	50

4.4.6.6 Feeding -Supplemental feeding can be used to enhance available nutrition and to serve as an attractant to increase angler success. Automatic fish feeders and pelleted fish food will be the primary means of supplemental feeding. Automatic feeders can provide three percent of a fish's body weight in food on a daily basis, which is the desired rate of feed. The stocking of live forage is also an option. Forage stocking options will be carefully considered to ensure that species chosen will have no negative impacts on the water body. These tools can allow for faster growth of fish and better sport-fishing opportunities in these lakes.

4.4.6.7 Fish Consumptions Guidelines - Current fish consumption guidelines are published by the SCDES.

4.4.6.8 Fish Kill - A 'Fish Kill' is a sudden death of a large number of aquatic animals including fish, prawns and crabs (SCDES). Fish kills usually take place in a defined area and over a short period of time.

1. Causes of Fish Kills - Fish kills may be entirely due to natural causes or in some way due to human activity. The following describes some of the common causes of fish kills and the possible associated conditions.

a. Low dissolved oxygen levels - Low dissolved oxygen levels are probably the most common cause of fish kills. The depletion of oxygen may result from several causes but are usually due to the use of oxygen by organisms such as algae, aquatic plants (at night), or bacteria in the presence of organic matter. Situations that may lead to oxygen depletion include:

- Discharges of organic matter (i.e. sewage)
- Anaerobic mud stirred up from the bottom
- Rapid turnover of a stratified waterbody
- Decaying macrophytes and algal blooms

The ability to tolerate low dissolved oxygen levels depends on the species of fish and their size. The response of fish to low dissolved oxygen levels is to gasp at the surface to force oxygen across the gills.

b. Rain and run-off - Heavy rainfall and subsequent flooding may wash organic matter such as leaf litter and other plant material, animal manure and organically rich soils into the water bodies. This promotes increased bacterial decomposition and may result in the depletion of oxygen. Fish kills during the late build up and early wet season are often caused by this post run-off deoxygenation. Run-off may also carry potential toxic material including oils from the roadways, contaminated soils (i.e. pesticides and insecticides), toxic spills and acid sulphate soils.

c. pH stress - pH is the measure of water acidity and can vary greatly in the natural environment. Generally, freshwater streams are slightly acidic whereas estuarine water bodies may be slightly alkaline. Sudden changes and extremes in pH (i.e. acidic or alkaline) may be lethal to fish, either directly or indirectly through the mobilization of heavy metals from soils. In extreme cases, acidic "burning" of the gills indicated by, brown discoloration of the gills or excessive mucous secretion may be evident on the affected fish. The change in pH levels can occur naturally, through runoff from acid-sulphate soils or artificially through industrial effluent, contaminated runoff and acid or alkali spills (SCDES).

d. Excessive plant growth - Excessive aquatic plant growth due to increased nutrient concentration in waterways can cause fish kills through super saturation of oxygen during the day or the depletion of oxygen during the night (SCDES). The plants, including algae, produce oxygen during daylight hours (photosynthesis) and consume oxygen at night (respiration). Although oxygen is produced during the day, the consumption of oxygen during the night may be such that oxygen levels are depleted to a level lethal to fish. Another problem with excessive plant growth is that during periods of die-off, the increased organic loading is consumed by increasingly large numbers of bacteria. The bacteria's high oxygen requirements can quickly lead to anoxic conditions resulting in a fish kill. Increased nutrients may also cause algal blooms. Most algal blooms appear to be harmless but under exceptional conditions, may become so densely concentrated that they generate anoxic conditions that can cause fish kills. Certain species such as dinoflagellates and cyanobacteria can also produce potent toxins. Algal blooms generally consist of a single species making identification important to aid in its control. Differences in watercolor (yellow, brown, green, blue or milky) may be a good indicator of an algal bloom and help in the identification of the organisms involved (SCDES).

e. Water temperature - Exposure to extreme water temperatures is a potential cause of fish kills. This may happen towards the end of the dry season, when the water temperature may exceed the tolerance range of the fish, resulting in fish deaths. Water temperature may affect fish in two ways. The metabolic activity of fish (oxygen consumption) is related to temperature; an increase in temperature will increase metabolic activity. Water temperature also affects the amount of soluble oxygen in the water, with increasing temperatures comes decreasing oxygen levels. Consequently, in very warm areas, metabolic activity increases and thus oxygen consumption is high whilst the potential concentration of dissolved oxygen is low. However, as with other water quality variables, tolerance levels do vary between species of fish and most species are generally tolerant to temperature extremes when gradually acclimatized.

f. Parasites and diseases - Fish are subject to a variety of bacterial, viral and parasitic diseases. Under stressful conditions, physical and environmental (i.e. extremes in water temperature, pH, etc.), the resistance of fish to disease is lowered and infections can occur. Usually, histopathological examination of fresh tissue is required to determine the presence of diseases.

g. False fish kills - False fish kills refer to the situation where unwanted "rubbish" fish have been discarded. The fish are usually small, undesirable species with hook related injuries or some other man-made interjection.

h. Pollution - Pollutants can come from a variety of sources including industrial waste, sewage and agricultural chemicals (pesticides and insecticides). Pollution can kill fish either by direct poisoning or indirectly, by a catastrophic change in water quality. It is often difficult to identify the cause of a chemical fish kill. The quick dilution in run-off and rapid (less than 48 hours) degradation of the many common pesticides and insecticides often removes any evidence of a chemical spill. Poisoned fish (affected by pollutants) often show signs of internal hemorrhaging and erratic swimming behavior.

2. Notification of a Fish Kill - It is important that all fish kills are reported as soon as possible. Usually, the cause of a fish kill can only be determined when investigating officers are on site during or just after the actual fish kill event. A rapid response is necessary to identify the cause or before the causing agent may become diluted or dispersed.

3. Fish Kill Investigations - Fish kills (observed deaths of fish) in most cases are caused by natural events; however, because these events are often very visible, they can cause considerable concern within the FJ community. There may be a single or a combination of causes for fish kills. It is, therefore, important that information recording and sample collection is carried out as described within the program manual. With accurate information and suitable samples, the cause of a fish kill can be rapidly determined. ENV is the lead organization to respond to reports of fish kill on FJ. It will liaise with other relevant organizations including the SCDES, SCDNR, and the USFWS.

4.4.7 Wildlife Management Practices

4.4.7.1 Ecosystem Restoration and Habitat Improvement - FJ employs multiple techniques to enhance and restore the native longleaf pine habitat. Commercial tree harvesting, prescribed fire, herbicide applications, and mechanical vegetation control all contribute to the restoration efforts. These actions are described in more detail in Appendix 1. In addition to the longleaf pine forest types, FJ contains other habitat types that are protected or managed for the benefits of game and non-game wildlife. This diversity also contributes to the overall sustainability of the installation for long-term utilization for military training.

To maintain and enhance the wildlife on FJ, a variety of habitat types will be maintained. A greater variety of habitat types will allow for a greater diversity of wildlife species living on FJ. Most efforts are directed toward activities, such as prescribed fire and commercial timber harvesting, that will benefit multiple species, both game and nongame. A few species-specific activities will be utilized for the most popular game species on FJ.

4.4.7.2 Prescribed Fire - Prescribed fire is one of the most cost-effective methods to set back plant succession over large acreages. The RCW is the primary featured species regarding growing season burns, as described in Appendix 1. Prescribed fire can also be of great benefit to other wildlife species, such as the wild turkey and various small game species. Fire can also benefit white-tailed deer by increasing the availability and nutrition level of understory plants; reducing large, woody understory stems; encouraging production of new sprouts; reducing roughs that suppress forbs and grasses; keeping browse within reach of deer; and encouraging understory fruit and mast production.

Prescribed fire is also used for the prevention of potentially catastrophic wildfires. Most areas will be burned on a 1-to-5-year rotation, with a preference for a 2-to-3-year rotation. Certain impact areas and ranges may be burned annually. Fire maintains an open understory that will provide native grasses and legumes, recycle nutrients, and provide bare mineral soil for seed germination. These results will provide a valuable food source in seeds and foraging grounds for many animal species.

Prescribed fire will be one of the main techniques used in managing wildlife habitats. Burning has a positive impact on large areas with minimal cost; therefore, burning is one of the most beneficial management tools. All prescribed fires will be conducted in accordance with the FJ IWFMP (Appendix 5).

4.4.7.3 Native Warm-Season Grasses and Ground Cover - Efforts to enhance and restore herbaceous native ground cover communities are necessary to improve the overall health of the ecosystem. Land and forest management practices prescribed in this plan all take into consideration the effects of the practice on the native herbaceous ground cover. Practices used to enhance native ground cover include:

1. Plantings of native ground cover mixes that contain Southeastern Coastal Plain or Sandhills ecotypes.

2. Eradication of non-native vegetation utilizing an integrated pest management approach, which may include the use of herbicides.

4.4.7.4 Hardwood Mast Management - Mast-producing hardwood tree species that benefit a variety of game and non-game wildlife will be maintained as a component of the ecosystem. Some examples of how these are maintained include the preservation of quality upland hardwoods during timber harvesting and midstory control operations. Although prescribed fire may be used to control hardwood encroachment in upland pine stands, not all the hardwood tree species are affected. Larger diameter hardwoods and certain hardwood species are typically not adversely impacted by fire. Hardwoods found in more mesic areas are often naturally protected from fire resulting in examples of oak-hickory forest types typical of the Piedmont. Mast producing hardwoods are maintained in bottomland hardwood areas and stream-side management zones throughout the installation.

4.4.7.5 Wildlife Openings - Wildlife openings on FJ can consist of areas that are planted annually or on a rotational basis, and openings which remain fallow and are dominated by native grasses and early succession plant species. The FJ Wildlife Branch will continue to maintain wildlife plantings and openings as resources allow.

4.4.7.6 Management of Game Species - Due to the popularity of hunting for certain game species, specific management actions will be conducted to enhance and maintain the populations of those animals.

1. White-tailed deer - The white-tailed deer is the most sought-after game species in SC and on FJ. The primary objective of deer management on FJ is to manage deer numbers to optimize recreational opportunity and to minimize habitat damage, traffic accidents, disease outbreaks, and other negative impacts associated with a high-density deer population. The secondary objective of deer management is to regulate the composition of the harvest to optimize herd health and maximize recreational satisfaction (i.e. improve body weight, and antler characteristics considered desirable by hunters). The maximum sustainable yield for the deer population on FJ is determined through monitoring of herd health characteristics and relative abundance gleaned from harvest data and surveys. Declining harvest data are assessed to determine if over-harvest is responsible. If so, the harvest is adjusted to create a buffer against losses from other mortality factors such as coyote predation. The harvest should then stabilize at the level of maximum sustained yield.

Historically, FJ's white-tailed deer herd was typical of populations with a history of heavy buck harvest and little or no doe harvest. The sex ratio was skewed towards does; the doe population was skewed towards the older age classes; and the buck population was skewed towards the younger ages. During the mid-1980's, individual deer health characteristics were fair to poor, and habitat damage from over-browsing was occurring. Indications were that there was an overabundance of deer in relation to carrying capacity. To reverse the downward trends in condition indices and attempt to realign the deer population with the habitat carrying capacity, a goal was established to reduce the deer population. To reverse this trend, the harvest was increased beginning in 1988 by increasing the doe harvest and maintaining or reducing the buck harvest. This was accomplished by increasing the number of antlerless deer tags issued and maintaining traditional bag limits for bucks. The doe harvest continued to be increased in this manner until it exceeded the buck harvest.

The current deer population on FJ is considered to have an acceptable sex ratio and to be within the carrying capacity of the available habitat. Future management of FJ's deer herd will have to be adjusted to account for factors such as changes in habitat and hunter participation. In addition, the installation is now home to what appears to be a thriving coyote population. This predator is a new variable in the deer management equation, and its effects on the deer population will need to be monitored closely. The following management practices are now being implemented on FJ:

a. Harvest Strategy - FJ's deer season is from 15 August through 1 January for bucks and 15 September through 1 January for antlerless deer. The annual bag limit is three bucks, and two antlerless deer. All deer harvested on FJ are required to be checked in at the Big Game Check Station. FJ's deer seasons and bag limits are never less restrictive than state deer seasons and bag limits for Richland County.

b. Cantonment Area Population Reduction - The deer population in and around the cantonment area can be influenced by the urbanization of adjacent private lands forcing deer onto FJ where there is still available habitat. Due to the large number of deer related vehicle accidents that have occurred in the past, the cantonment deer numbers need to be kept at a reduced level. To decrease the population, archery hunting with harvest of either sex animals is allowed in this urban area beginning 15 September through 1 January.

c. Quality Deer Management - During the 2010 deer season, a survey of hunters was conducted to assess the desire for a Quality Deer Management Area (QDMA) on FJ. Of the responses, nearly 84% favored the establishment of such an area. During a 2011 revision, rules were added to the FJ Hunting and Fishing Regulations (FJ 28-4) that created a QDMA on FJ. Data had long indicated that a majority of the largest bucks harvested on the installation were within close proximity to the East Impact Area (EIA) or the Colonel's Creek drainage. Hunter access to the EIA is prohibited. The Colonel's Creek drainage includes large areas of densely vegetated, swampy terrain which greatly hinders accessibility. Prime habitat, combined with very low human pressure, provides an ideal situation for the maturation of deer in these areas. For this reason, the QDMA was designed to surround these areas. No change was made to the bag limit for this area, but any buck harvested must possess a 12-inch minimum inside antler spread or 4 antler points on one side of its rack. Harvest data from this area will be closely monitored in the years to come, and harvest strategy will be altered if needed. A heavier emphasis may also be placed on supplemental planting and mast-producing tree management within the QDMA, if funds and resources become available. Prescribed burning and mid-story control are also conducted in this area.

d. Hunter Education. The FJ Wildlife Branch will continue to provide information on pertinent subject matter to improve the hunter's understanding of overall management goals and objectives. Subject matter may include various topics such as coyote harvest, timing of doe harvest, or developments in wildlife research.

2. Wild turkey - Good wild turkey habitat exist throughout much of FJ, featuring mature hardwoods along the creek drainages for mast production; mature pine stands; open understories to take full advantage of the turkey's keen sight; scattered clearings for feeding;

nesting and strutting areas, well distributed water supplies; sufficient prescribed fire to stimulate plant production, improve palatability, and nutrition; and reasonable freedom from disturbance. In addition, many of the installation's wildlife openings are managed for the benefit of its abundant turkey population. The DPW Wildlife Branch also closely monitors harvest during turkey season and will close turkey areas when needed to prevent too many males to be taken from any area. The number of check-ins that an individual can have during a day is also limited to reduce pressure on the resource.

3. Bobwhite quail - Although some good quality quail habitat exists on FJ, quail numbers remain significantly lower than they were historically, as is the case throughout most of the southeast. FJ will continue to follow RCW management guidelines for burning and timber harvest. These actions should prove to be very beneficial for quail. Frequent burning favors the growth of annuals and results in a more open condition, which quail prefer. Timber management follows the RCW guidelines and will promote open woodlands beneficial not only to bobwhite quail but also to wild turkey and RCW. Restoration of native ground cover and warm season grasses will benefit quail. Maintenance of wildlife clearings planted with sorghum, millet, partridge pea, wheat, sunflowers, or native warm season grasses in areas throughout the installation will provide an additional food source for quail. The dove field areas, which primarily feature large stands of sesame, sorghum and millet varieties, are often the most beneficial. This habitat management should significantly benefit bobwhite quail.

4. Doves - Mourning dove is a highly mobile species, and local habitat conditions do not limit the total population; however, providing good habitat year-round can increase local populations. Dove management on FJ focuses primarily on concentrating their numbers during hunting season and adjusting annual hunting regulations. Mourning doves are a popular game species among FJ hunters. Doves prefer large, open fields with low ground cover or bare dirt. These environments increase the ability of the birds to forage on seeds and decrease the risk of predation. Supplemental planting of grain crops can also greatly increase the chances that an area will attract and hold doves. This includes crops such as millet, Egyptian wheat, sesame (benne), and others. Consideration will be given to drought tolerance, deer resistance, and attractiveness to off target species when choosing seed types. Cool season crops, such as wheat and oats, are also planted in portions of some dove fields and left standing through the following year to provide another food source for doves. State and Federal law allows for some manipulation of fields to attract doves, so tilling, mowing, and burning are often implemented to expose seed after crop maturation. Herbicides may also be applied to these fields to control invasive weeds. Areas that are planted for doves have been designated as Managed Dove Fields. These areas are only opened to hunting on a rotational basis in order to reduce pressure and maximize dove usage and hunter success.

5. Waterfowl - Nearly all bottomland hardwood stands on FJ contain some oak species for mast production, which is an important food for some duck species, especially wood ducks. Additionally, many of the controlled lakes and beaver ponds serve as roosting and nesting areas. There are also open water areas throughout the installation which are preferred habitats for some waterfowl species. Wood ducks and resident Canada geese are present on FJ all year, but various other species, such as ring-necked ducks and green-winged teal, often visit the installation during winter migration. FJ Wildlife Branch personnel utilize moist-soil management

practices on some ponds to improve waterfowl habitat. Ponds are drawn down in the summer to allow for vegetation to grow around the edges. In the fall the lakes are flooded to allow access to this food source by ducks. Also, seed producing plants may be planted on the edges of these ponds during drawdown to provide supplemental food in the fall of the year, if weather conditions and resources allow. Two impoundments, which are associated with Davis Pond, are planted and flooded annually. These areas are normally planted with small grain crop mixes and provide another supplemental food source for waterfowl. Wood duck nest boxes are a useful management tool that is used on FJ. There are currently more than 100 nest boxes maintained on the installation. A high percentage of these boxes are used by wood ducks each year, and nest success is also high. Waterfowl hunting is very popular pursuit among FJ hunters. The areas where waterfowl hunting is permitted on FJ have been designated as Waterfowl Management Areas. These areas are only opened to hunting on a rotational basis in order to reduce pressure and maximize waterfowl usage and hunter success.

6. Rabbits - Cottontail rabbits thrive in openings where shrubs, grasses, and forbs dominate and in woodlands with fairly open canopies (40 to 50 percent crown closure). This level of canopy closure allows sufficient sunlight to reach the forest floor to produce desirable grasses and forbs. A high degree of pine crown closure serves as a limiting factor to rabbit populations at many areas on FJ. Prescribed fire, which improves nutrition and palatability of food plants, is of little benefit where crown closure prevents the growth of food. Habitat management techniques, such as mowing, harrowing, planting, thinning of pine plantations, and prescribed burning benefit cottontail rabbits. Various wildlife openings, ranges, clearings, and artillery firing points that are dominated by shrubs, grasses and forbs provide good habitat. Pine woodlands of fully stocked pole and sawtimber stands shade the forest floor, inhibiting the growth of adequate succulent forage. Consequently, areas most suitable for rabbits shift throughout the installation as pine stands are altered. Swamp rabbits are also present on FJ. Swamp rabbits generally prefer thickets, marshes, and edges associated with wetland areas. Adequate habitat of this type exists on the installation, but much of it is largely inaccessible. For that reason, the regularity with which swamp rabbits occur on FJ is unknown, and any management attempts would be severely limited.

7. Eastern gray squirrel - Productive gray squirrel habitat contains a wide variety of mast-bearing hardwood trees; fruit producing trees and shrubs; flowers, buds, and cones in addition to adequate den cavities for escape, shelter, and raising young. Suitable gray squirrel habitat exists throughout the installation and is most commonly associated with creek drainages and low-lying areas where a high percentage of FJ's mature hardwoods are found.

8. Fox squirrel - In contrast to the gray squirrel, fox squirrels prefer open park-like woods with sparse vegetation. Since the fox squirrel is adapted to ground movement, it uses widely scattered hardwoods in pine uplands. Management strategy for fox squirrels favors stands of mature pine preferably longleaf, with scattered pockets of hardwoods, which are essential for dens and food diversity throughout the year. Scattered oaks throughout upland pines should also be protected. Snags are left for den sites, except in the cantonment area. Prescribed fire can be utilized every 3 to 5 years to maintain ground foraging habitat.

4.4.7.7 Monitoring - Key information needed to successfully manage a population of wildlife is to estimate/know population size, sex ratio, mortality, natality, and age distribution. To help accomplish this task the following population census and/or sampling methods will be used.

1. White-tailed deer - Check station sampling to record the number of antlered and antlerless deer harvested, the timing of those harvests, and collecting the weights, jawbones to determine age, and antler measurements of bucks will be the main data used to monitor the health of the deer herd. Additional deer surveys could be conducted on an as-needed basis and as time and resources allow. These could include spotlight, FLIR (forward looking infrared), or trail camera surveys.

2. Wild turkey - In the spring of each year, turkey hunt data is collected. The weight, beard length, and spur length of each harvested bird, along with other variables, such as hunter effort, are all monitored. FJ also participates in a turkey brood survey each summer in cooperation with the SCDNR.

3. Bobwhite quail – Every summer, FJ participates in a Bobwhite Quail Whistling Cock survey and a quail sighting/brood survey, both in cooperation with the SCDNR.

4. Fox squirrel – FJ participates in a fox squirrel sighting survey conducted by the SCDNR. The survey collects data on color phases of the squirrel as well as habitat usage and occurs on a two-year rotation.

5. Monitoring Avian Productivity and Survivorship (MAPS) - The MAPS program comprises a continent-wide network of hundreds of constant-effort mist netting stations. Analyses of the resulting banding data provide critical information relating to the ecology, conservation, and management of North American landbird populations, and the factors responsible for changes in their populations. In some years, FJ participates in the MAPS program by using mist nets to capture, collect data, and band birds.

6. Annual nightjar surveys - Nightjars refer to a group of birds that belong to the Caprimulgidae family. Nightjars found on FJ include eastern whip-poor-wills (*Antrostomus vociferous*), chuck-will's-widows (*Antrostomus carolinensis*), and common nighthawks (*Chordeiles minor*). The primary objective of the survey is to contribute data to the Nightjar Survey Network, Center for Conservation Biology, at the College of William and Mary, Williamsburg, Virginia. This data helps determine the population distribution and trends of nightjar species across the US.

4.4.7.8 Nest Boxes - Nest boxes provided for several species on the installation will be maintained, monitored, and for some species, increased.

1. American kestrel - The American kestrel, North America's smallest falcon, is listed by SCDNR as a "Highest Priority Species of Concern" in SC. FJ is involved in maintaining and monitoring American kestrel nest boxes to encourage the reproduction of the species. Fifty-eight kestrel nesting boxes are maintained across the installation. Monitoring

efforts from breeding seasons (2009-2011) show American kestrels using greater than 70% of the boxes for nesting. eastern screech owls, Southern flying squirrels, and eastern bluebirds are other frequent users of the nest boxes. The 'minimum protocol' from the American Kestrel Partnership program will be used for monitoring (https://kestrel.peregrinefund.org/nest-monitoring). No banding or handling of kestrels will occur.

2. Eastern bluebird – FJ maintains 26 eastern bluebird boxes around the cantonment area for the enjoyment of bird watchers. Bluebird populations were declining in the 20th century due to the aggressive competition for nesting cavities from introduced species like the European starling and the house sparrow. The establishment of bluebird nest boxes has helped to increase the population in many regions.

3. Purple martins - In February 2011, biologists in the Wildlife Branch erected a purple martin nesting structure on FJ at Inchon Lake. This was the first time a nesting structure had been placed on the installation for this avian species. Within a month the first purple martin arrived, and by the end of July there were 3 nests that fledged 5 birds each. The most martins counted at the nesting structure were 24 birds. This was an outstanding success as many new martin nest structures do not attract birds for several years. These martins return each year to FJ, enhancing the enjoyment of soldiers and families that visit Inchon Lake recreation area. After the flood of 2015 drained Inchon Lake, the nesting structure was moved to Upper Legion Lake where it has supported purple martins each year.

4. Wood duck – Over 100 wood duck nesting boxes are currently monitored and maintained by Wildlife Branch personnel on FJ. Each winter, boxes are repaired as needed, cleaned out, and filled with new bedding material. Data is also collected on the previous nesting season usage. These boxes provide valuable nesting habitat to wood ducks and are also commonly used by non-game species such as the screech owl. This nesting box program has routinely been successful, yielding high usage rates and hatches each year.

4.4.7.9 Harvest of Game Species - To help maintain stable populations of game species, hunting seasons will be opened annually. These seasons and bag limits will coincide with those set by the SCDNR but may be more restrictive. All Big Game (deer and turkey) harvested will be accounted for on harvest records located at the Heise's Pond Big Game Check Station. All other game species will be recorded on harvest forms at check-out in the iSportsman system. It is mandatory that hunters provide all required harvest information.

4.4.7.10 Control of Nuisance Wildlife and Wildlife Damage - The FJ Wildlife Branch will coordinate with the US Department of Agriculture's Wildlife Services (Wildlife Services) and other agencies for guidance and assistance with the control of nuisance wildlife. Several species of wildlife occur in numbers and locations considered to be unacceptable to people. These nuisance animals will be managed using an Integrated Wildlife Damage Management (IWDM) approach when their Wildlife Acceptance Capacity (WAC) is reached or exceeded.

WAC, sometimes known as cultural carrying capacity, is the maximum wildlife population level in an area that is acceptable to people (Decker and Purdy 1988). For wildlife damage situations,

there will be varying thresholds for those people and resources directly and indirectly affected by the damage. This threshold of damage is a primary limiting factor in determining the WAC. Once this WAC is met or exceeded, population reduction methods are implemented to alleviate associated damage and conflicts.

1. Beavers - Beavers are the most problematic nuisance species on FJ and are present in almost all the water bodies on the installation. Beavers regularly build dams at bridges and water control structures, causing roadway flooding and damage to the structures. Many trees have also been damaged on FJ, either by flooding or girdling. Beaver caused flooding also threatens endangered species habitat and military ranges and training areas on FJ.

Beavers are typically controlled by shooting and trapping with foothold traps, snares, and Conibear traps. Alternatives such as pipes under beaver dams (Clemson Beaver Pond Leveler) may be used but will not negate the need to trap some animals. Beaver dams are breached using binary explosives, mechanical excavators (backhoes) and by hand.

2. Feral hogs - Occurrences of feral hogs on FJ have increased. To date, only small groups of hogs have been confirmed. However, large, established populations of feral hogs do occur within close proximity to the installation boundaries. For this reason, it is believed that increased hog activity on FJ is imminent. Feral hogs can cause a wide array of problems. Significant habitat degradation due to rooting is generally the most severe and widespread damage threat. This damage can directly or indirectly have an adverse impact to endangered species, especially plants. Hogs may also out-compete native wildlife for food sources. Other risk factors include predation (especially on ground nesting birds, reptiles, and amphibians), and erosion issues. Feral hogs in SC are known to carry many diseases, most notably Swine Brucellosis. Thus far, damage to wildlife openings has been the most significant hog damage documented on FJ.

Trapping and shooting are the most common control methods utilized to slow the establishment of hogs on FJ. Feral hog control activities are generally done in cooperation with Wildlife Services. Wildlife Branch personnel will also continue hunter education efforts to encourage the legal harvest of hogs. Historic problems areas are often surveyed with trail cameras when hog presence is suspected, and actions are taken based on the results.

3. Resident Canada geese - Resident Canada geese (*Branta canadensis*) congregate in large numbers on the FJ golf courses, around cantonment area lakes and ponds, and areas used by Soldiers for physical fitness activities, often leaving behind unacceptable quantities of feces. Human health may be impacted by these feces, especially from the threat of parasites and bacteria such as *Cryptosporidium parvum, Giardia lambia, salmonella sp*., and *E. coli*. Paired/nesting Canada geese also routinely become territorial and aggressive.

Management techniques for Canada geese include hazing and egg oiling programs to reduce population growth, a no-feeding policy, and removal of domestic ducks and geese, as part of an IWDM approach in managing Canada geese. In addition, during the summer molt the geese are live captured and removed in cooperation with Wildlife Services.

4. Vultures - Black and Turkey Vultures regularly roost and occupy wooded areas within the housing area of FJ. These large groups of vultures often damage roofs of homes and create health and safety concerns. Their droppings pose health concerns near homes and playground equipment, and their low altitude soaring behavior can cause a hazard to vehicle operators on roads.

Management techniques include the use of sound and light devices and vulture effigies hung correctly in roost trees at the roost locations to disperse the vultures. In some instances, lethal removal of birds may be required to effectively resolve the damage.

4.4.8 Personnel Responsibilities - The US Army Garrison, FJ is directly responsible for the implementation and enforcement of the Fish and Wildlife Management Plan. The responsibility of installation stakeholders was discussed in detail in Section 1.4.

4.4.9 Outside Assistance - The planning and management of natural resources on FJ is a collaborative effort that requires assistance from federal and state agencies, educational institutions, contractors, and other interested parties. The responsibility of external stakeholders (i.e., USFWS and SCDNR) was discussed in detail in Section 1.4.2 and beneficial partnerships are discussed in detail in Section 3.4.

4.5 FOREST MANAGEMENT - The RCW ESMC (Appendix 1) provides detailed plans and objectives for forest management within the RCW Habitat Management Area. Forest management practices including commercial thinning, prescribed burning, wildfire suppression, chemical and mechanical treatments, along with reforestation activities will improve and enhance installation lands. These practices are compatible with the current and foreseeable training missions on FJ.

4.5.1 Goals - To manage the installation's forests to provide quality missionscape for the training mission, while also enhancing wildlife habitat especially for endangered species, and ensuring a healthy forest ecosystem.

4.5.2 Objective - The Forest Management Section will be used by forest resource managers and other natural resource professionals as a planning tool and guidance for providing a healthy forest ecosystem. The forest management program is implemented by ENV Forestry Branch. When determining which natural resource projects will be implemented the following items are considered: income from the sale of forest products, manpower, and the funding level of the conservation program. This plan is intended to provide the flexibility to accommodate these conditions, while insuring support of the military mission.

The activities described herein provide a framework for the orderly and scientific management of the installation's forests. The primary objective is to provide a healthy forest ecosystem that supports and enhances military training, and the enhancement and protection of other natural resources associated with forest resources.

4.5.3 General Information Inherent to Forest Management

4.5.3.1 Forest Products Market - The Columbia area has historically had a strong local demand for wood fiber, chip-n-saw, and sawtimber. The future market forecast for pine pulpwood, hardwood pulpwood, pine chip-n-saw, and pine saw logs is expected to remain at current levels. Pine pulpwood operations in the area have changed over the last 35 years from short wood to tree length operations. Such utilization changes have influenced the market in this area. Short wood has been replaced by tree length wood that is used for chipping, as well as for dimensional wood. In addition, low grade hardwoods, which were previously non-merchantable, are increasing in demand for pulpwood operations. The loss of harvesting by short wood methods has reduced the capacity to harvest small volumes of timber (less than 250 tons), particularly small salvage sales and timber harvesting associated with new construction.

The USACE, Savannah District maintains a mailing list of potential bidders for each sale, which includes timber mills, their dealers, independent timber harvesting contractors, as well as pine straw harvesting contractors.

4.5.3.2 Timber Harvest Cycles - Current and future timber harvests will be based on several factors, which include but are not limited to stocking levels (Basal Area [BA]), growth rates, military training requirements, construction, threatened and endangered species habitat requirements, and metal contamination. Geographic Information System (GIS) and RCW foraging habitat analysis will be used first to determine what stands need to be thinned to improve RCW habitat. Based on those results and input from the RCW biologist, an annual timber harvest plan will be developed. Those stands scheduled to be harvested the next fiscal year (FY), will be inspected in the field and the GIS data verified. Once verified, a prescription will be developed for each stand.

4.5.4 Description of Forest Types and Forestland Classifications

4.5.4.1 Forest Types and Tree Species - Most of the tree species common to FJ can be grouped into eight major forest types based on the existing forest conditions and management requirements.

1. Natural Pine (NP) - Longleaf pine and loblolly pine make up this type. Currently, planning is underway to restore shortleaf pine (*Pinus echinata*) in some areas of the installation known to contain shortleaf pine. This forest type includes all NP stands, regardless of species, in which at least 80 percent of the overstory BA is pine. A further breakdown into sub-types can be made according to pine species and mixtures, which normally vary, with the topography and soil on the installation. Longleaf pine historically was the predominant species that grew naturally on the dry, deep, sandy soils of the Sandhills region. It occurs in pure stands on the sand ridges and upper slopes becoming mixed with loblolly pine on the lower slopes and wetland margins. Loblolly pine grows naturally on the clay type soils of the piedmont region and on wet soils associated with wetlands. It occurs in pure stands on the installation on the upper and lower slopes where clayey soils exist, and on wetland soils associated with drainages becoming mixed with longleaf pine on the dryer slopes and ridges in the absence of fire. Loblolly pine exists in pure stands on sites that historically would have been longleaf pine sites because of past human activities both before and after US Army ownership.

2. Pine-Hardwood - For this type, the pines must constitute 50 to 79 percent of the overstory BA, the remainder of the overstory being hardwood, where scrub oak (*Quercus laevis*) is not the dominant species. This type can be divided into two sub-types according to site. Longleaf, loblolly, and/or shortleaf pine are commonly found mixed with upland hardwoods on the upper and lower slopes and loblolly and/or pond pine (*Pinus serotina*) with bottomland hardwoods on the lower slopes and bottomland sites.

3. Pine-Scrub Oak - This type is made up of pine with a scrub oak understory that may revert to scrub oak without proper management. Longleaf pine is typically the pine species associated with this type, but other pine species may also be present. The area must have greater than 30 percent pine BA, but less than 80 percent pine BA, and scrub oak is the dominant hardwood type. This type is usually located on sand ridges and upper slopes where sandy soil is relatively deep.

4. Hardwood-Pine - The pines in this type must constitute greater than 20 percent of the BA but less than 49 percent of the BA.

5. Scrub Oak (SO) - A minimum of 51 percent of the hardwood BA must be dominated by scrub oak to be classed as this type; the remaining BA is usually composed of scattered longleaf pine of less than 30 BA. Scrub oak species include turkey oak, blackjack oak (*Quercus marilandica*), sand post oak (*Quercus margarettae*), and bluejack oak (*Quercus incana*).

6. Upland Hardwood (UH) - Less than 20 percent of the BA of the overstory trees in this type can be in pine, and the hardwood species are dominated by upland hardwood species. UH species may include southern red oak (*Quercus falcata*), water oak (*Quercus nigra*), northern red oak (*Quercus rubra*), scarlet oak (*Quercus coccinea*), white oak (*Quercus alba*), post oak (*Quercus stellata*), American beech (*Fagus grandifolia*), pignut hickory (*Carya glabra*), and mockernut hickory (*Carya tomentosa*). Persimmon (*Diospyros virginiana*), flowering dogwood (*Cornus florida*), and black cherry (*Prunus serotina*) are also found in association with UH. UH are usually located on lower slopes, or on soils containing more clay than sand.

7. Bottomland Hardwood (BH) - Less than 20 percent of the BA of the overstory trees in this type can be in pine, and the hardwood species are dominated by BH species. BH species may include; black gum (*Nyssa sylvatica*), red maple (*Acer rubrum*), sweetgum (*Liquidambar styraciflua*), yellow-poplar (*Liriodendron tulipifera*) and baldcypress (*Taxodium distichum*). These species are in head waters of streams, swamps and poorly drained soils bordering streams.

8. Pine Plantations - Plantations are divided into forest types based on species. Although plantations are not specifically a forest type, FJ lists them as a forest type, because they are substantially different from NP stands in their composition. These are as follows, longleaf pine plantations, slash pine plantations, loblolly pine plantations, and shortleaf pine plantations.

4.5.4.2 Forestland Classification - ARs currently specify two forestland classifications: reimbursable (commercial) and non-reimbursable (noncommercial) forestland. Reimbursable

forestland (RFL) is described as land that is capable of economically producing crops of industrial wood in excess of 20 cubic feet per acre per year under management and is not programmed for another use that would preclude future forest development. The direct bullet impact area of all small arms ranges, the EIA, and the other known UXO areas are withdrawn from the RFL category in the current inventory.

Current federal law and DoD/US Army policy prohibits the use of reimbursable forestry funds for activities that cannot reasonably be expected to produce forest revenues or in areas that are classed as non-reimbursable forestland (NRFL). An increase in NRFL acres will increase the need for other funds to cover forest ecosystem management and protection activities, which historically have been paid for with reimbursable forestry funds. The availability of current NRFL for forest management is currently not foreseeable.

4.5.5 Management

4.5.5.1 General - FJ Forest Management Program activities, such as thinning pine stands, restoration, and related projects, are directed primarily toward enhancing the military training environment and restoring the longleaf pine ecosystem. Management for pine stands is directly related to management of endangered species, principally the RCW. Forestry prescriptions are written in accordance with the silvicultural guidelines of the RCW Recovery Plan (USFWS 2003), the Management Guidelines for managing RCW on Army installations (US Department of the Army 2007), the 2013 FJ RCW ESMC, and 4-3 of AR 200-1. Restoration of the longleaf pine ecosystem on FJ has been a major initiative for the forestry program. FJ has converted over 7,500 acres of off-site pine to longleaf pine since 1993.

4.5.5.2 Forest Inventory - A primary responsibility of the forestry branch is to maintain a forest inventory of the installation. Analysis of forest inventory data provides a more accurate, up to date estimate of the forest volume, type, and health. FJ completed an installation-wide forest inventory in 2010/2011, with additional areas being resurveyed after treatment 2018-2020, and continues to resurvey a portion of the installation annually. The overall total tree volume is expected to increase, with a greater increase of pulpwood volume due to pine plantations on FJ reaching merchantable size.

A forest inventory is generally not as intense as a cruise for a timber sale. Factors that may affect the intensity of a forest inventory include the availability of time, funds, personnel, number of acres to inventory, location of the stand, and purpose of the inventory. Data collected for an inventory is like a cruise, but additional information is taken on the site quality, age, and the data needed for input into the RCW foraging habitat analysis. Stratified systematic point sampling is the method used for inventorying timber stands. Number of plots per stand is determined by the forest type, stand variability, and acreage in the stand.

Timber cruising is an intensive inventory of a forest stand to determine the quantity of forest products that can be derived from a timber sale, and data used to assess the quality of RCW habitat. Data collected includes tree species, tree quality (i.e. sawtimber, pulpwood, pole, etc.), tree size, and tree quantity to determine stand and stock tables. The systematic sampling method is used not only for a forest inventory, but also as the preferred method for a timber sale. The FJ

Standard Operating Procedures, for Silvicultural Management Control (Appendix 6) contains further information on forest inventory and timber cruising.

4.5.5.3 Primary Forest Tree Species for Management - Longleaf and loblolly pines, native to the installation, will be the primary forest tree species emphasized in management since most of the forestland soils support one or both species. Other native forest communities, such as bottomland and upland hardwood stands, will be grown and managed in areas to which they are adapted. During the 1950s, 1960s, and early 1970's, most pines planted were slash pine because of this species' excellent seedling survival rate and the longleaf seedlings very poor survival rate. Because FJ is located outside of the natural range of slash pine, they experience poor growth in the dry sandy soils that occur on the installation, are susceptible to severe ice damage, and have a high incidence of fusiform canker. Current planning incorporates harvesting slash pine plantations to restore longleaf pine in these areas. In addition, shortleaf pine will be restored to areas which originally contained this species. Soil types and site conditions will determine which of the three preferred species will be used.

4.5.5.4 Rotation Ages - The rotation ages set forth below are minimums and do not establish an absolute rotation age. A rotation will not be established for longleaf pine, bottomland hardwoods, or upland hardwoods. The rotation age for other pines is 100 years. On some sites loblolly pine may not survive to that age. If a loblolly pine stand is obviously deteriorating, its disposition will follow the FJ RCW ESMC. Pines in active RCW clusters and recruitment clusters will have no rotation age in accordance with the Guidelines for Managing RCW on Army installations (US Department of the Army 2007).

4.5.5.5 Compartments and Stands - The entire installation, including the cantonment area, protected forest areas, and impact areas, were originally divided into ten compartments with each compartment boundary coinciding with roads, streams, or other permanent features. Management compartment boundaries were redefined in 1980 to include 13 compartments. This was done to develop more practical boundaries, isolate the impact and cantonment areas into separate compartments, and organize compartments into more logical boundaries.

The stand is the lowest forest management unit. Stands are subject to change in size, classification, and composition, due to changing military land use, fire, insect, storm depredation, and/or forest management actions. The concept of stands within compartments provides managers with the resources and records control that are positively identifiable, but flexible enough to permit changes over time.

Stands will be identified within each compartment and will be designated "Stand 1" through "Stand n," beginning with Stand 1 in each unit. All management references will be by Compartment and Stand Number, for location purposes (for example: Compartment 12, Stand 3 or 12003).

4.5.5.6 Forest Management Information Systems - Currently all forest inventory data and past silvicultural stand treatments are stored in an enterprise geodatabase.

The following is a list of permanent records and methods of recording.

1. Report Forms (Proponent and Location)

- Timber availability reports for current and previous FY with projection for the next FY. (File Folder in FJ Forester's Office)
- Timber sale contracts in progress. (FJ Forester)
- Income summary by FY. (USACE, Savannah District, & Forestry File Cabinet)
- Cost summary by FY. (Forestry File Cabinet Historical before 2009, GFEBS since 2009)

2. Files (All files are located on GIS Server)

- Current and proposed FY timber harvesting areas.
- Current and proposed FY reforestation areas.
- Current prescribed burning areas.
- Completed prescribed burning areas by FY.
- Number and location of wildfires by FY.
- UXO containing areas and metal contaminated timber areas.
- Plantation records by FY.
- Thinning records by FY.
- Herbicide records by FY.
- Fuel wood records by FY.

4.5.6 Silvicultural Practices

4.5.6.1 General - Silvicultural methods employed include shelterwood, crop tree, seed tree, single tree, group selection, patch or clearcut, and in sensitive areas, such as streamside management zones, the single tree selection method. These silvicultural methods are outlined in the SC's BMPs for Forestry. These silvicultural methods will be used to improve and restore areas, which have been high graded in the past.

4.5.6.2 Pine Management - The even-aged management system is used for pine on upland sites and bottomland hardwoods on bottomland sites. The primary objectives of current silvicultural practices are to enhance military training areas, while managing for a healthy forest ecosystem.

Pine stands greater than 80 BA are thinned to a BA between 45-80 square feet during each prescription cycle through rotation age. During the next 5-year cycle, no stands are designated for final harvest.

4.5.6.3 BH Management - Forest management of FJ's roughly 3,200 acres of BH is performed based on the condition of each stand. Harvests that take place on FJ comply with practices outlined in the BMPs for SC's Forest Wetlands and requirements of Section 404 of the CWA. The primary goal of silvicultural management of BH on the installation is to improve the

health and vigor of the stands and restore historically occurring hardwood tree species and associated vegetation. No BH management is scheduled during this 5-year cycle.

4.5.6.4 Metal Contamination - Trees contaminated with bullets and shrapnel likely occurred since soldiers began firing munitions on FJ. The location, level, and type of metal contamination have not been precisely defined on the installation. Those stands that have low levels of contamination are managed using forestry funds, if there are mills that can use contaminated timber. Currently, no mills are accepting any level of metal contaminated wood. Stands that are not marketable, due to metal contamination, and are deemed essential for RCW management may be managed using environmental funding.

Metal contamination surveys are conducted in areas that are known, or potentially contaminated with military bullets, or shrapnel. The area is surveyed using a metal detector to determine the type, extent and severity of the contamination. As the survey proceeds, each potentially contaminated tree is flagged and the location of the metal contamination in the tree is painted. Once the survey for metal contamination has been completed for the stand, the trees suspected of metal contamination are located to determine the type and extent of contamination. The next step is to determine the type of metal contamination, and if those contaminated trees can be differentiated from other trees in the stand.

Stands that need a survey for metal contamination are first located on historic photos and maps. The location of the stand on the landscape enables the planner to find and determine the existence of old ranges and thereby determine the direction of fire. Combining historic photos with historic harvest maps may provide clues on the extent of metal contamination and the direction on the trees to look for metal contamination. Adding a topographic map provides information on the area where contamination may most likely be found. In addition, the topographic map provides the approximate height of the contamination on the tree.

A large volume of merchantable timber on FJ is in outer limits of existing firing range safety fans. A small portion of this area is adjacent to existing ranges, which are in constant use. Heavy use by the military precludes entry for timber harvesting purposes except during “Victory Block Leave”, or during other short periods when ranges are not scheduled. Much of the area is affected by ranges that are not used continuously. Harvesting operations can be coordinated within these areas, but entry in these areas is frequently limited. In addition, changes in firing schedules sometimes require the contractor to alter work plans on short notice. Therefore, stands adjacent to these areas, but not within the restricted areas, may be harvested to facilitate the harvest of restricted areas.

These conditions complicate timber sale administration to a much greater degree than on other public or private forest land. As a result, local buyers resist buying the metal contaminated forestry products especially in the sawtimber market. Careful timber sale planning helps minimize this resistance by: subdividing sale areas into practical timber harvesting units, providing accurate sale information that is usable by the contractor, and making every effort to accurately determine the extent and type of metal contamination, and the timber products that are available.

Most unmarketable stands are in the 70-year-old and older age class. In the immediate future these contaminated stands, which are considered to be unmarketable, will be needed for cavity trees and forage habitat, due to the shortage of both. One method for managing these stands would be to cut and remove the stems to be thinned. However, this method would be very costly. An alternative would be to thin by selectively removing trees by injecting herbicide into the main stem. Another alternative for younger stands would be to thin by burning the stand during the growing season. This would reduce the number of stems in a less systematic manner and the resulting basal area would be unpredictable. Too much or not enough basal area could potentially be removed with this method, and forest pests could be encouraged into the site as a result. These alternatives will need to be tried and tested to determine which work and under what circumstances they work.

4.5.6.5 Timber Harvest - The annual harvest of timber products on FJ consists of sales ranging in size from 250-550 acres. These small sales have proven to be the most effective method of timber disposal. Smaller sales tend to invite competitive bidding from both large and small producers. Smaller sales reduce and simplify the bidders' risk when metal contamination is encountered.

Most timber sales on the installation involve a combination of four products, sawtimber, chip & saw, pulpwood, and fuelwood. Occasionally poles, pilings, veneer, and fence posts are also harvested. Where more than one product is to be harvested, the order of merchantability is dictated by stumpage values. Those values, from highest to lowest, are piling, poles, veneer, sawtimber, chip & saw, pulpwood, fence posts, and fuelwood.

Initially, silvicultural prescriptions are coordinated with the Wildlife Branch to determine the highest priority for RCW habitat improvement. All prescriptions are submitted to the FJ Environmental Management Branch (EMB) for environmental review on a REC form. The Wildlife Branch provides comments on the REC and forwards the information to the USFWS for final concurrence, if necessary.

Reports of timber availability are prepared and submitted by a Forester to the USACE, Savannah District Engineer. This report includes, acreage, estimated timber sale volumes by product marked and diameter distribution in each sale area, specifications to be included in the contract, description, level of metal contamination, Global Positioning System (GPS) and GIS generated maps of each sale area, and other detailed information.

Timber sales are inspected daily by FJ forestry personnel. Close coordination is maintained between the FJ Forester and the District Engineer Resident Forester (RF) in all timber sale activities. Contract violations are reported to the RF rather than the contractor unless there is an emergency. Final completion reports are submitted to the FJ Forester for all timber sales in progress. Both monthly and annual reports are furnished by the RF listing volume and value by contract of all products harvested during that period.

Contract clearance reports are submitted by the USACE, Savannah District Engineer to the FJ Forester for final inspection of the sale area. A thorough inspection is made particularly noting

the utilization of all marked trees, sawtimber tops, cutting unmarked trees, removal of limbs, logging debris in the roads and firebreaks, and minimum stump heights.

Firewood is provided to individuals for personal use without charge. The firewood permits are without cost, because the cost to administer the collection of fees would be cost prohibitive. Firewood is issued on a permit based on the number of truckloads. Permits are issued by the DPW Forestry Branch, 2563 Essayons Way. Most firewood comes from areas where reforestation, or blow-down has occurred, or where roads and breaks are being day-lighted. Not all standing dead trees are harvested, some are left for wildlife den trees.

4.5.6.6 Timber Sale Planning - Timber sales are administered by USACE, Savannah District Engineer personnel. General sale plans are coordinated by the installation Forester and RF with the Savannah District. However, detailed timber sale planning must take place before timber marking begins, if efficient sales are to be administered, continuous income is to be maintained, and endangered species are to be conserved.

The initial phase of a timber sale is to perform an analysis of an up-to-date forest inventory. Stands that are stocked with at least 80 square feet of pine basal area per acre, or greater are targeted for thinning. Stands are then grouped based on stand location, potential for metal contamination, possible products to be harvested (poles, pilings, sawtimber, pulpwood, and fuelwood), and accessibility of that training area. Present and future requirements of military training, endangered species, and maintaining the health and vigor of the forest dictate the priority that stands will be harvested. These stands are then field checked to verify the validity of the inventory data.

The next step is to prepare the stands for a field examination. The first step of examination is to conduct a metal contamination survey (see Section 4.5.6.4). The next step is to perform a timber inventory to determine volume (or use existing forest inventory data if current), type of products, and an estimate of value. Volume to be harvested determines the type of timber sale. Small volume sales are designated salvage type sales, and larger volumes are designated commercial type timber sales. Stands are then grouped into level of metal contamination, forest product, and type of timber marking/timber harvesting method. Estimated volumes are then used by the Forester to develop the annual timber availability. The annual timber availability is sent to Army Environmental Command (AEC), and the USACE, Savannah District Engineer, and the RF. The availability provides the District Engineer, RF, and AEC with the estimated volume, and approximate value of FJ timber sales for the upcoming fiscal year.

Timber stands that are sufficiently stocked, do not impact training, and are deemed accessible for harvest, are submitted to the EMB for environmental review in the form of a timber prescription. Timber prescriptions, along with a map, are submitted with a REC to the EMB. The REC ensures all necessary environmental review has been completed. Receiving the Memorandum of Environmental Consideration (MOEC) is the final step of the environmental review process. Any environmental restrictions and/or recommendations are incorporated into the MOEC. Once the MOEC has been received, the next phase of timber sale preparation can begin. The final steps to timber sale planning is flagging and marking boundaries, using GPS to map boundaries, timber

marking, cruising the timber, and completing the timber availability. These steps in the timber sale planning process are formalized in Appendix 6.

4.5.6.7 Timber Marking - See Appendix 6.

4.5.6.8 Timber Cruising - See Appendix 6.

4.5.7 Reforestation - Planting of available open land began on FJ in 1953. Initially, planting was first limited by lack of adequate personnel and equipment and the shortage of a seedling supply that existed throughout the state until 1959. After procurement of a Fleco Undercutter, large areas could be prepared for reforestation, but planting was limited to what could be accomplished by FJ Forestry. Hand planting of sizeable areas was beyond personnel capabilities, and machine planting was hampered by the rough condition of the land after undercutting. The Forestry Funding Program established in 1962, provided the solution to the reforestation bottleneck, and large areas were hand planted under contract. All available open land on the installation was reforested to slash pine. However, surveys of slash pine plantations have shown that most of these stands planted on the sandhill ridges have stagnated. A restoration program began in the late 1980's to restore these slash pine plantations to longleaf pine. This restoration program is also being applied to all available SO stands. Slash pine seedlings were used in most early plantings with exception of small eastern red cedar (*Juniperus virginiana*), Arizona cypress (*Cupressus arizonica*), and white pine (*Pinus strobus*) plantations established for Christmas trees and ornamental use on the installation. Today, most pine stands are regenerated with longleaf pine, with limited areas restored to loblolly or shortleaf pine. When the longleaf pine restoration program began in the 1980's, both bare root stock and containerized seedlings were used to establish longleaf pine plantations. Currently only containerized longleaf pine seedlings are being planted. Areas planted with loblolly and shortleaf pine, will be planted with either containerized seedlings (preferred), or bare root stock, depending on availability.

Once the off-site pine species have been removed, the area is chemically treated to control hardwood and grass competition, depending on site conditions. Imazapyr is the chemical that is used to control hardwood competition. Imazapyr is applied in late summer to fall and is used to control hardwoods on areas that have had off-site pines removed, prior to planting and can also be used as a mid-rotation release. Unwanted grass competition, and shrubs are controlled using metsulfuron, sulfometuron and/or glyphosate.

4.5.8 Protection from Insects

4.5.8.1 General - To date, the only forest insect which poses a serious threat is the southern pine beetle (*Dendroctonus frontalis*[SPB]). SPBs are a bark beetle pest that attacks pines throughout the south. Although serious outbreaks of SPBs have occurred in counties to our west in recent years, FJ has not experienced any major outbreaks. Spot infestations of ips engraver beetles (*Ips* spp.) and black turpentine beetles (*Dendroctonus terebrans*) have and continue to occur on the installation. Ips and black turpentine beetles usually start in trees damaged by fire, lightning, or vehicles and these infestations are small and isolated. Normally in these cases, salvage harvesting is not practical, and the trees are either left standing for snags to be used by wildlife or may be toppled using a crawler tractor.

4.5.8.2 Prevention and Detection - Maintenance of a healthy forest through proper management appears to be the best preventive measure. Observation of stand conditions is a routine procedure practiced by forest management personnel, with any symptoms of infestation or stand deterioration being investigated as to cause, and any indicated corrective action is taken promptly.

4.5.8.3 Corrective Action - See the section on Forest Pest and Disease Management of the FJ ESMC for the RCW (Appendix 1) for more information on corrective action of forest pests.

4.5.9 Road and Firebreak and System

4.5.9.1 General - Firebreak boundaries of 20-30 feet wide have been constructed around the concentrated impact areas of all live-fire ranges on FJ. Culverts have been installed on stream crossings to facilitate rapid fire suppression response. On small arms ranges, these firebreaks extend on both sides of the firing line for about one mile where a back firebreak joins the two sides to encircle the area. These are not the safety limits of the range, but firebreaks designed to enclose the area receiving concentrated fire and ricochets of tracer ammunition. Combined range complexes such as the West Impact Area (WIA) are considered as one common impact area and in addition to encircling boundaries, interior firebreaks are maintained across the impact areas to sub divide them into smaller sections for prescribed burning purposes and to provide access. Firebreak boundaries for ranges using explosive munitions are constructed to widely encircle target impact areas because these areas are too hazardous to use a crawler tractor and fire plow to suppress a wildfire.

The Forestry Branch is responsible for maintenance of some secondary unimproved dirt roads, and all firebreaks on FJ, excluding the area licensed to the SCARNG. The SCARNG is responsible for road and firebreak maintenance within their licensed area. A motor grader is used to remove flammable debris and maintain turn-out ditches. A crawler tractor maintains roads and firebreaks by pushing back debris that has grown into the original footprint of the road. Low water crossings and culverts are installed or replaced as needed. Occasionally, fill dirt is brought in to build up roads that may either have very sandy soils or low wet features. This gives military trainers and other users critical access to training areas. Because of firing schedules, road maintenance on ranges is usually done on holidays, Victory Block Leave, and periods when the ranges are not scheduled.

4.5.9.2 Maintenance - Approximately 400 miles of unimproved dirt roads and firebreaks, outside of the impact areas, are maintained approximately twice per year. Unimproved dirt roads and firebreaks within the EIA and WIA are maintained at least once per year depending on range scheduling availability.

4.5.10 Fire Management - Wildland fire is both a threat to natural resources and, if used properly, a valuable ecosystem management tool. The following sections describe methods used by FJ to protect natural and human resources from wildfires, and the use of the prescribed

fire to ensure continued ecosystem functionality, silvicultural management, and endangered species management.

4.5.10.1 Current Management - FJ has a much greater fire occurrence potential when compared to other forests under private and public ownership. This is primarily due to the large number of military personnel engaged in training and the presence of live firing ranges using tracer and incendiary ammunition. For this reason, the mission of providing adequate forest fire protection is more complex and costly than operations on other forested areas. Methods and procedures discussed in this section have been developed to fit installation requirements to provide adequate protection in the most cost-effective manner. For detailed information about prescribed burning and wildfire suppression, see the IWFMP in Appendix 5.

See the IWFMP (Appendix 5) for details on Wildfire Suppression.

See the IWFMP (Appendix 5) and ESMCs (Appendices 1,2, & 3) for details on prescribed burning.

4.5.11 Cooperation with other Agencies - A cooperative agreement between FJ and the SCFC has been in effect since 1953. This agreement provides mutual assistance in suppression of forest fires on or off FJ and near installation boundaries as requested by either organization. Coordination is maintained, in accordance with the agreement, between FJ and the SCFC in detecting and locating fires both on and off the installation.

4.6 VEGETATIVE MANAGEMENT - Vegetative Management on FJ is accomplished through implementation of actions described in various sections of this plan to include Forest Management (Section 4.5), Fish and Wildlife Management (Section 4.4), ESMCs (Appendices 1,2, and 3), and the IPMP (Appendix 7).

4.7 MIGRATORY BIRDS MANAGEMENT - There is a continental-wide concern over declining numbers of many bird species. A recent study found a net loss of 29% of the 1970 abundance of birds in North America and Canada which could threaten ecosystem integrity, function and services (Rosenberg et al. 2019).

The MBTA of 1918 and EO 13186 (10 January 2001, Responsibilities of Federal Agencies to Protect Migratory Birds) specifically protects migratory birds. The MBTA makes it illegal to pursue, hunt, kill, capture, possess, buy, sell, purchase, or barter any migratory bird, including the feathers or other parts, nests, eggs, or migratory bird products, except as allowed by the implementing regulations. EO 13186 requires that Federal agencies avoid or minimize the impacts of their activities on migratory birds and make efforts to protect birds and their habitat. However, the 2003 National Defense Authorization Act (50 CFR § 21.15, Authorization of take incidental to military readiness activities) exempts the Armed Forces from the incidental taking of migratory birds during military readiness activities. Military readiness activities include all training and operations of the Armed Forces that relate to combat and the adequate testing of military equipment, vehicles, weapons and sensors for proper operation and suitability for combat use. All other activities not designated ‘military readiness’ must comply with the protection of migratory birds; this includes the routine operation of installation operating support

functions. Installation support functions include administrative offices, military exchanges, commissaries, water treatment facilities, storage facilities, schools, housing, motor pools, laundries, MWR activities, shops and mess halls and the operation of industrial activities or the construction/demolition of above facilities (see 50 CFR 21.3).

The MOU between the DoD and the USFWS to Promote the Conservation of Migratory Birds (DoD 2014b) outlines the responsibilities of each agency in the protection of migratory birds. Both parties agree that migratory birds are important components of biological diversity, and that the conservation of migratory birds will both help sustain ecological systems and help meet the public demand for conservation education and outdoor recreation, such as wildlife viewing and hunting opportunities.

A goal of FJ's bird conservation efforts is to maintain fully functioning natural ecosystems that can provide for the needs of various and differing species. Maintaining ecological processes and the species that depend on them across landscapes that are intensively used by people and training is essential to planning. Implementation of this INRMP will not adversely affect migratory birds on FJ. INRMP implementation benefits migratory bird species through the implementation of projects, including preservation of wetlands, nest box programs, and migratory bird surveys. A detailed discussion on FJ's migratory bird management strategy is provided in Appendix 4.

4.7.1 Management Strategies - Implementation of the following management measures will minimize, mitigate and monitor the take of migratory birds from military readiness activities on FJ.

1. Continue the nest box program on FJ as discussed in Section 4.4.7.9 of the Wildlife Management Practices Section.

2. Implement the requirements of the MOU between USFWS and DoD to promote the conservation of migratory birds (Appendix 4).

3. Implement the program-wide goals and objectives of the DoD Partner In Flight program (Appendix 4, www.dodpif.org).

4. Implement habitat enhancement for migratory bird species.

5. Where possible, FJ will enter into conservation partnerships with Federal, state and local agencies and non-governmental organizations to improve habitat and allow for bird research on the installation.

6. Implement the IPMP to reduce pesticide use on FJ.

7. Control invasive species that compete with migratory bird species and their habitats.

8. Where possible, site military readiness activities in ways to avoid or minimize impacts to migratory birds. If FJ notes clear evidence of bird take because of military readiness activities,

FJ will document the take, evaluate these activities and where practicable, reduce or eliminate the take of migratory birds. If the take cannot be eliminated, the amount of take will be documented and, where practicable, mitigated for by other management.

9. For non-military readiness activities, compliance with the MBTA is mandatory.

4.8 INVASIVE SPECIES MANAGEMENT – EO 13112, signed by the President on 3 February 1999, requires each Federal agency, to the extent practicable and permitted by law and subject to the availability of appropriations, to use relevant programs and authorities to, among other things:

- Prevent the introduction of invasive species
- Detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner
- Monitor invasive species populations accurately and reliably
- Provide for restoration of native species and habitat conditions in ecosystems that have been invaded.

Additionally, each agency is prohibited from authorizing, funding, or carrying out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the US or elsewhere unless, pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions. An exemption from the preceding requirement is permitted to the DoD when the Secretary of Defense finds that exemption is necessary for national security reasons.

Feral pigs (*Sus scrofa*), nine-banded armadillos (*Dasypus novemcinctus*),and European starling (*Sturnus vulgaris*) are the only invasive vertebrate species confirmed on FJ. Due to their potential for significant damage to wildlife habitat and training lands, current effort is directed toward controlling feral pigs. Section 4.4.7.11 describes the actions taken to address this invasive species.

Invasive plant species surveys conducted on FJ have resulted in the identification of plant species that are considered invasive (Table 4.4). Of these, six (Chinese privet, Japanese honeysuckle, Japanese climbing fern, Japanese shade grass, kudzu, and Chinese wisteria) have an invasive threat level of “severe”, according to the SC Exotic Pest Plant Counsel. This rating means these species are aggressive and can out-compete native species quickly.

None of the invasive plant species are currently found in wide-spread large populations but are found in high densities in a few locations. This offers opportunities for control prior to their spread over larger areas. Herbicide applications are the preferred method of control for most of these invasive species. Prescribed fire and mechanical control may be implemented in combination with the use of herbicides to sufficiently control these species.

Table 4.4 Invasive Plants on Fort Jackson, SC

Ailanthus altissima (tree of heaven)
Albizia julibrissin (mimosa)
Lespedeza bicolor (bicolor lespedeza)
Lespedeza cuneata (sericea)
Ligustrum sinense (Chinese privet)
Lonicera japonica (Japanese honeysuckle)
Lygodium japonicum (Japanese climbing fern)
Melia azedarach (Chinaberry)
Microstegium vimineum (Japanese shade grass)
Phyllostachys aurea (Golden bamboo)
Pueraria montana (kudzu)
Pyrus calleryana (Bradford pear)
Wisteria sinensis (Chinese wisteria)

4.9 PEST MANAGEMENT - Pest Management Operations on FJ are guided by the FJ as required in AR 200-1. The IPMP (Appendix 7, Fort Jackson 2019) is an internal Army compliance and management plan that integrates pest management requirements and activities with ongoing mission activities, allows for quick identification of potential conflicts between the Installation's mission and pest management, and identifies compliance actions necessary to maintain the availability of mission essential properties. The objective of the IPMP is to use an integrated pest management approach for the judicious use of both non-chemical and chemical control techniques to achieve effective pest control with minimal environmental impacts. The IPMP identifies 10 general categories of pests that cause significant damage and require control or management:

- Disease vectors and public health pests (mosquitoes, ticks, fleas, and rodents)
- Noxious and invasive plants (noxious weeds and animals)
- Other undesirable vegetative (weeds)
- Structural pests (termites, carpenter ants)
- Pests found in and Around Buildings (ants, cockroaches etc.)
- Turf and ornamental (white grubs etc.)
- Vertebrate pests (squirrels, mice, beaver, alligators, stray animals, etc.)
- Quarantine and regulated pests (imported fire ants, spongy moths)
- Other Pest Management Requirements (large game animals, road kills, etc.)

The IPMP describes the pest management requirements and outlines the resources necessary for surveillance and control of pests. It also describes the administrative, safety, and environmental requirements of the program. The program involves DoD and SC certified pesticide applicators; staffs of ENV and Contract Management Branch, Preventive Medicine Services and Veterinary Activity; building occupants and facility managers to monitor and control pests. Pests included in the plan are weeds and other unwanted vegetation; termites; ticks, mosquitoes and other biting insects; vertebrate pests, such as birds, rodents, and snakes; flying and crawling insects; and spiders. These pests can interfere with the military mission, damage real property, increase maintenance costs, lower morale, and expose personnel to diseases unless properly controlled.

All barracks, offices, dining facilities, warehouses, schools, golf courses, child development centers, hospital, ranges and all surrounding areas inside the property of FJ are covered for pest control services through contract with a private company. Actual pest management procedures are found in the IPMP.

All pest management actions are reviewed for their potential impacts to natural resources prior to implementation.

4.10 LAND MANAGEMENT

4.10.1 Soil Erosion and Sediment Control - Soil erosion occurring in the training areas of FJ is being addressed primarily through the ITAM LRAM program.

FJ's goal is to manage the lands in such a manner as to control soil erosion and improve and protect the quality of water, vegetation and soils. This goal is achieved by implementation of the following objectives:

- Survey training areas to assess needs through the ITAM RTLA program.
- Rehabilitate and maintain training lands through the LRAM component of ITAM.
- Maintain a GIS database of erosion sites.
- Implement BMPs to control erosion.
- Control erosion on maneuver trails and training areas.

FJ has a SC National Pollutant Discharge Elimination System (NPDES) General Permit for Stormwater Discharges from Regulated Small Municipal Separate Storm Sewer Systems (SCR037901). There are six components of the permit: public education and outreach, public involvement/participation, illicit discharge detection and elimination, construction site storm water runoff control, post-construction storm water management in new development and redevelopment, and pollution prevention/good housekeeping. Water quality monitoring is also a requirement of this permit. While some may consider this MS4 Stormwater program environmental in nature, it is also connected to natural resource management through erosion control and water quality issues.

Another aspect of the erosion control program on FJ involves construction sites. Under the CWA NPDES program and the SC Stormwater Management and Sediment Reduction Act, land disturbing activities one acre and greater are required to develop and implement Stormwater Pollution Prevention Plans (SWPPP), which are approved by SCDES. These plans address post-construction stormwater runoff volumes and sediment and erosion control during construction. This program ultimately benefits the natural resources of FJ and the surrounding community by reducing the velocity of runoff from developed areas, thus reducing stream bank erosion and flooding and by minimizing the amount of sediments that enter streams, lakes, and wetlands.

4.10.2 Non-point Source Pollution - Water Resource Permits - FJ has received NPDES permits that enable the installation to discharge stormwater to waters of the US and the State of SC. For non-point source discharges, FJ has a SC NPDES General Permit for Stormwater Discharges Associated with Industrial Activities (SCR001892), NPDES General Discharge

Permit for Discharges Associated with Nonmetal Mineral Mining Facilities (SCG731156), and NPDES General Permit for Stormwater Discharges from Regulated Small Municipal Separate Storm Sewer Systems (SCR037901).

The Recycling Center is covered under the Industrial General Permit. This facility is inspected quarterly, and stormwater samples are collected quarterly during storm events. Personnel at these sites are trained annually in spill response and prevention, as well as general housekeeping measures to prevent pollution from entering nearby waterbodies. The Wildcat Borrow Pit off firebreak 11 is covered by the Nonmetal Mineral Mining General Permit and has the same inspection and sampling requirements as the Industrial General Permit.

There are six components of the Small MS4 General Permit: public education and outreach, public involvement/participation, illicit discharge detection and elimination, construction site stormwater runoff control, post-construction stormwater management in new development and redevelopment, and pollution prevention/good housekeeping.

Construction sites on FJ operate under the NPDES General Permit for Stormwater Discharges from Construction Activities (SCR100000). Each construction site that disturbs one acre and greater must develop a SWPPP and obtain individual coverage under the general permit. FJ is considered a Qualifying Local Program through SCDES and performs SWPPP reviews in-house. The Notice of Intent and FJ approval letter are sent to SCDES to obtain permit coverage.

4.11 AGRICULTURAL OUTLEASING - FJ does not maintain an agricultural out leasing program.

4.12 GIS MANAGEMENT - Mapping and spatial analysis are integral components of natural resources management that are fulfilled using GIS data and software. Data provides documentation for the location and attributes of resources while software contains the tools necessary for the management, display, and analysis of these data.

Data is maintained locally at the Directorate level. However, periodically data must be transferred to the US Army for final approval and integration with a US Army enterprise database. The Installation Geospatial Information and Services Coordinator, who organizes all the Garrison GIS activities, delivers completed GIS data to the Command Level Authority, who is typically the Garrison Commander, for final approval. Finally, the data are forwarded up through regional and national levels for approval and is appended to the US Army GIS database.

4.12.1 GIS Data Use and Development - ENV uses GIS mapping capabilities for daily decisions as well as long term planning of natural resources management and its integration with the Army mission. This work is driven by laws such as the NEPA, ESA, and CWA. For NEPA compliance, all impacts to federal land from a proposed project and its alternatives must be considered before the project can be implemented. These impacts are frequently to natural resources such as endangered species, water, and timber, so detailed maps are required to assess the impacts on them. A list of GIS data layers that the ENV maintains is available from DPW.

The branches and offices within ENV keep GIS databases of these resources including endangered plant and animal inventories, hydrograph data such as streams and wetlands, cultural resource data, and environmental compliance data. The Wildlife and Forestry Branches maintain numerous GIS data layers. The Wildlife Branch maintains data for hunting and fishing areas, food plots, and endangered species. The Forestry Branch maintains data for forest management such as a forest stand inventory, fire breaks, and prescribed burning locations. Along with these data the ENV also stores ancillary data that can affect a project such as infrastructure, boundaries, and geodetic reference points. Data for the Army's training mission such as training area boundaries, live-fire ranges, and training impact areas are maintained by the DPTMS ITAM office.

4.13 OUTDOOR RECREATION

4.13.1 General - FJ is a large, relatively undeveloped, open space. This open space and outdoor recreation opportunities associated with it are perhaps the installation's best natural attributes in terms of community quality of life, particularly considering its location adjacent to the city of Columbia.

Outdoor recreation enhances the quality of life for military and civilian personnel. As such, Army lands with suitable natural resources are to be managed to allow outdoor recreational opportunities, consistent with the Sikes Act. For the purposes of this INRMP and to be consistent with AR 200-1, outdoor recreation is defined as recreational programs, activities, or opportunities that depend on the natural environment. Examples include hunting, fishing, horseback riding, picnicking, birdwatching, hiking, and camping. Developed or constructed facilities and activities, such as golf courses, tennis courts, baseball facilities, etc., are not included.

4.13.2 Military Mission Considerations - The military mission has priority over outdoor recreation involving range access. If outdoor recreational activities are to continue to thrive on FJ, this military mission priority must not be compromised. If recreational or management activities conflict with military activities, the military mission comes first.

4.13.3 Public Access – (See Section 3.5.1) There are many opportunities for the general public to participate in installation activities. In maintaining a policy of public access, FJ relies on a responsible public to adhere to restrictions placed on access. FJ limits access for hunting and fishing to authorized personnel only (see Section 3.5.1.). While unsupervised use by the general public is prohibited, FJ does allow non-affiliated civilians of the general public to participate in hunting and fishing activities when sponsored and supervised by an authorized participant.

FJ has a long tradition of sharing its renewable natural resources with the local community. However, the general public is denied hunting and fishing access except for through a guest hunting and fishing permitting program in which the general public can be sponsored by an authorized and permitted patron. Guidelines for sponsoring guest are detailed in the FJ 28-4. A youth fishing derby is held annually at the Heise's Pond complex. DFMWR organizes the event, and the Wildlife Branch stocks the ponds with catchable sized channel catfish prior to the event.

Additionally, cyclists and runners, many being members of the general public, utilize our iSportsman system to check in and out of routes on the installation.

There are approximately 2000 active users in the FJ iSportsman system. Most of FJ is available to hunting and angling when not being used for military training. In addition, anglers almost always have access to lakes and ponds within the cantonment area.

Public access for outdoor recreation activities is also available via the passage of the Palmetto Trail through FJ (see Section 3.5.1).

4.13.4 Hunting and Fishing Administration - – The Wildlife Branch is responsible for the overall execution of the FJ hunting and fishing program. A major component of program execution is coordination with DPTMS. DPTMS provides the Wildlife Branch a list of training areas available for hunting and fishing each week, which are then opened in the iSportsman area availability schedule. Any changes to the training schedule are immediately reported to the Wildlife Branch so that the availability schedule can be updated. If an area has to be closed during a hunt, hunters may be notified by Short Message Service text through iSportsman to vacate the area and must confirm that they have vacated. A CLEO or Range Operations may also sound three blasts on a siren or horn to warn hunters to vacate the area immediately. Additionally, if soldiers enter an area being hunted, hunters must immediately vacate that area. All persons entering authorized hunting, fishing, and scouting areas must check in and out through the iSportsman system and be aware of any off-limits areas within the area that they are checked in to. The FJ system is safe and requires commitment, training, and attention to detail on the part of hunters and anglers.

4.13.5 Hunting and Fishing Regulations - The SCDNR issues regulations for hunters and anglers in SC, including those who use FJ. FJ Regulation 28-4, Hunting and Fishing Regulation (Appendix 8) and SCDNR regulations on hunting and fishing are the primary means of establishing controls on hunting and fishing on FJ.

4.13.6 FJ Permits and State Licenses - Any person 16 years of age and older who hunts, scouts, or fishes on FJ must have in possession a valid FJ hunting and/or fishing permit applicable to their pursuit. Individuals must register an account in the FJ iSportsman system and obtain these permits through the system. They must also possess applicable SC hunting and/or fishing licenses. In addition, persons hunting waterfowl must have a federal and a SC Migratory Waterfowl Permit (duck stamps). All migratory bird hunters must have in possession a State Migratory Bird Permit. Turkey hunters must be in possession of their SC issued turkey tags. There are exceptions to permit requirements. For instance, military personnel on leave who are legal residents of SC and stationed at installations outside of SC are not required to purchase a SC hunting or fishing license.

Fees collected from the sale of FJ hunting and fishing permits are deposited in a 21X rollover account and used for the protection, conservation, and management of fish and wildlife habitat and for certain operational costs of conducting the hunting and fishing program. activities. They may only be used for these activities and only on FJ.

4.13.7 Check In/Out Procedures - All persons entering authorized hunting, fishing, and game scouting areas must check in and out through the iSportsman system. The check in/out process is described in FJ Regulation 28-4.

4.13.8 Safety Considerations - Sports and recreational activities on FJ must be regulated to avoid conflicts between the military mission and recreation. Recreational users are required to follow check in/out procedures. Safety rules must be followed during each recreational activity. The no hunting buffers, restricting the occupancy of hunting areas, and other safety precautions (e.g., weapons and ammunition restrictions for still hunting and stand hunting of deer) foster safe hunting activities on the installation. FJ requires hunters to take SC or equivalent hunter safety course. A FJ hunter and angler safety briefing is required for all individuals 16 years of age and older, and instructions for how to obtain this training will be listed on FJ iSportsman. Youth hunters/anglers must remain in direct control and immediate proximity of a fully permitted adult.

4.14 BIRD/WILDLIFE AIRCRAFT STRIKE HAZARD - FJ does not maintain a Bird/Wildlife Aircraft Strike Hazard Program.

4.15 WILDLAND FIRE MANAGEMENT - FJ's wildland fire management is described in the IWFMP (Appendix 5).

4.16 TRAINING OF NATURAL REOURCE PERSONNEL

4.16.1 Wildland Fire Personnel Training - DoD has recently issued new wildland fire policy guidance in an attempt to adopt and transition to National Wildfire Coordination Group's (NWCG) standards to govern all wildland fire activities carried out by DoD personnel in addition to Army and installation policies. DoD is currently a member of the NWCG. The NWCG is made up of all Federal agencies with wildland fire responsibilities and the National Association of State Foresters. The Federal Wildland Fire Policy requires all personnel involved in prescribed fire and/or wildfire activities meet certain training qualifications. DoD is presently reviewing how it will implement these new policies. FJ's requirements for personnel qualifications will be reviewed and the IWFMP will contain complete information on personnel qualifications.

4.16.2 Timber Marking and Cruising - All personnel engaged in timber marking and cruising on FJ, at a minimum must meet the qualifications established by the Office of Personnel Management for Forestry Technician Series 0462. Additional training will be given in relation to local requirements and procedures. This training will be under actual field conditions in a productive capacity.

4.16.3 Pesticide Applicator Training - All FJ personnel who apply pesticides must be accompanied by FJ personnel who received and maintain DoD (government staff) or SC (contractors) certification as pesticide applicators for the categories of pest control engaged.

4.17 COASTAL/MARINE MANAGEMENT - FJ does not lie within an area controlled under a Coastal Zone Management Program. Therefore, FJ's on-post operations and activities are not managed or controlled by the Coastal Zone Management Program.

4.18 OTHER LEASES - FJ does not maintain any other leases related to natural resources on the installation.

5. IMPLEMENTATION - Over the course of its implementation, the INRMP will:

- Enable FJ to make progress towards achieving a sustainable natural resources base and a realistic training environment which is embodied in the diversity of the longleaf pine ecosystem
- Establish appropriate stewardship policies that serve to protect both natural and cultural resources
- Ensure compliance with environmental laws
- Provide a continuity of direction and effort that can accommodate changes in personnel and leadership
- Promote cost-effectiveness through better planning and coordination
- Promote good public relations by demonstrating the installation's commitment to stewardship, as well as a multiple-use concept
- Make use of innovative strategies to accomplish specific management objectives

5.1 Plan Implementation and Review - DPW and DPTMS will develop annual work plans based on the requirements and funding of all program elements that comprise the INRMP. Detailed natural resources management prescriptions that drive the projects are provided in Appendix 9. The annual work plans to be developed for each FY will include a listing of projects, funding requirements, Common Levels of Service supported, and manpower data to complete the action. This work plan will be used to track progress on INRMP implementation, budget expenses, request budget allotments for future months and coordinate needed manpower requirements for labor intensive projects. Each year the core government Natural Resources Managers will meet as necessary to review plan implementation and discuss any necessary adjustments.

This in-process review will serve to prioritize projects, resolve conflicts, coordinate implementation of specific provisions of the INRMP, identify common objectives so some projects may be completed by several partners, and identify the need for plan updates. The projects listed in the annual work plan will be assessed and revised as necessary. A list of prioritized projects will be developed at the beginning of each FY and reviewed and updated each quarter for the remainder of the year.

5.2 ACHIEVING NO NET LOSS - Historically, FJ has achieved a no net loss in the capability of military lands to support the mission of the installation. Implementation of the INRMP will ensure that there is no net loss in available military lands to support FJ's mission. The Wildlife and Forestry Branches have the primary role and responsibility for the implementation of the INRMP. ITAM, DPTMS, and FJ FES are also integral participants.

The implementation of proposed projects, as described in this section and future revisions and updates of this INRMP to reflect emerging natural resources planning needs, assist FJ in achieving no net loss to the military mission. These projects focus on maintaining RCW habitat, assessing the impacts of military readiness activities on endangered species, controlling erosion

and sedimentation in stream channels, implementing ecosystem management, managing the installation's forests, and providing for recreational opportunities.

To implement this plan and ensure minimal impacts or conflicts with military training, frequent and close coordination between the ENV and the DPTMS is necessary. DPTMS schedules and manages training land use and needs to be aware of management actions within the training areas, especially those actions that involve contractors, or workers who are not a regular part of the FJ natural resources staff. In addition, the natural resources staff needs to be aware of when and where field training is occurring so work can be adjusted around those activities when necessary. DPTMS provides the Wildlife and Forestry Branches a list of the range and training areas scheduled for use on a regular basis to assist with work planning.

5.3 COOPERATIVE AGREEMENTS - FJ maintains the following cooperative agreements related to natural resources conservation:

- Interagency agreement with USDA Wildlife Services for support of the management of invasive wildlife species and animal damage control.
- MOU between FJ, the SCARNG, the SC Department of Parks, Recreation & Tourism, and the Palmetto Trails (Palmetto Conservation Foundation) for the passage of the Palmetto Trail through FJ.
- The VA National Cemetery has a MOA with FJ to provide access for wildfire suppression activities within the boundaries of the National Cemetery that threaten forest products therein or FJ property. The Cemetery will protect wetlands and a beaver pond mitigation area and FJ reserves the right to enter the cemetery for environmental surveys.
- USFWS Interagency agreement for the Conservation of Natural Resources
- FJ has a MOA with the SCFC to support each other with wildfire suppression. Upon request, the other agency will respond, if able, to assist the requesting agency with firefighting assistance.
- SC Wildfire Cooperators: This is an organization of state, federal, and private agencies that manage wildland fire. The members include the SCFC, US Forest Service, USFWS, National Park Service, DoD, the National Weather Service, and The Nature Conservancy. No dues are paid, and all agencies attend an annual coordination meeting to stay current with procedures, new laws or regulations, changes to weather indexes, changes to fuel models, etc.
- Forest Management MOU with USACE Savannah District for timber sale administration.
- The MOU between the DoD and the USFWS to Promote the Conservation of Migratory Birds dated 5 September 2014 outlines the responsibilities of each agency in the protection of migratory birds.
- Memorandum of Agreement between Department of the Army and the Environmental Protection Agency signed in 1990.

5.4 FUNDING - All requirements set forth in this INRMP requiring the expenditure of the FJ's funds are expressly subject to the availability of appropriations and the requirements of the Anti-Deficiency Act (31 USC, Section 1341). No obligation undertaken by FJ under the terms of

this INRMP will require or be interpreted to require a commitment to expend funds not obligated for a particular purpose.

Unlike most functions within the DoD, natural resources management relies on a variety of funding mechanisms, some of which are self-generating and all of which have different application rules. Below are general discussions about different sources of funding to implement this INRMP.

5.4.1 Forestry Reimbursable and Reserve Funds - Forestry funds are generated from sale of forest products. Forestry funds are centrally controlled by the Army, and FJ is limited to recovering its approved expenses for forest management. The remainder of the money generated by the FJ forestry program is split between the US Treasury and Richland County.

Only expenses that are directly related to the management of Forest Products Production Areas may be reimbursed from sale receipts and include: timber management, reforestation, timber stand improvement, inventories, fire protection, construction and maintenance of timber area access roads, purchase of forestry equipment and supplies, disease and insect control, cultural resources inventory and mitigation, timber marking, inspections, sales preparation, training of personnel, and timber sales.

5.4.2 Sikes Act Funds – See Section 4.4.5.2.These funds have no year-end (unobligated funds carry over on 1 October). Fee collection and administration (i.e. printing and issuing the State Sikes Act Permit) costs (not to exceed 10% of the annual Sikes Act revenue) are authorized. Unobligated balances shall be accumulated with current fee collections, and the total amount accumulated at the Installation will be available for obligation.

(Note: The protection and management of threatened and endangered species will not be funded from Sikes Act funds collected from hunters and anglers. These activities are stewardship responsibilities of FJ.)

5.4.3 Agricultural Funds - Agricultural funds are derived from agricultural leases on installations. They are centrally controlled at both Department of Army and IMCOM levels with no requirements for spending where they were generated. They are primarily intended to offset costs of maintaining agricultural leases, but they are also available for preparing and implementing INRMPs.

FJ has no agricultural leases. Thus, the major use of these funds would be implementation of this INRMP. The installation rarely receives agricultural funds.

5.4.4 Environmental Funds - Environmental compliance and INRMP implantation is funded with Environmental Quality funds. Compliance with laws is the key to getting environmental funding. The program heavily favors funding high priority needs to reach or maintain compliance with federal or state laws, such as the Endangered Species Act.

5.4.5 Range Program Funds - Range Program Funds are utilized to implement the ITAM program. Funding is provided for the management and maintenance of training lands to sustain and enhance the capability to meet long-term training requirements. ITAM funding does not pay for projects which qualify as Conservation Compliance as defined in the Environmental funding budget guidance.

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7. LIST OF ACRONYMS

AEC	Army Environmental Command
AIT	Advanced Individual Training
AR	Army Regulation
BCT	Bacic Combat Training
BGEPA	Bald and Golden Eagle Protection Act
BH	Bottomland Hardwood
BMP(s)	Best Management Practices
BO	Biological Opinion
CLEO(s)	Conservation Law Enforcement Officer(s)
CWA	Clean Water Act
CX	Categorical Exclusion
DES	Directorate of Emergency Services
DFMWR	Directorate of Family, Morale, Welfare and Recreation
DoD	Department of Defense
DoDI	Department of Defense Instruction
DPW	Directorate of Public Works
DPTMS	Directorate of Plans, Training, Mobilization and Security
EA	Environmental Assessment
EIA	East Impact Area
EMB	Environmental Management Branch
ENV	Environmental Division
EO	Executive Order
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESMC	Endangered Species Management Component
FEMA	Federal Emergency Management Agency
FJ	Fort Jackson
FJ FES	Fort Jackson Fire and Emergency Services
FTX	Field Training Exercise(s)
FY	Fiscal Year
GIS	Geographic Information System
GPS	Global Positioning System
IMCOM	Installation Management Command
INRMP	Integrated Natural Resources Management Plan
IPMP	Integrated Pest Management Plan
ITAM	Integrated Training Area Management
IWDM	Integrated Wildlife Damage Management
IWFMP	Integrated Wildland Fire Management Plan
JLUS	Joint Land Use Study
JCUB	Joint Compatible Use Buffers
JNGB	Joint National Guard Base
LRAM	Land Rehabilitation and Maintenance
MAJIC	Midlands Area Joint Installation Cooperative
MAPS	Monitoring Avian Productivity and Survivorship
MBTA	Migratory Bird Treaty Act

MOA	Memorandum of Agreement
MOEC	Memorandum of Environmental Consideration
MOU	Memorandum of Understanding
NRFL	Non-Reimbursable Forestland
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NP	Natural Pine
NPDES	National Pollutant Discharge Elimination System
NWCG	National Wildfire Coordination Group
NWI	National Wetland Inventory
QDMA	Quality Deer Management Area
REC	Record of Environmental Consideration
RCW	Red-cockaded Woodpecker
RF	Resident Forester
RFL	Reimbursable Forestland
RTLA	Range and Training Land Assessment
SPB	Southern Pine Beetle
SC	South Carolina
SCANG	South Carolian Air National Guard
SCARNG	South Carolina Army National Guard
SCDES	South Carolina Department of Environmental Services
SCDNR	South Carolina Department of Natural Resources
SO	Scrub Oak
SWAP	State Wildlife Action Plan
TRADOC	US Army Training and Doctrine Command
UH	Upland Hardwood
US	United States
USACE	US Army Corps of Engineers
USAF	United States Air Force
USC	United States Code
USFWS	US Fish and Wildlife Service
UXO	Unexploded Ordnance
WAC	Wildlife Acceptance Capacity
WIA	West Impact Area

Stone, Christopher

From: Plasynski, Julia A <julia_plasynski@fws.gov>
Sent: Wednesday, April 16, 2025 10:12 AM
To: Wilcox, Michelle M CIV USARMY USAG (USA)
Cc: Stone, Christopher
Subject: Re: [EXTERNAL] RE: McCrady/Fort Jackson's Multi-Purpose Machine Gun Range project, FWS Project Code: 2023-0069117

You don't often get email from julia_plasynski@fws.gov. Learn why this is important

Hi Michelle,

Since the Monarch butterfly is proposed and does not have the full protection of a listed species under the ESA, we do not need to consult on it. Additionally, we do not have any voluntary conservation measures that would be relevant to the project.

If the listing status changes and the project is still underway, we can revisit the determination. However, it is not necessary right now.

Thank you for checking in about it!

Julia Plasynski

Julia Plasynski
Fish and Wildlife Biologist
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854-202-2327

From: Wilcox, Michelle M CIV USARMY USAG (USA) <michelle.m.wilcox2.civ@army.mil>
Sent: Monday, April 14, 2025 3:46 PM
To: Plasynski, Julia A <julia_plasynski@fws.gov>
Cc: Chris Stone <Christopher.stone@scmd.sc.gov>
Subject: [EXTERNAL] RE: McCrady/Fort Jackson's Multi-Purpose Machine Gun Range project, FWS Project Code: 2023-0069117

This email has been received from outside of DOI - Use caution before clicking on links, opening attachments, or responding.

Hello Ms. Plasynski, Thank you very much for working with us on our CO for the Multi-purpose machine gun range on Ft Jackson. We are currently working on an Environmental Assessment for this same project and the National Guard Bureau wanted us to touch base with you about the changed status of the Monarch butterfly from 'Candidate' to 'Proposed Threatened'. In our biological assessment for MPMG on page 18 we suggested that, "It is possible that a few

milkweed plants may be destroyed in the construction of the range, but we determined that this effect will be insignificant. Therefore, this project will have no effect on this candidate species."

Could we ask you for an 'informal' email concurrence that this determination is okay now that the monarch is proposed-threatened? Or what do we need to do?

Thank you,
Michelle Wilcox

From: Plasynski, Julia A <julia_plasynski@fws.gov>
Sent: Thursday, August 8, 2024 8:49 AM
To: Wilcox, Michelle M CIV USARMY USAG (USA) <michelle.m.wilcox2.civ@army.mil>
Cc: Charleston Regulatory, FW4 <charleston_regulatory@fws.gov>; JohnsonHughes, Christy <christy_johnsonhughes@fws.gov>; Williams, Barbara S CIV USARMY ID-TRAINING (USA) <barbara.s.williams38.civ@army.mil>; Olds, Melanie J <melanie_olds@fws.gov>
Subject: McCrady/Fort Jackson's Multi-Purpose Machine Gun Range project, FWS Project Code: 2023-0069117

Good morning Michelle,

The Ft. Jackson Multi-Purpose Machine Gun Range Conference Opinion is attached. Thank you for your coordination throughout the process.

Best,
Julia Plasynski

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Endangered Species Act - Section 7 Conference

CONFERENCE OPINION

U.S. Fish and Wildlife Service Reference:
2025-0024332

Department of Defense's 7(a)(1) Conservation Strategy for the Monarch Butterfly (*Danaus plexippus*) for Mission and Sustainment Operations within the Continental United States

Federal Action Agency: Department of Defense

Conference Conducted By: U.S. Fish and Wildlife Service

Catherine T. Phillips
Assistant Regional Director,
Ecological Services

Date

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APPENDICES

Appendix A. DOD's 7(a)(1) Conservation Strategy for Monarch - INRMP Stage Consistency Check
Appendix B. DOD Installations in Continental U.S. with INRMPs with Estimated Grassland Acres

1 ACRONYMS AND ABBREVIATIONS

Acronym	Definition
AFCEC	Air Force Civil Engineer Center
AFPMB	Armed Forces Pest Management Board
ATV	all-terrain vehicle
BASH	Bird Aircraft Strike Hazard
BMPs	Best Management Practices
CARCD	California Association of Resource Conservation Districts
CCAA/CA	Candidate Conservation Agreement
CDL	Cropland Data Layer
CEC	Commission for Environmental Cooperation
CEMML	Center for Environmental Management of Military Lands
CFR	Code of Federal Regulations
CI	confidence interval
CRP	Conservation Reserve Program
CS	tear gas (a chemical used in riot control)
CSLO	Camp San Luis Obispo
DAF	Department of Air Force
DISDI	Defense Installation Spatial Database Infrastructure
DOD	Department of Defense
DOD PCRG	DOD's Pollinator Conservation Reference Guide
DODI	DOD Issuance
DODM	DOD Manual
DOI	U.S. Department of Interior
DZ	drop zone
EFTA	Environment for the Americas
ENA	Eastern North America population
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESTCP	Environmental Security Technology Certification Program
FY	Fiscal year
ha	hectare
HC/TA	hexachloroethane/terephthalic acid smoke
IMMP	Integrated Monarch Monitoring Program
INRMP	Integrated Natural Resources Management Plan
IPMPs	Integrated Pest Management Plans
ISR	intelligence, surveillance and reconnaissance
LZ	landing zone
MAFWA	Midwest Association of Fish and Wildlife Agencies
MCAS	Marine Corps Air Station
MCB	Marine Corps Base

MCU	Monarch Conservation Units
MJV	Monarch Joint Venture
MOSI	Western Monarch Overwintering Science Initiative
NAVFAC	Naval Facilities Engineering Systems Command
NLCD	National Landcover Dataset
NPLD	National Public Lands Day
NRCS	Natural Resources Conservation Service
NRM	DOD Natural Resource Manager
NSA	Naval Support Activity
NWS	Naval Weapons Station
OE	*Ophryocystis elektroscirrha*
PAZ	Priority Action Zone
pE	probability of extinction
PZ	pickup zone
RASP	Recovery and Sustainment Partnership Initiative
RCDs	resource conservation districts
REPI	Readiness and Environmental Protection Integration
SAIA	Sikes Act Improvement Act
SAP	Species Action Plan
SERDP	Strategic Environmental Research and Development Program
SERPPAS	Southeast Regional Partnership for Planning and Sustainability
SFB	Space Force Base
SRTA	short-range training ammunition (low-velocity plastic bullets)
SSA	Species Status Assessment
U.S.	United States of America
UAS	Unmanned Aerial Systems
UAV	Unmanned Aerial Vehicles
USC	U.S. Code
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFSIP	U.S. Forest Service International Program
USFWS	U.S. Fish & Wildlife Service
USGS	U.S. Geological Survey
UTV	utility task vehicle
WAFWA	Western Association of Fish and Wildlife Agencies
WASH	Wildlife Aircraft Strike Hazard
WMC	Western Monarch Count

2 INTRODUCTION

This document represents the U. S. Fish and Wildlife's (USFWS) Conference Opinion (Opinion) based on our review of the Department of Defense's 7(a)(1) Conservation Strategy for the Monarch Butterfly (Conservation Strategy or Strategy) and military mission and sustainment actions. The Opinion addresses effects to species in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (ESA).

This document complies with section 7 of the ESA, and 50 CFR §402 of the USFWS's interagency regulations governing section 7 of the ESA, as amended. The monarch butterfly (*Danaus plexippus*) is a candidate for listing as threatened or endangered. There are no requirements under section 7(a)(2) or 7(a)(4) of the ESA to consult or confer, respectively, on actions due to their effects on candidate species. This is a voluntary conference, proactively requested by the Action Agency, to help ensure compliance of the Proposed Action with section 7 of the ESA in the event the USFWS were to propose listing of the species under its authorities of the ESA.

The Conservation Strategy was developed pursuant to section 7(a)(1) of the ESA, as amended, which requires all federal agencies to carry out programs within their authorities to advance the recovery of endangered and threatened species. The Conservation Strategy describes how the Department of Defense (DOD) will use their authorities to conserve monarch within the continental United States (i.e., the lower 48 states; U.S.). Through implementation of its Strategy, which includes ecosystem management and proactive conservation policies and programs, DOD will continue to have a meaningful positive impact on the status of monarch. The Strategy was developed in collaboration with the USFWS to ensure the program will serve the purposes of advancing monarch conservation and continuing to fulfill DOD's responsibilities under 7(a)(1). The Strategy describes ecosystem management across its more than 22 million acres of land subject to the Sikes Act (16 U.S.C. 670 *et seq.*), implementation of existing policies and procedures, and conservation programs that may affect monarch, over 25 years.

The primary intent of the Strategy is to identify, document, and highlight the contributions of DOD's actions to monarch conservation and describe how DOD's policies and programs proactively abate the impacts of many threats to monarch on military installations across the U.S. Given the monarch butterfly's occurrence in a wide variety of habitats and its near ubiquitous distribution throughout the U.S., its listing under the ESA could result in substantial impacts to the DOD and military readiness. Considering this, another intent of the Strategy is to promote regulatory predictability and flexibility, decrease potential regulatory conflict, and streamline monarch consultation requirements for all DOD activities under ESA section 7(a)(2) across all military installations if the species were to become listed under the ESA. Accordingly, additional information on mission and sustainment actions was provided as supplemental information to the Strategy so that those effects could be considered as part of this programmatic conference. Military mission and mission sustainment includes all activities needed to support the mission of the military, including military training, readiness, and operations activities.

The conference was carried out in accordance with the implementing regulations (50 CFR 402.10(d) under 7(a)(2). This conference opinion may be adopted as the USFWS's biological opinion should the species be listed. Prior to adoption as the biological opinion, the USFWS will incorporate any significant new information (including new information from the rulemaking process on the proposed listing or proposed critical habitat designation) into the biological opinion and will include the addition of an incidental take statement, if appropriate (see Reinitiation Notice).

2.1 Conference History

This Opinion is based on information provided in the Strategy, several virtual meetings, emails, and other sources of information shared between agencies. A previous version of a Conservation Strategy was received by the USFWS on January 3, 2024. Although preliminary technical comments were sent in May 2024, the USFWS provided additional feedback including a suggested outline on September 3, 2024. The Conservation Strategy was revised to align with the USFWS's proposed outline. Through several meetings in September through early December 2024, the USFWS and DOD representatives worked collaboratively to develop the updated Strategy, which was finalized on December 9, 2024, along with this Conference Opinion.

3 Conference Opinion

3.1 Programmatic Conference/Consultation Approach

This is a programmatic conference with the intention of increasing efficiency and streamlining the conference (and consultation) process. The intent of this approach is to add predictability and allow the agency to take a landscape approach to avoid the "piecemeal" effect, such that DOD can establish and monitor the effectiveness of their Conservation Strategy across all Military Services. The programmatic nature of the Strategy lends itself to a programmatic conference/consultation approach. Ultimately, consulting on this programmatic action through this programmatic Opinion will produce better conservation outcomes for the monarch than installation-by-installation consultations.

This Opinion evaluates the potential effects of implementation of the Strategy and provides a jeopardy analysis. It serves as the analytical framework and establishes the specific conditions that future projects must adhere to and operate within to remain consistent with the Opinion's scope and analysis.

Under the Sikes Act, the DOD is required to develop and implement Integrated Natural Resources Management Plans (INRMPs) in cooperation with the USFWS and the respective State fish and wildlife agency for installations with significant natural resources. The plans represent the mutual agreement of the three parties and are reviewed for operation and effect at least every 5 years. In addition to these processes under the Sikes Act, USFWS and DOD conduct section 7 consultation under the ESA on INRMP projects implemented in the furtherance of the INRMP, when appropriate to ensure DOD installations are not likely to

jeopardize the continued existence of any listed or proposed species, or adversely modify or destroy designated or proposed critical habitat. Refer to Next Steps and INRMP Integration for additional details on how the Strategy and this Opinion will be stepped down to the installation level; refer to Appendix A for an example draft form that may be used or adapted to assist USFWS Field Offices and installations with this process.

This Opinion covers the future implementation of continuing/ongoing activities for which DOD has discretionary control. Actions that have occurred in the past, or continuing activities for which DOD does not have discretionary control, are considered as part of the baseline. As described in the Effects of the Action section, we consider all consequences to listed species that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action, and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action.

If the monarch is proposed for listing, DOD must consider whether any action not considered under this conference is likely to jeopardize the continued existence of the monarch (50 CFR 402.10). If a final rule were published, effects to monarch from any DOD actions not considered in this conference will require a separate consultation, unless this Opinion is amended or another programmatic consultation that covers those actions is established in the meantime.

Finally, no other federally threatened or endangered species that occur on DOD installations are covered by this Opinion. However, previous consultations do exist that have addressed the effects of many of the Strategy's activities on other listed species and critical habitats. Based on those prior consultations, many of these activities are anticipated to benefit many other species, including other at-risk pollinator species. In the event that such effects on other species or critical habitats have not been addressed by a prior consultation, a separate consultation will occur prior to implementing that particular activity.

3.2 Description of the Proposed Action

A federal action means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies in the U.S. or upon the high seas (50 CFR 402.02).

There are two parts to the Proposed Action: 1) DOD's approval and implementation of their 7(a)(1) Conservation Strategy and 2) future implementation of ongoing military mission and sustainment actions.

3.2.1 7(a)(1) Conservation Strategy

The goal of the Strategy is to continue to effectively conserve monarch butterfly on DOD lands, while executing all military missions and sustainment actions.

The Strategy includes three main approaches to ensuring conservation of monarch (Figure 1):

1) ecosystem management across ~22 million acres throughout the U.S. on installations with an INRMP,

2) future implementation of existing policies and procedures to promote conservation of monarch and other at-risk pollinators, and

3) future implementation of existing conservation programs (e.g., outreach, partnerships, research funding) to benefit monarch (contingent upon appropriations).

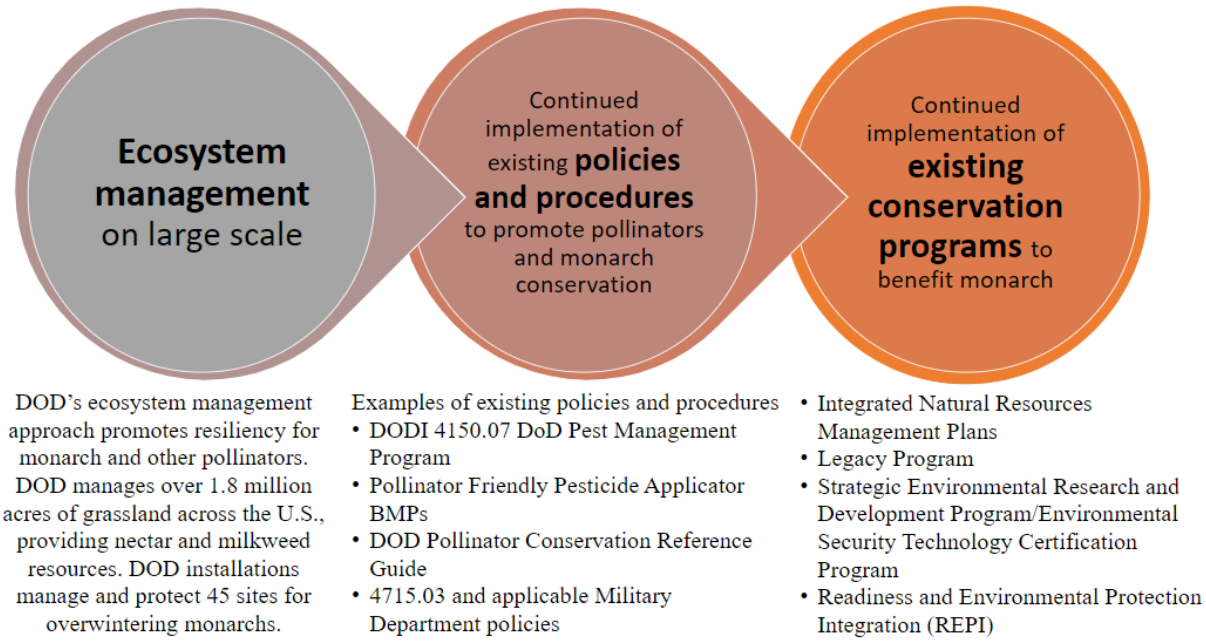


Figure 1. General three-pronged approach for conservation of monarch.

The Sikes Act Improvement Act (SAIA), passed in 1997, made it mandatory that all military installations, including state-owned army national guard sites with significant natural resources prepare and implement, when resources and staff are available, their INRMPs in cooperation with the USFWS, relevant state wildlife agency. DOD policy also recommends coordination with the National Oceanic and Atmospheric Administration's National Marine Fisheries Service where appropriate. INRMPs are required to support the preparedness of the armed forces by providing for no net loss to the military mission coupled with the management of natural resources.

According to the Defense Installation Spatial Database Infrastructure (DISDI) Fiscal Year (FY) 21 *DOD_Site_Locations_Boundaries* shapefile, the DOD owns and manages approximately 25 million acres within the lower 48 U.S. (not including Alaska, Hawaii, and the commonwealths), with just over 22 million of those acres (~90%) being subject to the Sikes Act (16 USC 670a-670f). Just under 3 million acres (~10% of DOD owned land) in the lower 48 U.S. are not covered by an INRMP, because the installations have been determined to not have significant natural resources to warrant an INRMP. Even installations that are not required to have an INRMP adhere to applicable federal and state laws as well as the same DOD policies and guidance required of installations with INRMPs. Furthermore, DOD natural resources policy –

including but not limited to DOD Instruction (DODI) 4715.03 *Natural Resources Conservation Program*, DOD Manual (DODM) 4715.03 *INRMP Implementation Manual*, and each Military Service Component's Policies – guide and direct installations on how to develop, implement, monitor, and report on INRMPs.

INRMPs focus on principles of ecosystem management and include management of threatened, endangered, and at-risk species. See Section 3.2.1.1.1 for additional discussion on INRMPs and consideration of pollinators on military lands.

The unique authorities and strong conservation programs on installations and across the DOD promote a land management ethic that prioritizes resilience within and across ecosystems. The scale of the DOD and its focus on climate resilience, partnerships, and conservation has and will continue to significantly contribute to conservation of monarch and other at-risk pollinators.

3.2.1.1 Ecosystem Management under the Sikes Act

Ecosystem management includes all land management activities, such as timber management and forest thinning; prescribed fire; use of pesticides; use of insecticides and herbicides; outdoor recreation; planting and seeding; nuisance wildlife control (trapping/removal); agricultural outlease (row crop production, grazing, haying); and management for monarch (planting host plants and nectar resources, managing overwintering sites, removing invasive species in suitable habitat).

Milkweed (*Asclepias* spp.) and nectaring resources have been declining across the U.S., largely due to conversion of grasslands to developed or agriculture areas (USFWS 2020). In the last ten years, the U.S. has lost more than 50 million acres of grasslands with 5.7 million acres being lost to agriculture between 2008 and 2012 (Lark et al. 2015). Grasslands on DOD installations are not faced with the same pressures from conversion, with only 0.15 and 0.07% change from grassland to developed and agriculture areas, respectively, occurring from 2014 to 2022 (see the Strategy's Appendix C). In addition, existing habitat and vegetation management actions on military installations currently maintain, enhance, and promote the availability and quality of monarch habitat. Positive management outcomes are accomplished largely through proper ecosystem management that can be achieved by implementing regionally appropriate and site-specific management regimes such as prescribed burning, mowing or haying, and invasive/noxious species control, among others, which are outlined in each installation's INRMP.

3.2.1.1.1 Integrated Natural Resources Management Plans

As described above, Congress requires the DOD to prepare and implement INRMPs to outline how military installations with significant natural resources will manage those resources. INRMPs are prepared in cooperation with the USFWS, appropriate state wildlife agency, and National Oceanic and Atmospheric Administration, when appropriate. The Sikes Act requires that the USFWS formally review INRMPs before they are implemented. In April 2018, the USFWS added an addendum to their Guidelines for Coordination on Integrated Natural Resource Management Plans that provided guidance for addressing pollinator needs and management in

INRMPs. In turn, INRMPs provide an excellent opportunity to encourage pollinator conservation on military lands.

Many DOD Natural Resource Managers (NRMs) have taken proactive approaches to monarch and pollinator conservation at their installations and have included sections within their INRMPs that address monarchs and other pollinators. For example, DOD contracted with Texas A&M's Natural Resources Institute to review INRMPs and found that just over 200 of the more than 300 INRMPs reviewed indicated that their installations either actively conduct or plan to conduct invertebrate surveys at their sites, with more than 100 indicating that they currently conduct or plan to conduct monarch or pollinator-specific surveys. Many of these same installations also provide information within their INRMPs on a wide variety of management activities that may affect monarchs or other pollinators and the best management practices (BMPs) and conservation actions they are implementing to avoid, minimize, or mitigate their impacts. Management activities addressed in current INRMPs that may affect monarchs or other pollinators include but are not limited to pesticide, insecticide, and herbicide use; prescribed burning; invasive/noxious species control; mowing; and tree removal.

Furthermore, many installations already manage for other threatened, endangered, or at-risk pollinator species such as the rusty patched bumble bee (*Bombus affinis*), Karner blue butterfly (*Lycaeides melissa samuelis*), and the regal fritillary (*Argynnis* [Speyeria] *idalia*), among others. In many cases management activities, conservation actions, and protocols intended for one species often benefit sympatric species. One such example is the regal fritillary, which both Fort Riley, Kansas, and Fort Indiantown Gap, Pennsylvania, have been managing, surveying, and implementing conservation actions that benefit the species for over a decade. Both installations indicated in their INRMPs that much of the work they do for the regal fritillary would also benefit the monarch. Subsequently, they folded the monarch and its host plant into existing protocols and management strategies and had been doing so long before the monarch was petitioned for listing.

3.2.1.2 Policies and Procedures

Existing DOD policies and procedures promote conservation of monarch through limiting pesticide exposure and utilizing pollinator-friendly BMPs for pest management to protect pollinators including butterflies, and adoption of the DOD Pollinator Conservation Reference Guide (DOD PCRG) which contains helpful references and additional BMPs.

3.2.1.2.1 Limiting Pesticide Exposure

Installations are required to develop and implement Integrated Pest Management Plans (IPMPs) under DODI 4150.07 *DOD Pest Management Program*. IPMPs identify how, when, and where pest species are treated while also focusing on and striving for the continued reduction in reliance on pesticides, insecticides, and herbicides.

These policies explicitly direct the DOD to minimize the use of pesticides, including herbicides, particularly in sensitive habitat sites or where listed species may occur. Then when doing so, it must be applied with care and precision by a Certified Pest Management Applicator. The DOD's position on Integrated Pest Management is one of early detection and rapid response as opposed

to continual treatment. There must be an identified pest before a treatment method is implemented.

In addition to DODI 4150.07 *DOD Pest Management Program*, the "Pollinator Friendly Pesticide Applicator Best Management Practices" fact sheet developed by Naval Facilities Engineering Systems Command (NAVFAC) Applied Biology instructs applicators on proper pesticide use to avoid harming pollinators, their food sources, water, and habitat. The instructions in the fact sheet are now the guidance found within all Navy and Marine Corps IPMPs. The DOD PCRG, which serves as the current DOD guidance for monarch and other related pollinator BMPs, also contains an entire section dedicated to informing land managers how they can reduce pesticide use and adverse impacts of pest control on pollinators, including monarch. Guidance includes:

- Eliminating or reducing the use of pesticides.
- If pesticides are used:
    - Select pesticides that are specific to the pest;
    - Time applications to avoid monarch activity periods;
    - Minimize drift to non-target areas by direct ground applications;
    - Establish buffers.

INRMPs for more than 100 installations discuss pesticides, insecticides, and herbicides as they relate to monarchs and other pollinators, as well as the conservation actions the installations currently take to reduce monarch and other pollinator exposure. For instance, at Camp San Luis Obispo (CSLO) in California, spatial buffers are in place at various distances depending on application method when deploying systemic insecticides in order to minimize exposure, limit transmission, and reduce drift. The National Guard Marseilles in Illinois restricts the use of glyphosate in all areas within their installation to limit pollinator exposure. Several other installations reduce pollinator exposure to pesticides when removing invasive species by using alternative methods of control such as aptly timed mowing.

DOD has standard operating procedures that reduce the influence that agricultural-related activities may have on monarchs and other pollinators. Outleases (i.e., row crop agriculture, haying, and grazing) are subject to the same existing rules and regulations listed under the installation's IPMP. Therefore, the lessee is contractually obligated to abide by the same rules and guidance that are followed for activities on the rest of the installation (including pesticide use).

The overall footprint of row crop agriculture on the DOD is relatively small. Currently there are <50,000 acres of row crops on DOD managed lands, which accounts for approximately 0.20% of the total DOD footprint. Like row crops, haying is also a relatively minor activity on DOD properties with approximately 50,000 acres of hay ground located within installations. Of the agricultural related activities that occur on DOD lands, grazing is the most significant with approximately 500,000 acres of livestock grazing occurring on DOD managed lands. Although

grazing related activities account for substantially more acres than row crops or haying, grazing only accounts for just over 2% of the total DOD footprint. Given the small number of agricultural outleases on DOD properties and their relatively small size in the context of their overall footprint across the entire DOD enterprise, the influence of agricultural outlease-related impacts to monarchs on DOD-managed lands is minimal.

3.2.1.2.2 2014 Presidential Memorandum

The DOD has enacted numerous pollinator-specific policies, strategies, and conservation efforts in response to the Presidential Memorandum issued in June 2014 entitled Creating a Federal Strategy to Promote the Health of Honey Bees and Other Pollinators. The 2014 memorandum established an interagency Pollinator Health Task Force that developed a national strategy promoting the health of bees, butterflies, other pollinating insects, birds, and bats that outlined goals and federal actions that needed to be taken to achieve those goals. The memorandum also directed the Department of Energy and other federal agencies to take immediate measures to support habitat restoration projects for pollinators, use pollinator-friendly native landscaping, and minimize the use of pesticides harmful to pollinators when possible (79 FR 35903). In response, the Office of the Under Secretary of Defense distributed a memorandum that expanded DOD Policy to use current BMPs, when applicable, to specifically "protect pollinators (e.g., bees, birds, bats, butterflies, moths) and their habitats." Subsequently, the U.S. Department of Agriculture (USDA) and U.S. Department of Interior (DOI) released the Pollinator-Friendly Best Management Practices for Federal Lands document while the USDA and U.S. Environmental Protection Agency (EPA) transmitted the National Strategy to Promote the Health of Honey Bees and Other Pollinators on behalf of the Pollinator Health Task Force. This report provides a dedicated DOD Pollinator Protection Plan, direction to other federal agencies, and recommends BMPs. In response to the memoranda and other agency actions, NAVFAC Applied Biology put together the Pollinator Friendly Pesticide Applicator Best Management Practices fact sheet, discussed above.

3.2.1.2.3 DOD Pollinator Conservation Reference Guide

In 2017, the Department of Air Force (DAF) in collaboration with the USFWS developed the DAF Pollinator Conservation Reference Guide. In 2018, Air Force Civil Engineer Center (AFCEC) and the USFWS allowed the Armed Forces Pest Management Board (AFPMB) to adopt their guide for DOD-wide distribution and this became the DOD Pollinator Conservation Reference Guide (DOD PCRG). The AFPMB is a directorate within the Office of the Secretary of Defense Energy, Installations, and Environment that recommends policies and procedures, provides guidance, and coordinates the exchange of information related to pest management throughout the DOD. The AFPMB also provides DOD-specific certification training to personnel to further conserve pollinators across military lands with respect to insecticide and herbicide use. Informed by existing agency policy, guidance, instructions, and business rules, the DOD's PCRG provides technical information, resources for implementation, and builds on existing guidance documents (e.g., the Pollinator-Friendly Best Management Practices for Federal Lands document). The DOD PCRGP is separated into six overarching sections that include an introduction; conserving pollinator species of concern; conserving and enhancing pollinator habitat; reducing pesticide use and adverse impacts of pest control; promoting pollinator

conservation through education and outreach; and partnerships for pollinator conservation off-installation. The DOD PCRFG highlights threatened, endangered, candidate, and at-risk pollinator species, provides links to helpful outside resources, offers recommended conservation actions, and serves as the current DOD reference for monarch and other related pollinator BMPs.

3.2.1.3 Conservation Programs

In addition to implementation of INRMPs, DOD will continue to implement (contingent on sufficient appropriation and prioritizing mission fulfillment) conservation programs for monarch across the nation. In the past, these efforts included a large interagency agreement, implemented under the Legacy Program, that covers multiple monarch conservation-focused projects; extensive overwintering habitat protection efforts; and large-scale conservation programs and initiatives (funding, research, outreach, and leveraging partnerships). Implementation of the installation-level programs will continue into the future but will vary by location and activity based on appropriations, interest, and opportunities. DOD's efforts to protect overwintering habitat and other large-scale conservation programs and initiatives are also described in this section. See the Strategy for examples of recently completed projects and their contributions to monarch conservation across the continental U.S., considered as part of the Environmental Baseline in this Opinion.

3.2.1.3.1 Overwintering Habitat Protection

The major threats to overwintering sites in the U.S. include urban development, disease and pests, improper tree management, and increased threat of drought and fire due to changing climate. The BMPs described below, and those included in other relevant guidance documents produced either by or for the DOD for overwintering habitat, will reduce or eliminate many of these threats on military lands. These actions primarily include reducing disturbance when monarchs are present, implementing vegetation management activities that minimize destruction or disturbance of monarchs, and enhancing nectar resources near overwintering sites and along the coast. Current BMPs in the DOD PCRFG include:

- Reducing human disturbance at overwintering site when monarchs are present.
- Avoiding tree removal and tree trimming at monarch overwintering sites unless trees pose a human health and safety risk.
- Developing long-term management plans at overwintering sites that include (in many instances) the planting of native trees and nectar plants.
- Consulting with a monarch expert and an arborist prior to any cutting or thinning within tree stands known to support overwintering monarchs. Schedule tree thinning or cutting outside of the November to February overwintering season.

For additional discussion on efforts to protect overwintering habitat, refer to Availability of Overwintering habitat section.

3.2.1.3.2 Large-scale Conservation Programs and Initiatives

3.2.1.3.2.1 Strategic Environmental Research and Development Program/Environmental Security Technology Certification Program

The Strategic Environmental Research and Development Program (SERDP) and Environmental Security Technology Certification Program (ESTCP) are programs that fund research that seek to harness the latest science and technology to improve DOD's environmental performance, reduce costs, and enhance and sustain mission capabilities. These programs promote partnerships and collaboration among academia, industry, and the Military Services, and other Federal agencies. SERDP invests in broad topics of basic and applied research and ESTCP focuses on DOD's environmental, resilience, and installation energy and water technology and validation, mainly by promoting the transfer of innovative technologies that have successfully established proof of concept to field or production use. Funding for these programs occurs annually and has included funding for projects that investigated development of environmental DNA (eDNA) as a management tool for at-risk pollinators on military lands, evaluation of the impacts of multiple stressors on at risk species, ecosystem resilience research, assessing pollinator communities via eDNA, and the impact of non-native predators on pollinators and native plant production.

3.2.1.3.2.2 Readiness and Environmental Protection Integration Program

Beginning in 2003, DOD has been partnering with private conservation groups as well as state and local governments under the Readiness and Environmental Protection Integration (REPI) Program. REPI is an important tool for combating encroachment that can limit or restrict military training, testing, and operations by helping remove or avoid land-use conflicts near installations while simultaneously addressing regulatory restrictions that inhibit military activities. While REPI's mission is to protect military readiness, REPI also benefits the environment by conserving land near military installations and ranges. The partnerships formed under the REPI program work across boundaries, often with the goal of enhancing and protecting wildlife habitat and other natural spaces. REPI is continually advancing innovations in new financing techniques, endangered species crediting, and use of other authorities while encouraging partners to accelerate the rate and pace of protection. To give a sense of scale of this program, from 2003 to 2023, DOD leveraged over $1.4 billion with nearly $1.3 billion in non-DOD partner contributions to protect, enhance, or restore over 1.2 million acres of land across the U.S. There are clear benefits to the ecosystems and species that live within them, including monarch, that are achieved by protecting and managing landscapes around military lands. In 2016, for example, $1.5 million in REPI funds were combined with $2.2 million in partner funding to protect 1,015 acres around Fort Cavazos which is within the key migration route and breeding grounds for the eastern monarch population.

Outside of direct funding of projects that protect and restore the ecosystems that monarchs rely on, the REPI Program seeks to prioritize landscape-scale initiatives through partnerships by participating in the Sentinel Landscape Partnership, the Southeast Regional Partnership for Planning and Sustainability (SERPPAS), and the Western Regional Partnership. Each of these partnerships prioritizes supporting and funding of large-scale restoration, management, and protection of ecosystems including the promotion of sustainable land uses, wildlife corridors, and research, to name a few. These partnerships promote resilient landscapes that can support their individual, population, and species needs, initiatives that promote landscape-level solutions like the ones listed above are essential to the sustainment and recovery of monarch in the future.

3.2.1.3.2.3 DOD Legacy Resource Management Program

The DOD Legacy Resource Management Program (Legacy Program) provides financial assistance to regional or national efforts to protect and enhance natural and cultural resources while simultaneously enabling military readiness. This program provides coordinated, department-wide, and partnership-based integration of military mission readiness with the conservation of irreplaceable natural and cultural resources. This program provides an opportunity for installations to work with experts in the field of monarch conservation and obtain technical assistance, site-specific monarch guidance, assistance with INRMP updates, help with monitoring efforts, habitat restoration activities, and more. Although the extent of future funding for this program is contingent upon appropriations, the program is one example of conservation programs that have benefited monarch and are likely to continue to benefit conservation of the species.

3.2.1.3.2.3.1 National Public Lands Day

National Public Lands Day (NPLD) is the nation's largest, single day volunteer effort for public lands. The DOD joined the NPLD partnership in 1999. Through the Legacy Program, DOD provides funding to support natural and cultural resources projects on military installations. Since 1999, the Legacy Program has awarded just over $3 million to fund nearly 600 NPLD projects that have directly benefited military lands across the U.S. Included among the Legacy Program-funded NPLD projects are several that have been specifically geared towards pollinators. From 2009-2014, the DOD funded approximately 150 pollinator-related NPLD projects and continues to support these small-scale projects. For example, a project conducted in 2021 at Fort Belvoir included the removal of invasive species and shrubs which were replaced by a pollinator garden with native wildflowers to promote pollinator habitat. Among the ten total grantees awarded for their 2023 NPLD projects, four installations including Eglin Air Force Base, Fort Cavazos, Joint Base Lewis-McChord, and Camp Shelby were awarded funds for pollinator specific projects.

3.2.1.3.2.4 Recovery and Sustainment Partnership

After years of ESA collaboration and innovation, the DOD and DOI formalized the Recovery and Sustainment Partnership (RASP) Initiative through a Memorandum of Understanding in 2018 (renewed in February 2024). The purpose of the RASP is to develop effective ecosystem and species conservation and recovery initiatives while promoting increased flexibility for military mission activities. The RASP's high-level coordination and collaboration between the DOD and DOI has facilitated the achievement of multiple objectives that have advanced species conservation and recovery while simultaneously meeting DOD mission-related needs. In 2021, the USFWS and DOD agreed to explore the development of a nationwide Species Action Plan (SAP) for the monarch under the RASP. The draft monarch SAP outlines a conservation approach to conserve monarchs nationwide that focuses on helping installations implement the following preliminary goals: 1) develop a streamlined and programmatic section 7 process for monarchs resulting in efficient and predictable ESA consultation coverage for all applicable DOD installations; 2) identify BMPs for DOD installations that will contribute to the conservation of the monarch, streamline the DOD and USFWS' future consultation requirements, and minimize any potential mission restrictions due to compliance with the ESA;

3) improve conservation status of monarchs; and 4) develop recommendations on standards and protocols for monarch inventory, monitoring, and data collection specific to eastern and western populations. DOD's 7(a)(1) Strategy helps meet several of the goals outlined in the draft monarch SAP.

3.2.2 Military Mission and Sustainment Actions

The Strategy briefly addresses impacts to monarch from implementation of military mission:

> Implementation of the military's mission may occasionally result in adverse effects to monarch or monarch habitat. DOD installations consist of working lands that, first and foremost, support the military's mission: to provide the military forces needed to deter war and ensure our nation's security. As discussed in Section III [of the Strategy], installations are also managed to support sustainment of the natural resources within their boundaries. Military training operations, which include a wide variety of activities (e.g., troop and wheeled maneuvers, live munitions training, demolitions), are likely to impact monarchs and their habitat; however, the impacts of these activities are limited in size in comparison to the benefits provided by the comprehensive and extensive nature of the DOD's general conservation strategy. In addition, when impacts occur outside of regularly utilized areas, it is DOD procedure that these areas are repaired and restored. When evaluating impacts on monarchs from military training operations and other activities that are done to manage and maintain installations, existing BMPs, ongoing natural resource management practices, and additional large-scale funded programs provide overall benefits to monarch populations and a significant contribution to the conservation of monarchs.

Additional information on mission and sustainment actions was provided as supplemental information to the Strategy. Military mission and sustainment includes all activities needed to support the mission of the military, including military training and operations activities.

3.2.2.1 Military Mission and Mission Sustainment Activities

In addition to the land management, policies and procedures, and conservation programs detailed in the Strategy, the Proposed Action includes the following routine mission and mission sustainment activities that may affect monarch habitat and/or individuals. These activities can be categorized generally as 1) ground-based training, 2) aviation training, 3) impact areas, and 4) construction and maintenance. The following sections provide a general description of each of these categories. Additional details on the scope, extent, and timing of the various activities that fall under these activities are not available at the programmatic level. At the INRMP development/review stage, installations will consider the site-specific details (timing, extent, duration, etc.) to ensure the effects analysis in this Opinion is consistent with those effects that occur to monarch as a result of carrying out mission and mission sustainment activities.

3.2.2.1.1 Ground-based Training

Ground-based training events occur predominantly on the ground but may involve an aircraft component (typically helicopters) for troop and/or equipment transportation. The following are the basic types of ground-based training. Note that a training event may involve one or more of these basic training types.

Maneuver Training. Maneuver training may be mounted (movement by vehicle) or dismounted and may involve unit sizes varying from tens to thousands of personnel. Maneuver training may include offensive operations, defensive operations, bivouac, assembly area operations (see below), and specialized training. It may also involve the use of smoke and obscurants, noise, and simulated nuclear, biological, and chemical conditions to replicate combat conditions as closely as possible.

Mounted maneuvers involving a variety of light, medium, and heavy wheeled tactical and logistical vehicles which are used to transport troops, equipment, and supplies, tracked vehicles and construction equipment (e.g., bulldozers and track hoes) that may be used in designated areas, and/or a variety of rotary aircraft. These maneuvers may occur on roads, trails, and off-road where the terrain, vegetation density, slope, and administrative factors are favorable to the vehicle type.

Dismounted (on foot) maneuvers may occur anywhere that safety or administrative restrictions permit and may include the use of defensive fighting positions, which ranges from lying in concealed positions, to digging individual fighting positions using hand tools, to large crew-served weapons emplaced using heavy equipment excavators. Where permitted, units may use blank ammunition and pyrotechnics to provide sound and visual effects simulating the battlefield environment.

Live-fire Training. Live-fire training includes many types of munitions, including ball and tracer rounds, high-explosives, rockets, mines, grenades, artillery and mortar rounds, short-range training ammunition (low-velocity plastic bullets, a.k.a. SRTA), explosives (e.g., for demolitions), and practice and training-practice ammunition. Training units vary from an individual gunner, a crew of a weapon system, or a collective unit firing at predetermined targets from designated firing positions on a range facility. Live-fire may also be incorporated into maneuver training within established safety zones.

Live-fire training also includes the following:

- Demolition training: Use of explosive materials to remove obstacles, clear hazardous areas, or eliminate unexploded ordnance.
- Mine training: Use and removal of anti-personnel or anti-tank land mines. Both training types occur within designated training locations.
- Aviation live-fire training: Firing at designated ground targets with guns, rockets, missiles, or bombs from aircraft.
- Pyrotechnics: Various items that are used for signaling, illumination, marking targets, or obscuring/screening movement. Pyrotechnic items include, but are not limited to, grenade and artillery simulators (flash/bang), flares, smoke grenades, HC/TA (hexachloroethane/terephthalic acid) smoke, CS (riot control/tear gas) grenades, and fog oil smoke.

Bivouacking and Assembly. Bivouacking and assembly involve setting up field areas for rest, resupply, maintenance, storage, communications, command post, medical facilities, or meal preparation. Bivouacking and assembly areas may consist of a number of tents, temporary

structures, and equipment. Supplies and equipment may be positioned on site with heavy machinery. Such areas vary depending on unit size and mission, ranging from less than 2 acres to more than 20 acres and are usually located in relatively level areas with vehicle access.

3.2.2.1.2 Aviation Training

Aviation training may be included in maneuver training and live-fire training, as described above. It also includes fixed wing and helicopter aircrew training, such as aviation flight skills (e.g., takeoff and landings), contour and low-level flights (50 feet to 500 feet above ground), confined and high-altitude area landing/takeoff, and navigation. Most takeoffs and landings take place in designated landing zones (LZs).

Unmanned Aerial Systems (UAS)/Unmanned Aerial Vehicles (UAV). UAS/UAV are aircraft that support land warfare operations and are typically engaged in intelligence, surveillance and reconnaissance (ISR); battle damage assessment; targeting; and convoy protection missions. UAS/UAV are transported to and from launch/recovery sites by vehicles with trailer and require a ground support crew (typically three personnel).

Pickup Zone, Landing Zone, and Drop Zone Training. Pickup zones (PZs) and landing zones are geographic locations utilized for tactical personnel movement training. The number and type of aircraft will vary depending on the unit size but typically involves from 1 to 26 helicopters. Drop zones (DZs) are used for parachute drops of troops, equipment, and/or vehicles. PZs and LZs are often utilized during dismounted maneuver training.

3.2.2.1.3 Impact Areas

Impact areas are designated areas within installations where live munitions can be used. Impact areas are further designated as "dudded" and "non-dudded." Dudded impact areas are areas within which all ordnance that may produce "duds" (those that fail to completely function at the target after being fired/initiated) will detonate or impact. This area may include targets, such as vehicle bodies, for artillery/mortar fire. Because of the potential for the unexploded ordnance (duds) to be present, dudded impact areas cannot be used for maneuver training. Non-dudded impact areas are mainly within the safety fans for small arms ranges where ordnance that may impact the area does not produce duds. Non-dudded areas may be used for maneuver training, but only when the adjacent weapons ranges are not in use.

3.2.2.1.4 Construction and Maintenance

Construction and maintenance may occur throughout the installation and include a variety of activities including, but not limited to the following:

- Construction, repair, or replacement of interior or exterior structures (e.g., clearing, grading, fill; staging areas, parking areas, etc.)
- Portable or permanent lighting
- Utilities installation, infrastructure, and maintenance (vegetation removal with rights-of-way)
- Demolition
- Borrow pits
- Pest management (through manual or mechanical means; use of chemicals)

- Erosion and sediment control
- Ground maintenance (e.g., mowing)
- Culvert installation, repair and replacement
- Dams and water control structures
- Drainage ditches (construction, maintenance, etc.)
- Bridges and roads (construction, repair and maintenance)
- Runways (constructions, maintenance, Bird/Wildlife Aircraft Strike Hazard [BASH/WASH] actions)
- Geotechnical investigations (seismic surveys, radar, core sampling, pit or trench digging)
- Fence installation and maintenance
- Vehicle use (on and off road)

3.3 Conservation Measures

Conservation measures are measures that the Action Agency has agreed to implement to minimize or avoid adverse effects. DOD included four overarching conservation measures for their Strategy, as well as several land management-specific BMPs, which are contemplated as conservation measures by this Opinion. These programmatic conservation measures and BMPs are expected to be implemented contingent upon sufficient appropriations and prioritizing mission fulfillment (i.e., consistent with their authorities under Sikes Act, implementation of conservation measures or BMPs cannot result in a loss of the capability of military installation lands to support the mission of the installation). The overarching conservation measures are:

- DOD will continue to maintain, enhance, and/or increase monarch habitat and will limit habitat loss in instances where the mission requires permanent loss of habitat.
- DOD will conduct land management practices that provide resilient native ecosystems in accordance with the Sikes Act, DOD, and Military Service Policies and will directly consider conservation benefits for monarchs.
- DOD will implement applicable BMPs (as identified below) in suitable habitat for monarchs (see section 5.1).
- DOD will continue to contribute to monarch conservation by conducting outreach activities, participating in partnerships, and contributing to research.

3.3.1 Best Management Practices

The DOD BMPs are provided to NRMs to aid them in ensuring land management is conducted in ways to enhance monarch habitat by identifying best practices. If implementation of these BMPs conflict with another species on the installation, DOD will consult with their local field office separately. BMPs do not apply outside of monarch habitat, in areas where surveys demonstrate probable absence, or in areas where it interferes with their mission (e.g., during military training activities) (see Strategy for more details). Although there may be some instances where installations cannot implement conservation measures or BMPs because doing so would result in a loss of the capability of military installation lands to support the mission of the installation, we generally expect installations will implement them and consider them to be reasonably certain to occur for purposes of this Opinion.

The following is an excerpt taken from the Strategy:

Best Management Practices for DOD Conservation Strategy

Best Management Practices (BMPs) in **bold** are included in current policy and procedure guidance (with source indicated). Additional context and BMPs are provided here to help Natural Resource Managers identify best practices. For more information, refer to these regional guides and resources: Xerces, Monarch Joint Venture, and Overwintering recommendations.

Mowing

- **Adjust management activities (including timing of mowing) so as not to interfere with breeding or nectaring by following recommended timing windows (**DOD PCRG). (See [Strategy] Figure 6 [Recommended Management Timing Window map]; late winter mowing is best) so long as it does not impact mission, safety, or security.
    - Additional context (from Monarch Joint Venture): Avoid mowing monarch habitat when monarchs are present (see [Strategy] Figure 6, Recommended Management Timing map). Mowing milkweed mid-summer in areas where there is a lull in monarch activity, such as the Southern Great Plains, may promote milkweed growth and late summer or early fall breeding (Baum and Mueller 2015; Fischer et al. 2015).
- Avoid mowing the entire habitat. Leaving refuge areas for wildlife will allow for recolonization of the mowed site. Leave areas that may be good nesting or overwintering sites (leaf litter, dead stems, other ground cover) for pollinators or other wildlife.
- Mow after native plants finish blooming and dispersing seed (i.e., schedule mowing to enhance floral resources). For weed control, time mowing for periods before noxious and/or invasive weeds flower.
- Use a minimum cutting height of 10-12 inches (shorter may be needed for early establishment mowing). This effectively removes seed producing parts of most invasive plants and minimizes wildlife impact.
- Instead of mowing or haying consider alternative management actions that encourage forbs and increase plant species diversity such as grazing or prescribed burning. If alternative methods are not possible, try to only mow once or twice per year, as mowing too frequently disrupts growth and the ability of flowering plants to compete with grass.

Mowing Rights-of-Way

- Maintain a regularly mown clear zone as needed for sight distance and safety, but limit mowing of vegetation beyond this zone when possible (Xerces Society 2018; McKnight et al. 2021).
- Avoid mowing patches of milkweed, especially during the monarch breeding season when eggs and larvae are present.

Grazing

- **Adjust management activities (including amount of grazing) so as not to interfere with breeding** (DOD PCRG).

- **If an area is grazed, control the amount of grazing to avoid eliminating flowering plants, reduce soil compaction, and prevent overgrazing** (DOD PCRG.
- **Include native flowering plants used by pollinators when grazing areas are re-seeded unless inconsistent with grazing practices** (DOD PCRG).
- Strive to achieve heterogeneous grazing intensities with ungrazed refugia across the landscape via rotational grazing practices or patch-burn grazing (Xerces Society 2018, McKnight et al. 2021).
    - Aim to graze only one-third of an area per year
    - Avoid grazing the same area every year

Row Crop Production

- Incorporate monarch-friendly planting into hedgerows, orchard understories, pivot corners, crop margins, riparian buffer strips and corridors, or other out-of-production areas (Xerces Society 2018).

Prescribed Fire

- **Conduct prescribed burns when monarchs are absent from the habitat** (using timing recommendations in [Strategy] Figure 6) (DOD PCRG).
- **Leave unburned patches (at least one-third the area of the proposed burn footprint) that provide refugia (nectar and breeding sites) for butterflies that can then re-colonize the burned area the next season** (DOD PCRG).
- For post-wildfire restoration and rehabilitation, see Grassland Restoration Activity planting BMPs (Xerces Society 2018; McKnight et al. 2021).

Application of Herbicides, Pesticides and Insecticides

- **Use pesticides in accordance with DOD Policy and by following label directions explicitly.**
- **Eliminate or reduce the use of pesticides in areas with monarchs** (DOD PCRG). Limit insecticide exposure where possible.
    - Avoid the use of neonicotinoids or systemic insecticides, or coated seeds any time of the year in monarch habitat (Xerces Society 2018; McKnight et al. 2021; USFWS 2023).
    - Do not plant milkweeds or other pollinator nectar plants in areas where neonicotinoids were applied in the last 2 years (Xerces Society 2018; McKnight et al.2021)
- Apply pesticides using methods that are targeted and reduce drift into non-target areas (Xerces Society 2018; McKnight et al. 2021; USFWS 2023).
- If herbicides are used, apply when plants are more responsive to treatment and when monarchs and other pollinators are less likely to be nectaring on the plants. Plants should not be sprayed in bloom or after they have gone to seed (USFWS 2023; [Strategy] Figure 6).
- Ensure staff and contractors are adept at plant identification. The ability to recognize native plants as well as invasive weeds will reduce unintended damage to non-target plants (Xerces Society 2018; McKnight et al. 2021).

Grassland Restoration Activities

- **Increase native milkweed and other flowering plants in monarch breeding areas** (DOD PCRG).
    - **Plant locally appropriate milkweed (*Asclepias* spp.)** and incorporate native, habitat-appropriate milkweed species into plantings.

- **Increase native flowering plants along migration routes that bloom during the time of migration** (DOD PCRG).
    - **Plant native flowering plants so nectar is available during the times monarchs are present in the area.**
        - Maximize native flowering plant diversity across bloom periods.
- Seed mixes should include a minimum of nine total species of native flowering plants including three species per blooming periods of April-June, June-July, and August-October (McKnight et al. 2021).
- Source seeds as locally as possible
    - Regional/Ecoregional-specific planting and native plants guides: NRCS, Xerces, Monarch Joint Venture
- Seed mixes will seek to be free of invasive or aggressive nonnative species that inhibit diversity when established, and these seed mixes will not be treated with insecticides.
- **Eliminate invasive plants, especially nonnative milkweed.**
    - **Do not plant nonnative milkweed like tropical milkweed (*Asclepias curassavica*) or balloon plant (*Gomphocarpus physocarpus*)** (DOD PCRG).
    - **Eliminate invasive plants and nonnative tropical milkweed, which is believed to promote the spread of disease (e.g., *Ophryocystis elektroscirrha* also known as OE) in migratory monarchs** (DOD PCRG).

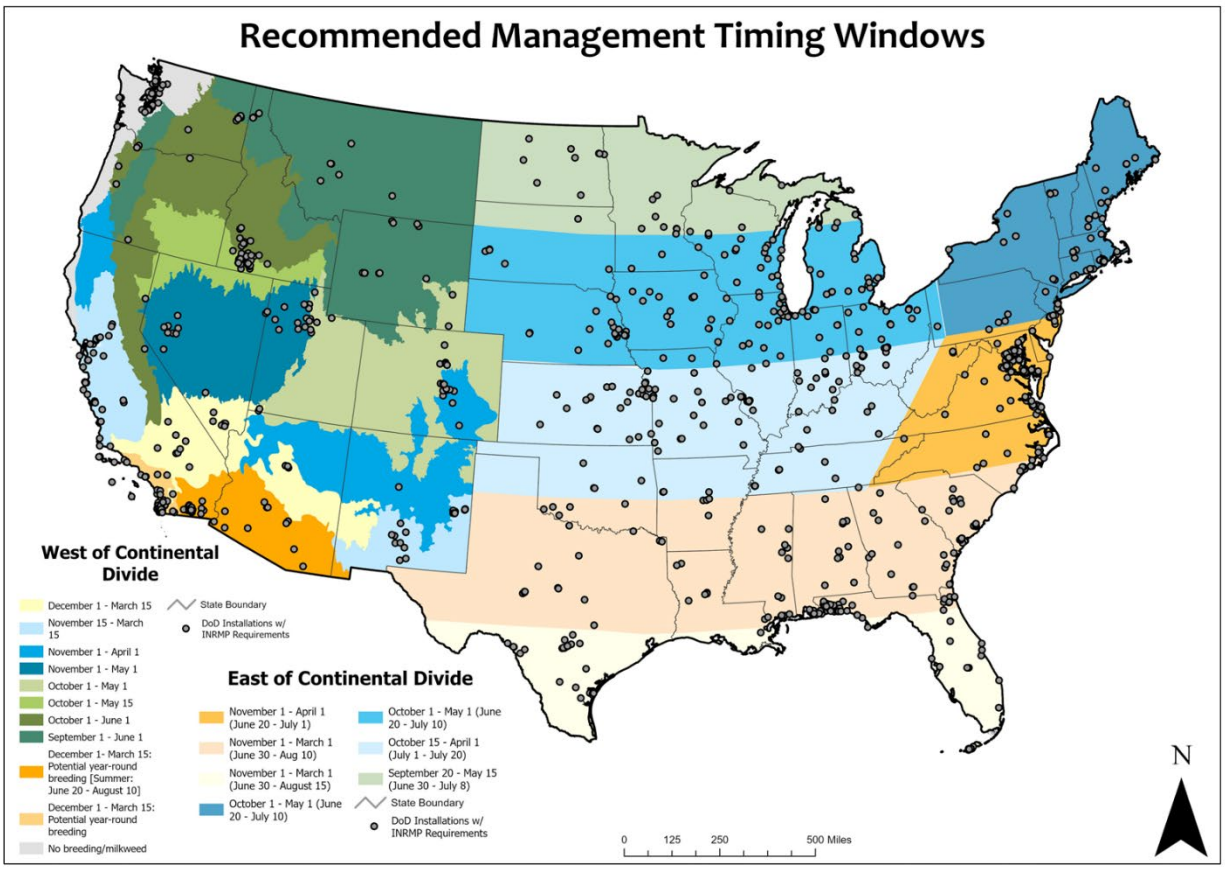
Overwintering site management (including tree removal or forest management)

- **Reduce human disturbance at overwintering sites when monarchs are present** (DOD PCRG).
- **Avoid tree removal and tree trimming at monarch overwintering sites unless trees pose a human health and safety risk** (DOD PCRG).
- **Develop long-term management plans at overwintering sites that include (in many instances) the planting of native trees and nectar plants** (DOD PCRG).
- **Consult with a monarch expert and an arborist prior to any cutting or thinning within tree stands known to support overwintering monarchs** (DOD PCRG).
- Enhance habitat within overwintering sites and within 500 feet (support zone) of sites by planting tree species where monarchs are known to cluster (USFWS 2023).
- Avoid the removal of living trees or shrubs within 500 feet of overwintering sites except for specific grove enhancement purposes and or safety concerns for dead trees (USFWS 2023).
- Reduce fuel loads and minimize risk of catastrophic wildfire within overwintering habitat through selective thinning of small diameter trees in the support zone and maybe the shelter zone.
- Conduct management activities (tree trimming, mowing, burning, and grazing) in overwintering sites from March 1-September 30. Planting trees, shrubs, or forbs for restoration is acceptable during overwinter season (USFWS 2023).

- Avoid pesticide applications within 500 feet of overwintering sites, especially when monarchs are present, and use non-chemical weed and pest prevention. If pesticides are used in or adjacent to overwintering habitat, then conduct applications from March 1-September 30, when possible (USFWS 2023).
- Enhance nectar sources by planting fall/winter/early spring blooming native forbs within overwintering sites and within 5 miles of the coast (USFWS 2023); however, it is discouraged to plant milkweed in areas where it did not occur historically, including near monarch overwintering sites, to avoid disrupting monarchs' natural behavior (Xerces Society).

Recommended Timing Windows

The management windows presented in [Strategy] Figure 6 illustrate timeframes when management activities are least likely to have negative effects on monarchs. The recommendation is to use the management windows described in Figure 6 in conjunction with recommendations for other species to inform the best timing of management in your area. It is important to note that the management timing windows depicted in Figure 6 represent approximate recommendations of timeframes to conduct management activities. Summer management intervals may still cause some mortality. In Arizona, summer management windows are only recommended for low elevation areas with high summer temperatures.



[Strategy] Figure 6. Map of recommended management timing windows for monarchs (Danaus plexippus) east and west of the Continental Divide. Dots represent Department of Defense (DoD) military installations that have Integrated Natural Resource Management Plan (INRMP) requirements. Management during the dates in paratheses should occur only if necessary (if cannot be done in the recommended window).

[End excerpt from Strategy]

3.4 ACTION AREA

The Action Area is defined as all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action (50 CFR 402.02).

The Action Area under consultation includes all DOD military installations within the continental 48 states and does not include Alaska, Hawaii, and the commonwealths, totaling approximately 25 million acres of land and water (Figure 2). Also included in the Action Area is the reach of conservation programs (e.g., funding research, outreach efforts, strategic partnerships) across the continental U.S. The Action Area also includes air space above and beyond installation boundaries used for aviation training.

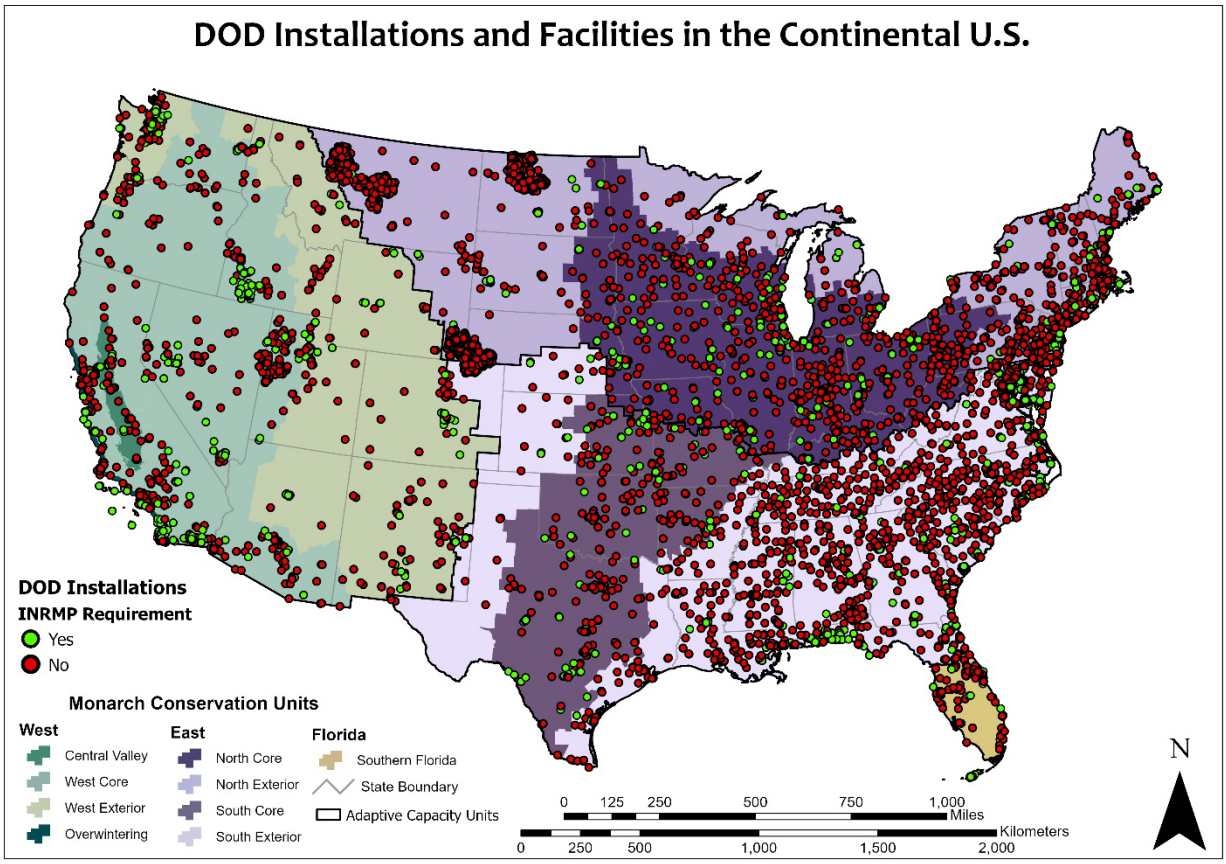


Figure 2. Map showing all DOD installation/sites. Point does not reflect size of installation. Color of point reflects whether or not the installation has an INRMP. Also shown are the Monarch Conservation Units.

Although monarchs are found in Hawaii, they are not native to the islands; therefore, Hawaii was not included in DOD's Strategy. Because Hawaii is outside the historical range of the species, and was not included in the Strategy, we do not consider it further in this Opinion.

Table 1. Number of installations and respective total acres of Department of Defense (DOD) military installations within Monarch Conservation Units (MCU). Number of installations and installations acreages were derived using Defense Installation Spatial Data Infrastructure (DISDI) FY 21 DOD_Site_Locations_Boundaries shapefile.

Department of Defense Military Installations within Monarch Butterfly Conservation Units				
	INRMP		No INRMP	
MCU	No. Installations†	Acres	No. Installations †	Acres
North Core	33	554,191	67	41,707
North Exterior	49	626,699	67	445,788
South Core	32	844,857	32	90,836
South Exterior	98	4,182,406	114	171,013
West Core	59	12,951,102	46	1,663,598
West Exterior	27	4,135,599	29	297,286
Central Valley	7	60,481	9	11,145
Overwintering	9	243,819	9	3,663
Southern Florida	8	140,273	9	10,295

† Some DOD installations are comprised of geographically separated units (GSU). GSUs can be located hundreds of miles apart. As such there are instances when an installation and its GSUs are located in multiple Monarch Conservation Units (MCU).

3.5 ANALYTICAL FRAMEWORK FOR THE JEOPARDY DETERMINATION

3.5.1 Jeopardy Determination

In accordance with our regulations (see 50 CFR 402.02, 402.14(g)), the jeopardy determination in this Opinion relies on the following four components:

1. The *Status of the Species* evaluates the species' current range-wide condition relative to its reproduction, numbers, and distribution; the factors responsible for that condition; and its survival and recovery needs.

2. The *Environmental Baseline* section of this Opinion refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process. The impacts to listed species or designated critical habitat from federal agency activities or existing federal agency facilities that are not within the agency's discretion to modify are part of the environmental baseline.

3. The *Effects of the Action* section of this Opinion analyzes all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action but that are not part of the action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action.

4. The *Cumulative Effects* section of this Opinion evaluates effects of future state or private activities, not involving federal activities, that are reasonably certain to occur within the action area of the federal action subject to consultation.

5. In accordance with policy and regulation, the USFWS is required to "[a]dd the effects of the action and cumulative effects to the environmental baseline and in light of the status of the species and critical habitat, formulate the USFWS's opinion as to whether the action is likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat," 50 CFR 402.14(g)(4).

6. "Jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species.

4 STATUS OF THE SPECIES

4.1 SPECIES DESCRIPTION

The monarch is a species of butterfly in the order Lepidoptera (family Nymphalidae) that occurs in North, Central, and South America; Australia; New Zealand; islands of the Pacific and

Caribbean; and elsewhere (Malcolm et al. 1993). Adult monarch butterflies are large and conspicuous, with bright orange wings surrounded by a black border and covered with black veins. The black border has a double row of white spots, present on the upper side and lower side of forewings and hindwings (Bouseman and Sternburg 2001). Adult monarchs are sexually dimorphic, with males having narrower wing venation and scent patches (Secretariat of the Commission for Environmental Cooperation (CEC) 2008). The bright coloring of a monarch serves as a warning to predators that they can be toxic.

4.2 LIFE HISTORY

In this section, we summarize the general life history and resource needs for the monarch. Resource needs are features that may be essential for the monarch to fulfill its life cycle.

4.2.1 Monarch Migration

There are three monarch butterfly populations in North America. Two of these populations migrate - eastern (east of the Rocky Mountains) and western (west of the Rocky Mountains). The eastern population overwinters in central Mexico and breeds throughout the U.S. and southern Canada. The western population overwinters along the California coast and breeds across the western states and southern Canada. A non-migratory population of monarch butterflies live in Florida year-round.

In eastern North America, monarchs travel north in the spring, from Mexico to Canada, over two to three successive generations, breeding along the way (Flockhart et al. 2013) (Figure 3). Individual monarchs disperse as far north as they can physiologically tolerate based on climatic conditions and available vegetation; the most specific predictors of the distribution of individual monarchs are monthly mean temperature, precipitation, and land use (Flockhart et al. 2013; Flockhart et al. 2017; Kesler and Bunch 2020). The number of generations of monarchs produced in a given year can vary between three and five and is dependent upon environmental conditions (Brower 1996). While a majority of the eastern monarchs shift to the more northern reaches of their range, western monarchs continue to occupy and breed in warmer climates throughout the summer, while also expanding to include the farther reaches of their range. In the spring in western North America, monarchs migrate north and east over multiple generations from coastal California toward the Rockies and to the Pacific Northwest (Urquhart and Urquhart 1977; Nagano et al. 1993) (Figure 3). In the southwestern states, migrating monarchs tend to occur more frequently near water sources such as rivers, creeks, roadside ditches, and irrigated gardens (Morris et al. 2015).

In the fall, in both eastern and western North America, monarchs begin migrating to their respective overwintering sites. This migration can take monarchs distances of over 3,000 km (Urquhart and Urquhart 1978) and last for over two months (Brower 1996). Migratory individuals in eastern North America predominantly fly south or southwest to mountainous overwintering grounds in central Mexico, and migratory individuals in western North America generally fly shorter distances south and west to overwintering groves along the California coast and northern Baja California (Solensky 2004) (Figure 3). Data from monarchs tagged in the southwestern states in the fall suggest that those in Nevada migrate to California, those in New

Mexico migrate to Mexico, and those in Arizona migrate to either Mexico or California (Southwest Monarch Study Inc. 2018). In early spring (February–March), surviving monarchs break diapause and mate at the overwintering sites before dispersing (Leong et al. 1995; van Hook 1996). The same individuals that undertook the initial southward migration begin flying back through the breeding grounds and their offspring start the cycle of generational migration over again (Malcolm et al. 1993).

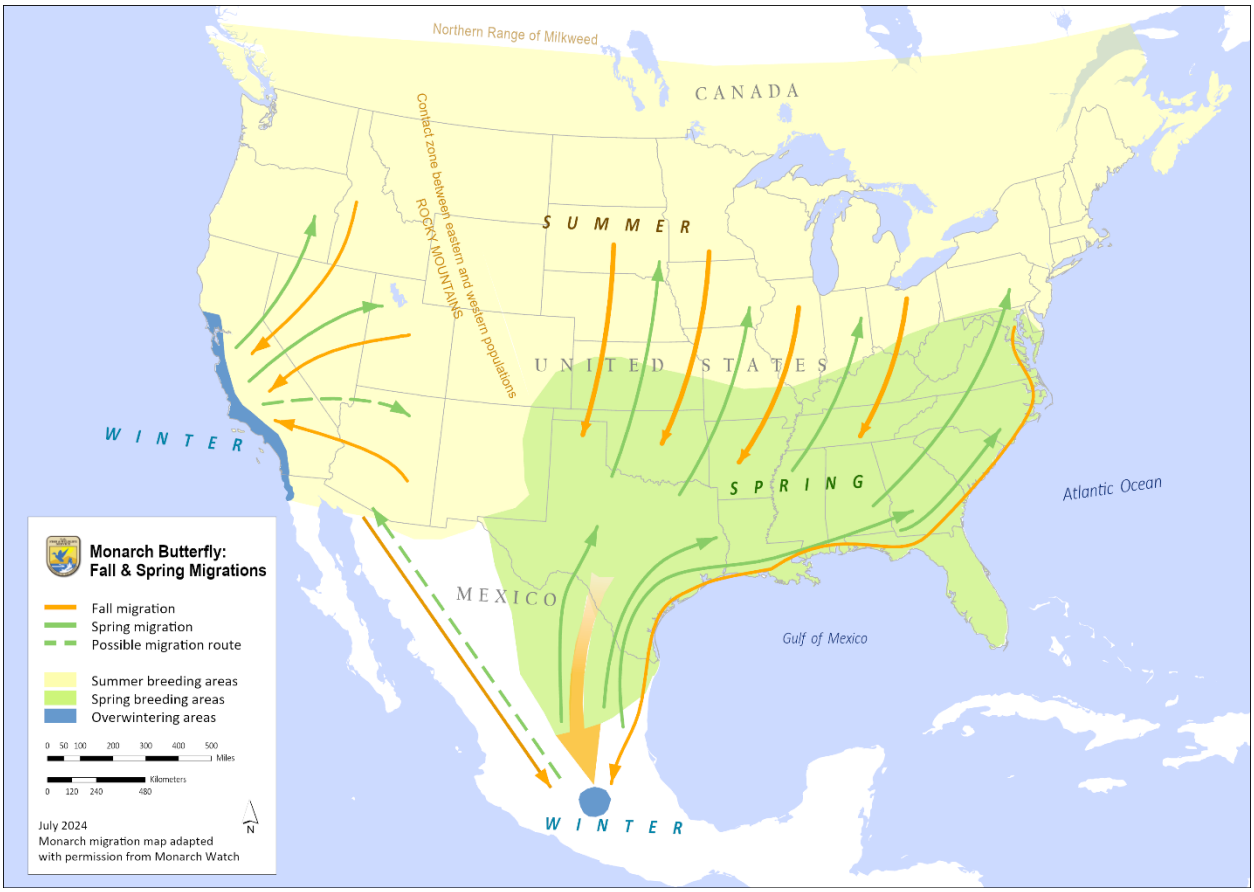


Figure 3. North American monarch migration map.

4.2.2 Monarch life cycle

During the breeding season, monarchs lay their eggs on their obligate milkweed host plant (primarily *Asclepias* spp.), and larvae (caterpillars) emerge after two to five days (Zalucki 1982; CEC 2008). Larvae develop through five larval instars (intervals between molts) over a period of 9 to 18 days, feeding on milkweed and sequestering toxic cardenolides as a defense against predators (Parsons 1965). The larva then pupate into chrysalis before eclosing 6 to 14 days later as an adult butterfly. There are multiple generations of monarchs produced during the breeding season, with most adult butterflies living approximately two to five weeks; in migratory populations the overwintering adults enter into reproductive diapause (suspended reproduction) and live six to nine months (Cockrell et al. 1993; Herman and Tatar 2001) (Figure 4). The number of generations of monarchs produced in a given year can vary between three and five

and is dependent upon environmental conditions (Brower 1996). Monarchs cannot develop in temperatures lower than 12°C (53°F) or higher than 33°C (91°F) (Zalucki 1982). Monarchs at all life stages are impacted by diseases and natural enemies (see the Monarch Species Status Assessment [SSA] for more information, USFWS 2020). The protozoan parasite *Ophryocystis elektroscirrha* (*OE*) is especially well-studied and infection rates among migratory and non-migratory monarchs in different areas are further discussed in the monarch SSA (USFWS 2020).

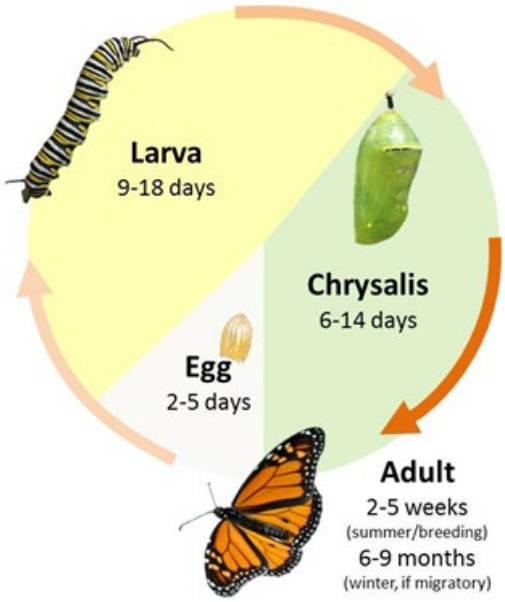


Figure 4. Monarch life cycle. Development times calculated from Zalucki (1982) based on temperatures ranging from 22°–32°C (72°–91°F). Adult life span based on Herman and Tatar (2001).

In a few parts of North America and in most areas outside North America, monarchs breed year-round, repeatedly following the above-referenced life cycle throughout the year. However, monarchs in temperate climates such as in eastern and western North America undergo long-distance migration, where the migratory generation of adults enters reproductive diapause and lives for an extended period of time (Herman and Tatar 2001). In the fall, in both eastern and western North America, monarchs begin migrating to their respective overwintering sites. This migration can take monarchs distances of over 3,000 km (Urquhart and Urquhart 1978) and last for over two months (Brower 1996).

4.3 RESOURCE NEEDS

This section summarizes the resource needs by life stage, geographic region, and time of year for the monarch butterfly.

Table 2. Monarch butterfly resource needs by life stage.

Life Stage	Requirements	Description	Geographic Location
Eggs, Larvae, and Adults – breeding	Milkweed resources	Healthy and abundant milkweed is needed for oviposition and larval consumption.	Breeding habitat throughout the continental U.S.
Chrysalis/Pupae	Roosting sites	Vegetation where pupae can develop with protection from direct sunlight.	Breeding habitat throughout the continental U.S.
Adult – breeding and migration	Nectar resources	Sufficient quality and quantity of nectar from flowers is needed for adult feeding throughout the breeding and migration seasons.	Breeding and migratory habitat throughout the continental U.S.
Adult – overwintering	Suitable habitat for overwintering	Habitat that provides a specific roosting microclimate for overwintering: protection from the elements (e.g., rain, wind, hail, excessive radiation) and moderate temperatures that are warm enough to prevent freezing yet cool enough to prevent lipid depletion. Nectar and clean water sources located near roosting sites.	California coast; some small overwintering sites exist in inland valleys in SE California and in areas of Arizona
Adult – migration	Connectivity & phenology	Nectar and milkweed resources along the migration route when butterflies are present; the size and spatial arrangement of habitat patches are generally thought to be important aspects but are not fully understood. Roosting sites may also be important for monarchs along their fall migration route.	Migratory habitat throughout the continental U.S.
All	Suitable climatic conditions	Temperatures, precipitation levels, and other climatic conditions supportive of life processes (e.g., breeding, migrating, and overwintering).	Migratory, breeding, and overwintering habitat throughout the continental U.S..

Figure 5 shows recommended timing windows for management actions across the range, showing times when management actions like burning, mowing, and grazing are less likely to harm monarchs (see www.monarchjointventure.org for more information) by avoiding breeding and migration windows.

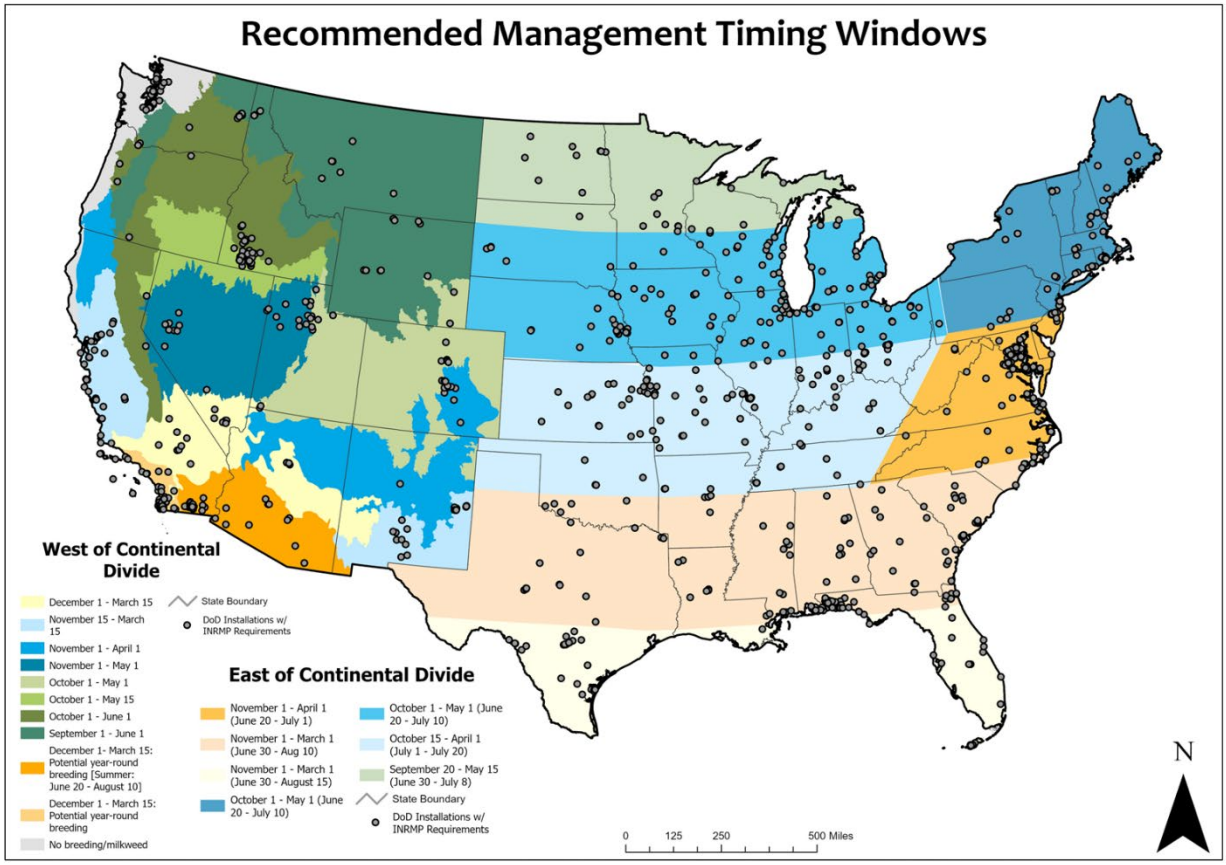


Figure 5. Recommended Management Timing Windows for Monarch (Danaus plexippus) east and west of the Continental Divide. In this figure dots represent Department of Defense (DOD) military installations that have Integrated Natural Resource Management Plan (INRMP). Dates are based on breeding and migration dates across the species range. Dates in parentheses are recommended only if necessary. Adapted from Monarch Joint Venture.

4.4 Breeding and Migratory Habitat

This section summarizes reproduction and migration of monarch throughout its range in the U.S.

4.4.1 Milkweed Diversity and Distribution

In the U.S., there are around 90 species of native milkweed (including subspecies and varieties) that are distributed in nearly every county, in every state, except Alaska and Hawaii.

In the western U.S., there are around 44 species of milkweed that occur in a variety of habitat types, and at least 20 species have been documented as larval hosts for the monarch butterfly. Areas in the west where milkweed didn't historically occur include coastal areas of the Pacific Northwest, and areas above 9,000 feet elevation (Xerces 2018).

4.4.2 Milkweed Abundance and Monarch Productivity

Monarch productivity generally increases with milkweed abundance until other factors take effect. In the range of common milkweed (*A. syriaca*), egg and larval density may increase with milkweed density up to about 6,000 milkweed stems per hectare (~2,428 stems per acre) and high milkweed abundance may also lead to higher survival rates of both eggs and larvae (Nail et al. 2015; Kasten et al. 2016).

High milkweed stem densities may boost productivity by reducing starvation of larvae, which typically require multiple stems during development. Monarch larvae feed and grow the fastest on young milkweed plants, especially early in development, and can consume entire plants (Yang and Cenzer 2020). Single larvae typically leave the stem on which they hatched after 6-7 days without consuming all available leaf tissue and search randomly for other milkweed stems (Fisher 2021). Isolated milkweed stems are unlikely to support larvae to pupation and large patches of milkweed and high stem densities could reduce the number of larvae that die by starvation (Yang and Cenzer 2020). Figure 6 shows counties across the U.S. that are more or less likely to have monarchs based on estimated milkweed abundance and density using a model (see Monarch Conservation Opportunities Tool v1 for more information).

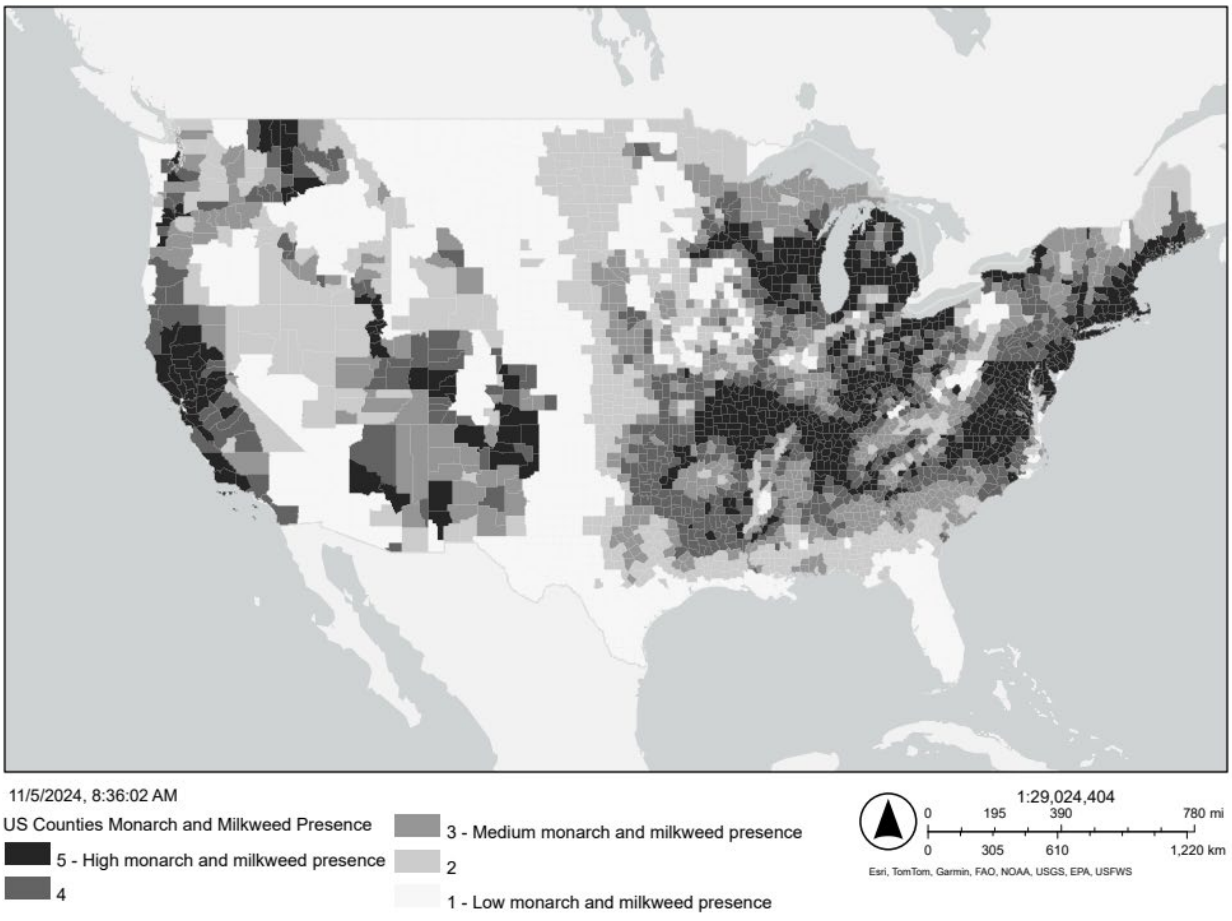


Figure 6. US counties and modeled milkweed presence (from the MCOT tool). Darker shade shows greater predicted abundance of milkweed (and monarch).

Density and diversity of milkweed may be higher in remnant natural habitats, but common milkweed readily colonizes habitat restoration sites. In Iowa, milkweed densities were highest in remnant (never plowed) prairie preserves (8,705 stems/ha), intermediate in roadside plantings (1,274 stems/ha), and lowest in non-linear "conservation" plantings (212 stems/ha) (Kaul and Wilsey 2019). Milkweed was included in the seed mix at only three of the 93 planting sites. Remnant prairies also contained the highest diversity of milkweed species. Lukens et al. (2020) studied 61 sites in Iowa, Minnesota, and Wisconsin about six years after seeding. Common milkweed was present at 96-100% of sites whether it was included in the seed mixes or not and present at high densities (1,218 – 1,526 stems per ha).

Inclusion of milkweed species unlikely to colonize naturally in seed mixes is likely to increase milkweed abundance and diversity, at least in the Upper Midwest. At the 61 restoration sites studied by Lukens et al. (2020), swamp milkweed (*A. incarnata*) and butterfly milkweed (*A. tuberosa*) colonized some sites where they were not included in seed mixes. Mean densities of the species, however, were higher where they were seeded – 1-2 plants per hectare versus 367 and 132 plants per acre, for swamp milkweed and butterfly milkweed, respectively.

Monarch breeding during the fall can be an important contributor to overwintering numbers in years when milkweed availability is high in the southern U.S. (Scott et al. 2022). During what may typically be regarded as the fall migration period, monarchs breed in some years during September and October on native milkweeds in west Texas (Brym et al. 2018; 2020). In 2018, for example, a high quantity and quality of milkweed stems after high precipitation led to a local peak abundance of eggs and larvae on milkweed that preceded the peak migration through the study area by about 26 and 16 days, respectively (Brym et al. 2018; 2020). The authors speculated that high temperatures may have also contributed to later-than-normal reproductive activity and were unsure whether breeding adults originated locally or had migrated from further north.

4.4.3 Effects of Milkweed Species and Diversity on Monarch Egg-Laying and Larval Growth

4.4.3.1 Egg-Laying Preferences

Increased milkweed diversity and inclusion of certain milkweed species in midwestern restoration plantings could ensure monarchs' preferred species for egg laying are available and could increase numbers of eggs laid. Among the nine milkweed species that occur in Iowa, females appear to prefer swamp milkweed for egg laying and they laid more eggs when able to choose among four milkweed species than when only one species was available (Pocius et al. 2018a, b).

Studies have demonstrated that swamp milkweed was preferred for oviposition (egg laying)in direct tests against both common milkweed and butterfly weed (Ladner and Altizer 2005, Potter et al. 2020).

Oviposition preferences between milkweed species have also been noted in the Southwest. In a comparison of two southwestern U.S. milkweed species that are commonly available for

planting, monarchs were more likely to lay eggs on Arizona milkweed (*A. angustifolia*) than on pineneedle milkweed (*A. linaria*) (Pegram and Melkonoff 2020).

Oviposition preferences between milkweed taxa in some situations may contrast with differences in larval growth rates and adult cardenolide levels. When laying eggs, monarchs preferred the subspecies *A. incarnata* pulchra in some circumstances despite slower larval growth rates and lower adult concentrations of cardenolides than in the group that fed on *A*. *incarnata incarnata* (Jones and Agrawal 2019). The authors speculated that this preference could be related to the higher predator defenses afforded by the denser trichomes on *A. i. pulchra*. Trichomes on *A. i. pulchra* are dense, like those on butterfly milkweed, and it exudes high amounts of latex, a plant defense against herbivory (Jones and Agrawal 2019).

4.4.3.2 Larval Growth Rates, Cardenolide Content, and Predator Defense Across Milkweed Species

Larval growth rates can vary substantially across milkweed species. In a study of 53 milkweed species, growth of early-stage monarch larvae was almost five times faster on the five "best" host plants than on the five "worst" (Agrawal et al. 2015). In Arizona, monarch larvae were more likely to be found on Arizona milkweed in the field and larval survival and growth as well as adult size were higher among monarchs reared on Arizona milkweed (Pegram and Melkonoff 2020).

In a comparison between two other western species, larvae that fed on narrow-leaved milkweed (*A. fascicularis*) grew faster, had higher survivorship, and were larger than larvae that fed on showy milkweed (*A. speciosa*) (Yang et al. 2020). Larvae generally grew faster when they fed on young plants of both species (see Seasonal Changes, below). The differences in larval performance between the two milkweed species was more pronounced on older plants. As both species senesced, the relative value to larvae of narrow-leaved milkweed increased, possibly due to an increase in traits useful for defending against herbivory in showy milkweed (Yang and Cenzer 2020).

4.4.3.3 Milkweed Host Plant Suitability – Seasonal Changes

The suitability of milkweeds for monarchs declines as plants age (Zalucki and Kitching 1982). Monarchs prefer young plants over mature plants for egg laying until they have already laid many eggs and become less "choosy", and larvae grow faster on young plants (Zalucki and Kitching 1982; Urquhart 1987; Bergstrom et al. 1994; Yang et al. 2020). The faster growth of larvae that fed on young versus old plants of narrow-leaved milkweed and showy milkweed – two western milkweed species – was due mostly to large differences during the first 24 hours of development when larvae are especially small (Yang et al. 2020).

As summer progresses monarchs may be "left with increasingly poor options" for egg laying, but still lay eggs on young leaves around the flower heads or on a cluster of buds on fully grown milkweed plants (Bergstrom et al. 1994; Haan and Landis 2019). Egg-laying also declines after insect damage on at least some clonal milkweed species, e.g., common milkweed and whorled milkweed (*A. verticillata*, He and Agrawal 2020). Avoidance of insect-damaged plants may be an adaptation to select plants that maximize larval fitness. Larvae that fed on insect-damaged

common milkweed, for example, were 20% smaller than those that fed on undamaged plants (Zandt and Agrawal 2004).

4.4.3.4 Milkweed Species and Parasite Defense

The milkweed species that larvae consume could affect their longevity when infected by parasites or parasitoids. Monarchs infected by the protozoan parasite, *OE*, lived longer when reared on milkweeds with an "intermediate concentration, diversity, and polarity of cardenolides" (Sternberg et al. 2012). Infected monarchs that fed on common milkweed lived longer than those that fed on swamp milkweed despite apparent preferences for egg-laying on the latter (see above) (Sternberg et al. 2012).

Conversely, after exposure to the parasitoid tachinid fly, *Lespesia archippivora*, monarch larvae that fed on common milkweed were more frequently parasitized and marginally more likely to die than those fed on swamp milkweed (Oberhauser et al. 2007, 2015). Estimated incidence of parasitism by tachinid flies on monarch larvae can be high – for example, 90% in some milkweed stands, 30% at conservation sites in Nebraska, and 13% among sites in Wisconsin, Michigan, and North Carolina – and "the vast majority of monarchs infected by tachinids die" (Oberhauser et al. 2007, Altizer and de Roode 2015, Geest et al. 2019).

4.4.4 Nectar

Adult monarch butterflies during breeding and migration require a diversity of blooming nectar resources, which they feed on throughout their migration routes and breeding grounds (spring through fall). Adults also require nectar at overwintering sites (fall through spring). Adult monarchs are generalists and will nectar on a wide variety of flowering plants.

4.4.4.1 Adults – Spring Migration and Spring-Fall Breeding and Migration

After breaking diapause and mating at overwintering sites, monarchs in migratory populations require sources of nectar to fuel flight and reproduction as they disperse to spring- and summer-breeding areas (Leong et al. 1995; Hook 1996). The same butterflies that undertook the autumn migration lay eggs as they encounter milkweed to restart the cycle of generational migration (Malcolm et al. 1993). Monarchs in the eastern migratory population move as far north as Canada over two to three successive generations and require nectar resources throughout their breeding range (Flockhart et al. 2013). In western North America, monarchs move north and east over multiple generations from coastal California toward the Rockies and to the Pacific Northwest (Urquhart and Urquhart 1977; Nagano et al. 1993). Abundant floral resources can typify habitats that are important for reproduction, and the presence of immature monarchs in some studies is positively associated with floral abundance (Keele et al. 2023).

As monarchs return to overwintering sites in the late summer and early fall, they require abundant sources of nectar to fuel flight and to build up lipid reserves to survive the winter months in reproductive diapause.

4.4.4.2 Eastern North America

Nectar availability for fall migrating monarchs in the Eastern North America (ENA) population can affect the size of the wintering population in Mexico (Inamine et al. 2016; Saunders et al. 2019). Monarchs in the ENA population store fat to increase the odds of surviving winter by nectaring extensively during migration. They store more fat when migrating than during breeding and low nectar availability due to drought or other factors could result in fewer monarchs on the wintering grounds (Saunders et al. 2019).

Nectar resources for migrating monarchs may be important throughout the Great Plains but may be especially critical in the "Central Funnel" in Oklahoma, Texas, and Mexico (Tracy et al. 2019). Monarchs begin to store fat early in migration but may undergo a behavioral shift and increase time nectaring when they reach Texas (Brower et al. 2006; Tracy 2018). Broad distribution of nectar resources throughout the Central Funnel may be critical because migratory routes shift up to 200 km east to west (Tracy et al. 2019).

Some plant species stand out as important nectar sources. In North Dakota, for example, milkweeds, native thistles (*Cirsium* spp.) and blazing stars (*Liatris* spp.) are "particularly important" nectar sources (Antonsen et al. 2021). The important of species in these groups was consistent throughout the state and across the three years of the study. Monarch abundance at a site was also consistently and positively related to the availability of flowering milkweed (Antonsen et al. 2021). At least nine species in the aster family are especially important as sources of nectar for migrating monarchs in Texas, especially frostweed (*Verbesina virginica*) (Brower et al. 2015).

Multiple factors, including the reduction in extent of natural areas and effects of widespread herbicide use, have reduced nectar resources for migrating monarchs (Brower et al. 2006; Tracy et al. 2019). In some areas, disruption of natural processes, especially fire, has also played a role. Fire suppression in the forested portions of the Ouachita Mountains Physiographic Region in northern Arkansas, for example, appears to have restricted nectar resources during fall migration to disturbed areas like road and utility rights-of-way (Rudolph et al. 2006a).

4.4.4.3 Western North America

In the West, nectar and milkweed are often associated with riparian corridors and milkweed may function as a principal nectar source (Dingle et al. 2005; Dilts et al. 2018; Xerces 2018; Waterbury and Potter 2018). Nectaring resources in migratory corridors in the western U.S. may be especially important for monarchs in the Western North America migrating population.

4.4.5 Fall Roosting Habitat

Monarchs use a variety of roosting trees along the fall migration route, where they aggregate on trees overnight. These roost sites have been documented more extensively in the eastern population, and little is known about roosting sites used during migration in the western population.

4.5 OVERWINTERING HABITAT

Migratory individuals of eastern and western North America require a very specific microclimate at overwintering sites. The eastern population of monarchs overwinter in Mexico, where this microclimate is provided by forests primarily composed of oyamel fir trees (*Abies religiosa*), on which the monarchs form dense clusters (Williams and Brower 2015). The sites used for overwintering occur in mountainous areas west of Mexico City located between elevations of 2,900 and 3,300 m (Slayback and Brower 2007). The temperature must remain cool enough to prevent excessive lipid depletion (Alonso-Mejía et al. 1997), while at the same time staying warm enough to prevent freezing (Anderson and Brower 1996). Exposure to these cooler temperatures also helps orient the monarchs northward in the spring (Guerra and Reppert 2013). The oyamel fir forest provides essential protection from the elements, including rain, snow, wind, hail, and excessive solar radiation (Williams and Brower 2015). Many overwintering sites also provide a source of hydration via nectar plants or a water source (Brower et al. 1977). Most of the observed overwintering sites are located within the Monarch Butterfly Biosphere Reserve, which covers over 56,000 ha (Vidal and Rendón-Salinas 2014; Ramírez et al. 2015).

Migratory monarchs in the western population primarily overwinter in groves along the coast of California and Baja California (Jepsen and Black 2015). There are approximately 400 groves that have been occupied, but only a portion of these sites is occupied in any given year. These sites, typically close to the coast, span approximately 1,225 km of coastline (COSEWIC 2010). These groves are populated by a variety of tree species, including blue gum eucalyptus (*Eucalyptus globulus*), Monterey pine (*Pinus radiata*), and Monterey cypress (*Hesperocyparis macrocarpa*) (Griffiths and Villablanca 2015), all of which act as roost trees. These groves provide indirect sunlight for the overwintering monarchs, sources of moisture for hydration, defense against freezing temperatures, and protection against strong winds (Tuskes and Brower 1978; Leong 1990; Leong 1999). The close proximity to the coast (average distance of 2.37 km ± 0.39 SE) also provides a mild winter climate (Leong et al. 2004). There are also some small overwintering sites in the Saline Valley of California, and areas of Arizona, although these sites only host a small number of adults each winter.

Additionally, there are other, smaller overwintering areas for the eastern and western North American population that exist with monarchs overwintering in diapause. For the eastern population, these include small colonies east of Mexico City (e.g., a site with small aggregations along western slopes of the Popocatépetl volcano; Calvert and Brower 1986), and along the coast of South Carolina (McCord and Davis 2010; Kendrick and McCord 2023). For the western population, these include several small inland California and Arizona overwintering sites (Morris et al. 2015; Pelton et al. 2016). Because of the relatively small number of monarchs at these sites and their transient nature, the Mexico and California overwintering sites and counts represent the large majority of the eastern and western migratory monarch populations, respectively.

4.6 POPULATION STATUS

4.6.1 Eastern North American Population

Annual winter population estimates of the ENA monarch population have been conducted in Mexico since the winter of 1993-1994 (Vidal and Rendón-Salinas 2014) (Figure 7). These estimates are determined by identifying and measuring the area occupied by wintering colonies of monarchs in and near the Monarch Butterfly Biosphere Reserve in Mexico and assuming a density of 21.1 million monarch/hectare (Vidal and Rendón-Salinas 2014; Thogmartin et al. 2017a). The monarchs are so densely clustered that we measure the area of forest occupied by monarch covered trees as a surrogate for overall population numbers. Because the area occupied by overwintering monarchs is a surrogate for overall population numbers, there have been several attempts to come up with the number of monarchs present in one hectare of occupied land to translate into overall number of monarchs present at the overwintering sites each year. The Thogmartin et al. (2017) paper examined the range of estimates from all of these studies, and found a median density of 21.1 million monarchs per hectare.

Although varying year-to-year, estimates consistently numbered in the hundreds of millions throughout the 1990s and early 2000s and survey data suggest that monarch numbers were as high or higher in the two decades before standardized monitoring began at the Mexican overwintering sites (Calvert and Brower 1986; Vidal and Rendón-Salinas 2014). The latest survey in 2022-2023 indicated there were approximately 46.6 million monarchs present in the reserve.

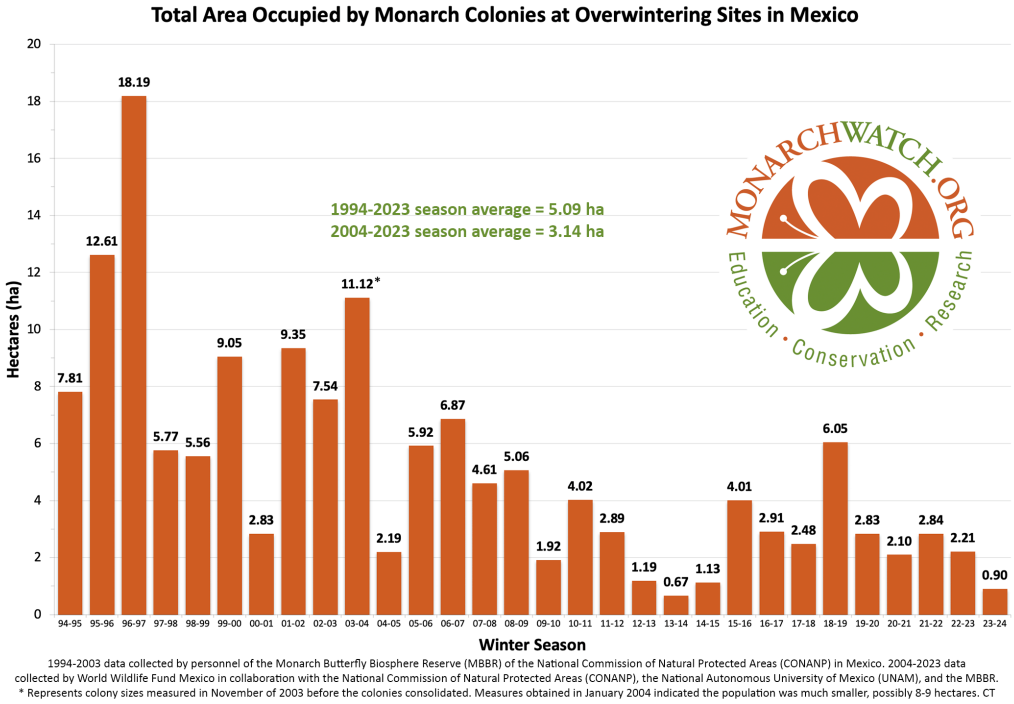


Figure 7. Area occupied (in hectares) by eastern North American monarch butterflies at overwintering sites in Mexico (actual hectare measurement displayed above each bar).

Based on genomic data to reconstruct demographic histories for monarch and common milkweed (*A. syriaca*), monarchs and milkweed experienced significant population expansion roughly 10,000–20,000 years ago, aligning with the most recent period of North American glacial recession, then increased again roughly 200 years ago, aligning with extensive human-caused landcover change predominated by deforestation and agricultural expansion (Boyle et al. 2023). However, genomic analyses did not detect effective population declines over the past 40 years.

Based on the past annual censuses, the eastern North American migratory monarch population has been generally declining over the last 29 years (Figure 8). Although the numbers at the overwintering sites have declined, we did not find a corresponding change in the spatial extent of the population during the breeding season. Given its current population size and population growth rate, the estimated probability of extinction (*pE)* over the next 60 years is 61% (48%–69%; confidence interval [CI] 50%) (Figure 8).

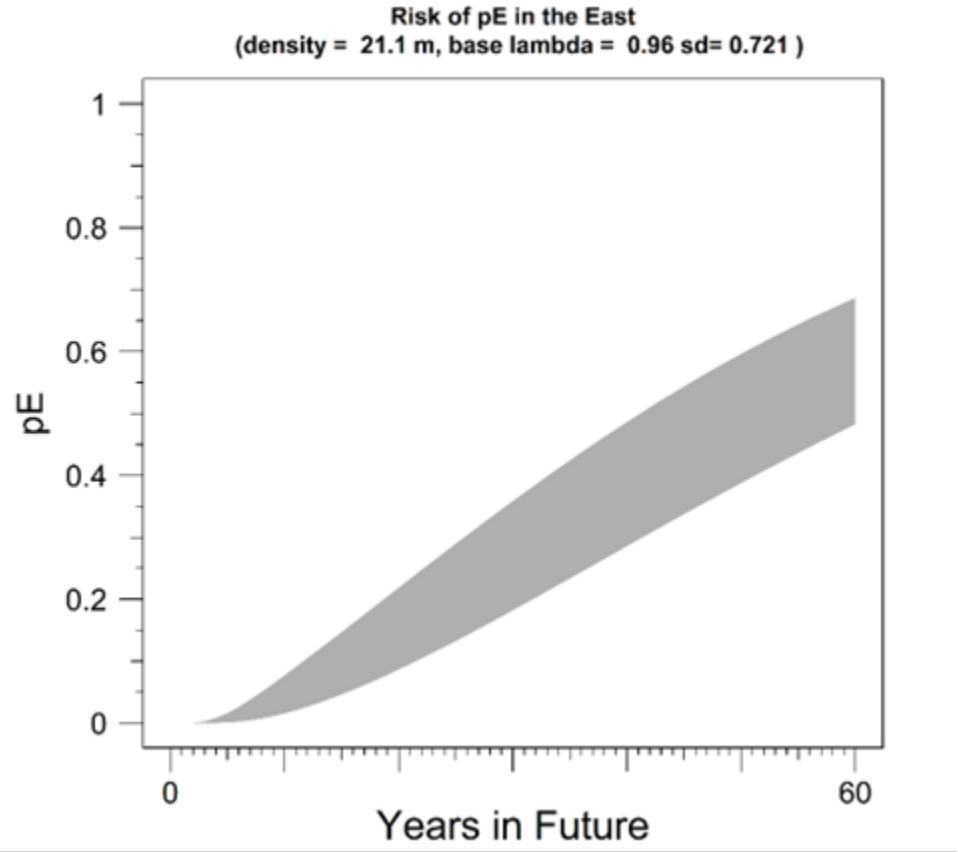


Figure 8. pE for the eastern North American monarch population over time, represented by 50% confidence interval (gray space). Probability based on current trend in growth.

4.6.2 Western North American Population

The western North American population has been censused annually since 1997, providing an estimate of annual population size (Figure 9). Recent work, using past survey data, gives estimates of millions of butterflies in the mid-1980s (Schultz et al. 2017). These estimates were

for overwintering abundance in coastal California from 1981–2015. The researchers used state-space models to estimate the western monarch population growth rate from spatially and temporally erratic sampling data going back to the early 1980s and found annual abundance estimates were high in the 1980s, fluctuating in the 1990s, and low in the 2000s.

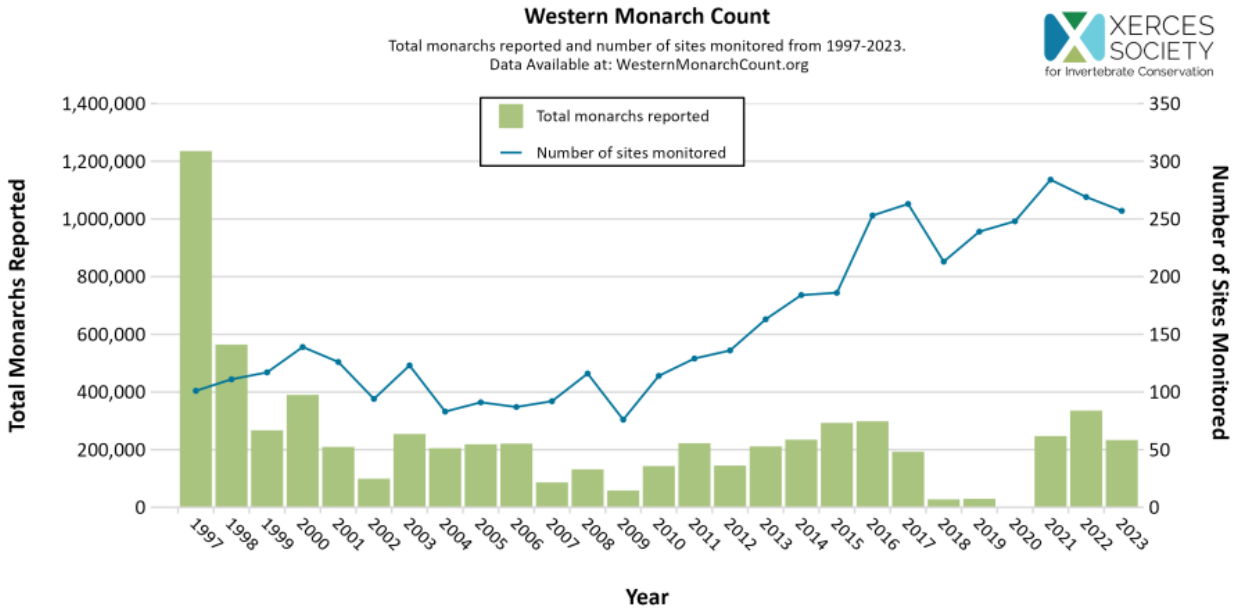


Figure 9. Thanksgiving counts showing the number of western North American monarch butterflies observed at overwintering sites (green bars). Blue line shows the number of sites monitored (survey effort) for a given year (Xerces 2024)

Based on the past annual censuses, the western North American migratory population has been generally declining over the last 26 years, despite an increasing number of sites being counted (Figure 9). Modeling conducted for the SSA indicated that under current conditions the risk of extinction over time is predicted to increase sharply, with the estimated *pE* over 60 years reaching 99% (98%–99%, CI 50%) (Figure 10).

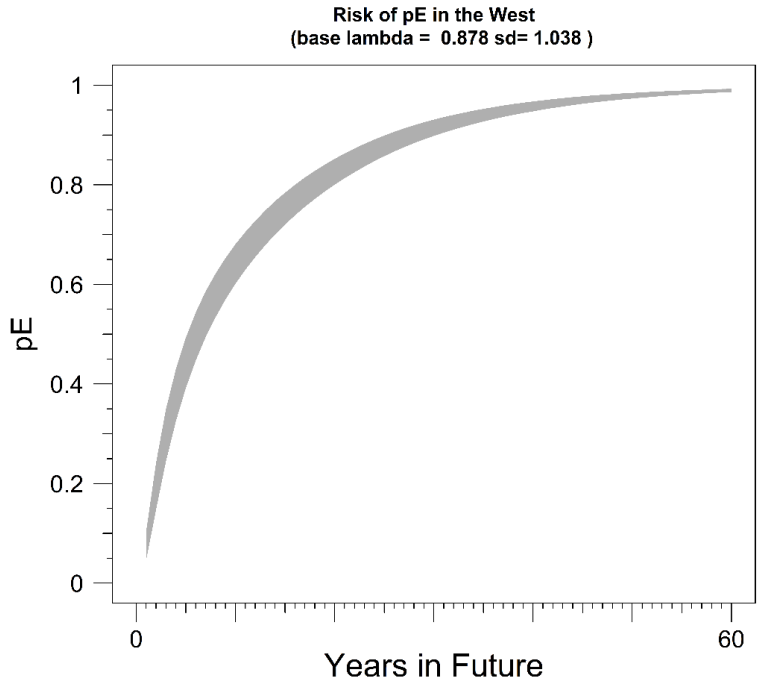


Figure 10. pE for the western North American monarch population over time, represented by 50% confidence interval (gray space). Probability based on current trend in growth.

4.7 THREATS AND PRIMARY INFLUENCES

The primary drivers affecting the health of the two North American migratory populations are changes in breeding, migratory, and overwintering habitat (due to conversion of grasslands to agriculture, urban development, widespread use of herbicides, logging/thinning at overwintering sites, unsuitable management of overwintering groves, and drought), continued exposure to insecticides, and effects of climate change. The Monarch SSA provides detailed information on each of the primary drivers affecting the monarch butterfly (USFWS 2020).

4.7.1 Limited Availability, Distribution, and Quality of Milkweed

The availability of milkweed is essential to monarch reproduction and survival. Reduction in milkweed is cited as a key driver in monarch declines (Brower et al. 2012; Pleasants and Oberhauser 2013; Inamine et al. 2016; Thogmartin et al. 2017b; Waterbury and Potter 2018; Saunders et al. 2019; Solis-Sosa 2021).

A majority of the milkweed loss has occurred in agricultural lands, where intensive herbicide usage for weed control has resulted in widespread milkweed eradication. Pleasants (2017), for example, estimated that over 860 million milkweed stems were lost in the Midwest between 1999 and 2014, a decline of almost 40%. Currently, approximately 89% and 94% of corn and soybean crop acreage, respectively, are planted as glyphosate (herbicide)-tolerant crops (USDA 2023). Glyphosate use in western agricultural lands has also increased dramatically since the 1990s, especially within the Central Valley of California, Snake River Plain of Idaho, and the Columbia River Basin, which spans the border between Washington and Oregon (USGS 2017; Waterbury and Potter 2018). As weed species develop increasing resistance to glyphosate, other herbicide (e.g., dicamba) tolerant crops are developed, which can lead to a corresponding increase in herbicide use. Accordingly, herbicide impacts to milkweed and nectar plants are expected to continue to impact monarch resources.

Milkweed is also lost on the landscape through development and conversion of grasslands (Lark et al. 2015, pp. 3–4). Between 2008 and 2016, a total of 4.9 million acres of grassland were converted to new cropland, including up to 3 million acres of Conservation Reserve Program (CRP) land between 2008 and 2012 (Zhang et. al. 2021; Lark et al. 2015). Pleasants and Oberhauser (2013) estimate that the loss of agricultural milkweeds in the Midwest has resulted in an 81% decline in monarch production, in part because monarch egg densities were higher on milkweed in agricultural fields (3.89 times more eggs than on non-agricultural milkweed). This particularly impacts the eastern monarch population because more Mexico overwintering monarchs originate from the Midwest crop belt region than any other region (with estimates ranging from 38% to over 85% of all overwintering monarchs originating from the Midwest; Wassenaar and Hobson 1998; Flockhart et al. 2017). Accordingly, herbicide impacts to milkweed and nectar plants will continue to impact monarch resources available in agricultural lands.

4.7.2 Limitations in Breeding and Nectar Resources

Losses of nectar sources during migration have also been particularly implicated as a potential key driver in monarch declines (Inamine et al. 2016; Thogmartin et al. 2017b; Saunders et al. 2019). Losses of nectar resources are due to same stressors identified above for milkweed resources. Additionally, with a warming climate, drought impacts may become more important, especially in the western population and in the migratory bottleneck for the eastern population.

4.7.3 Availability and Quality of Overwintering Habitat

Both western and eastern monarchs rely on the microclimate provided by the trees at their overwintering sites (Leong et al. 2004; Williams and Brower 2015).

Loss of trees occurs at overwintering sites in Mexico primarily through small- and large-scale logging, storms, and an increasingly unsuitable climate (see 4.7.5 Climate Change section below for more details). Most overwintering sites used by eastern monarchs occur within the Monarch Butterfly Biosphere Reserve (Reserve), a 56,259-ha protected area. Within this area, there is a logging ban within the 13,551-ha core zone (Ramírez et al. 2015). However, recent logging has occurred both legally (including salvage logging allowed after storms) and illegally at multiple colonies (Vidal et al. 2014; Brower et al. 2016). Some conversion of forest to avocado plantations has also occurred in the Reserve buffer.

Western monarch overwintering habitat along the Pacific Coast has been subject to loss through various forms of development, particularly urban development (Sakai and Calvert 1991; Frey and Schaffner 2004). Habitat alteration, both natural and anthropogenic, can also alter the microclimate of the western overwintering sites, leading to less suitable habitat conditions (Jepsen et al. 2015). There are many other stressors that can work alone or in tandem on the western overwintering sites, including disease and pests that impact the trees used for overwintering, as well as senescence and improper grove management. Fire is also a threat, both indirectly through habitat loss and directly to overwintering monarchs (Pelton et al. 2016). Drought in the West can further exacerbate the stressors on the western overwintering sites (see *Climate Change* section below).

4.7.4 Insecticides

Insecticides are pesticides with chemical properties that are designed to kill insects, and most are non-specific and broad-spectrum in nature. That is, insects exposed to these insecticides are susceptible to mortality and/or sub-lethal effects. Furthermore, the larvae of many Lepidopterans are considered major pest species and insecticides are tested specifically on this taxon to ensure that they will effectively kill individuals at application rates indicated on product labels. Even though monarchs are not the target species of these products, they may be exposed to insecticides where they are applied and in areas beyond the insecticide application sites due to drift (Olaya-Arenas and Kaplan 2019; Halsch et al. 2020).

The monarch butterfly is widely distributed across the U.S., occurring in a variety of urban and rural habitat types that include milkweed plants and other flowering forbs. Insecticide impacts to monarchs are primarily influenced by the extent to which monarchs are exposed to insecticides throughout their range. Although insecticide use is most often associated with agricultural production (for example, between 2005 and 2012, 60% of insecticide applied occurred on agricultural lands, USEPA 2017), any habitat where monarchs are found may be subject to insecticide use.

4.7.5 Climate Change

Climate change can affect monarchs both directly and indirectly (Nail and Oberhauser 2015) on both the overwintering, breeding, and migratory grounds. Direct effects of climate change, particularly increasing temperatures, may impact monarch fecundity (Oberhauser 1997), mating success (Solensky and Oberhauser 2009), and survival during migration and while overwintering (Masters et al. 1988; Alonso-Mejía et al. 1997). Laboratory studies indicate optimal temperatures for monarch range from 27–29°C with sublethal effects beginning around 30–36°C range and an upper lethal thermal limit of 42°C (Zalucki 1982; York and Oberhauser 2002; Zalucki and Rochester 2004; Nail et al. 2015). Nighttime temperatures of 34°C during periods with daytime temperatures of 38°C resulted in lower survival, showing that respites from elevated temperatures are important in allowing monarchs to survive temperature stress (Nail et al. 2015). Temperatures consistently above 33°C to 35°C are unsuitable for monarchs and may account for their general absence from southern U.S. states after spring (Malcolm et al. 1987; Zalucki and Rochester 1999).

4.7.5.1 *Overwintering sites*

Monarchs need a very specific microclimate at their overwintering sites not just to avoid storm mortality, but also to avoid early lipid depletion.

Increasing storm frequency in the Mexican overwintering colonies can lead to catastrophic (up to 80%) mortality through the freezing temperatures that accompany these storms (Anderson and Brower 1996; Brower et al. 2004). Severe storms may become more frequent with precipitation predicted to increase during the winter when monarchs are present in Mexico (Oberhauser and Peterson 2003). In addition to the impact climate change may have on overwintering monarchs directly, the Mexico overwintering sites are predicted to be less suitable for oyamel fir trees, the predominant monarch roosting tree, as climate change progresses. Current modeling of the monarch's fundamental niche predicts the loss of 38.6% to 69.8% of current suitable habitat within the Monarch Butterfly Biosphere Reserve by 2050 (Zagorski 2016).

In western North America, climate change is predicted to cause a significant change in the distribution of overwintering monarchs in coastal California. Results from climatic niche modeling by Fisher et al. (2018) suggest that climate change will result in an inland and upslope displacement of suitable overwintering conditions. The probability of occurrence of suitable overwintering conditions becomes roughly proportional to elevation. However, we do not have

evidence that monarchs would move to or use these upslope areas. Widespread drought is likely to impact trees in the western overwintering areas both directly and indirectly due to increased susceptibility to pests (Paine and Millar 2002).

4.7.5.2 Breeding and Migratory Habitat

A warming climate may influence breeding habitat by altering suitable locations for both monarchs (Batalden et al. 2007) and their milkweed host plant (Lemoine 2015). Saunders et al. (2019) suggested that nectar resources during migration may be reduced under climate conditions (decreased precipitation) projected for south-central Texas. Drought may also influence the amount and availability of nectar needed for migrating butterflies (Brower et al. 2015; Stevens and Frey 2010; Espeset et al. 2016). The coastal non-migratory population may also be impacted by loss of habitat through rising sea levels due to climate change (TBCSAP 2015). While drought and increased temperatures may reduce monarch habitat in some areas, the climatically suitable niche for monarchs may increase, potentially increasing their summer breeding grounds if both monarchs and milkweed are able to adapt (Lemoine 2015).

Climate change may additionally impact monarchs in ways that are more difficult to measure. This may include phenological mismatch (e.g., timing of milkweed and nectar sources not aligning with monarch migration; Thogmartin et al. 2017b) or range mismatch with associated species (e.g., changed environmental suitability of monarch natural enemies; McCoshum et al. 2016). Furthermore, recent research suggests that carbon dioxide may impact the medicinal properties of some milkweed species, potentially leading to increased *OE* parasite virulence and decreased monarch tolerance of *OE* infections (Decker et al. 2018).

4.8 CONSERVATION EFFORTS

Protection, restoration, enhancement and creation of habitat is a central aspect of recent monarch conservation strategies, thus highlighting the importance of restoring and enhancing milkweed and nectar resources (Oberhauser et al. 2017; Pleasants 2017; Thogmartin et al. 2017b; MAFWA 2018; Pelton et al. 2019; WAFWA 2019). Improved management at overwintering sites in California has also been targeted to improve the status of western North American monarch butterflies (Pelton et al. 2019; WAFWA 2019).

Major conservation plans and efforts include the Mid-America Monarch Conservation Strategy developed by the Midwest Association of Fish and Wildlife Agencies (MAFWA), the Western Monarch Butterfly Conservation Plan developed by the Western Association of Fish and Wildlife Agencies (WAFWA), and the Nationwide Candidate Conservation Agreement for Monarch Butterfly on Energy and Transportation Lands (CCAA/CCA) developed by entities from the energy and transportation sectors and the Energy Resources Center at the University of Illinois – Chicago. The Mid-America Monarch Conservation Strategy established a goal of adding 1.3 billion stems of milkweed on the landscape by 2038 (MAFWA 2018). The 1.3 billion stem goal is an estimated goal for adding enough habitat to support 6 hectares of overwintering population for the eastern North American population, per Pleasants (2017) and Thogmartin et

al. (2017b). A full description of these conservation efforts is in the Monarch SSA (USFWS 2020).

4.8.1 Importance of Milkweed Geographic Location in the West

For the population of monarchs that overwinter in California coastal areas and then migrate inland to breed, availability of milkweed may be especially important in areas where the first generation of monarchs are produced each spring. Pelton et al. (2019) suggest increasing the availability of three early emerging native milkweed species to support monarch reproduction in these areas and a few later emerging species that could also be beneficial. The important geographic zones, or Priority Action Zones (PAZs) for western monarchs are shown in Figure 11.

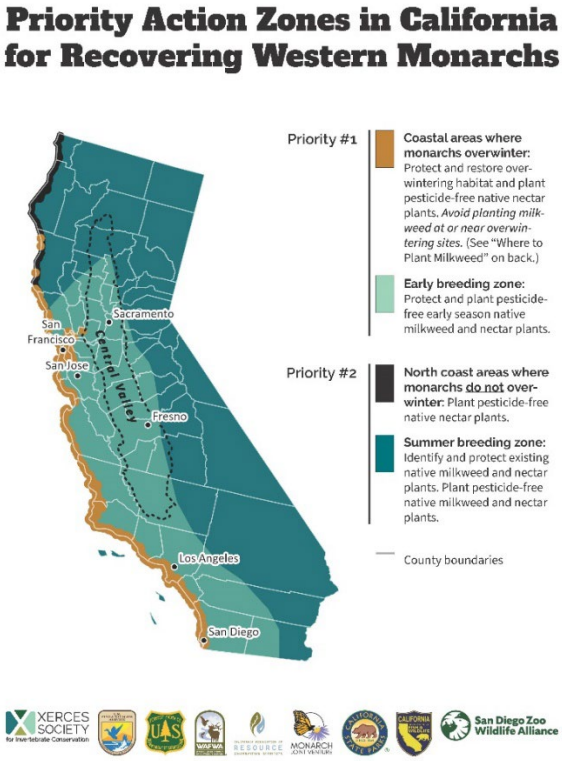


Figure 11. Priority Action Zones in California

4.8.2 Monarch Conservation Units

Monarch Conservation Units (MCUs) were created to delineate the approximate boundaries of areas important to monarch butterfly populations across the continental U.S. (Figure 12). These boundaries were created as part of the monarch SSA development. Different monarch populations, or different portions a population's range, may have different conservation needs. Differences in biology, available data, and scientific uncertainties across monarch populations may require variable conservation approaches. As new information becomes available, the boundaries of the MCUs may shift. The Strategy acknowledges this: *This section* [Conservation Unit description] *will be updated as new information becomes available regarding what areas*

are most important to monarchs in all conservation units. These updates will be incorporated into the overall Strategy to ensure priorities are being addressed in the future.

Current MCUs can be found in the online Monarch Conservation Opportunities Toolkit.

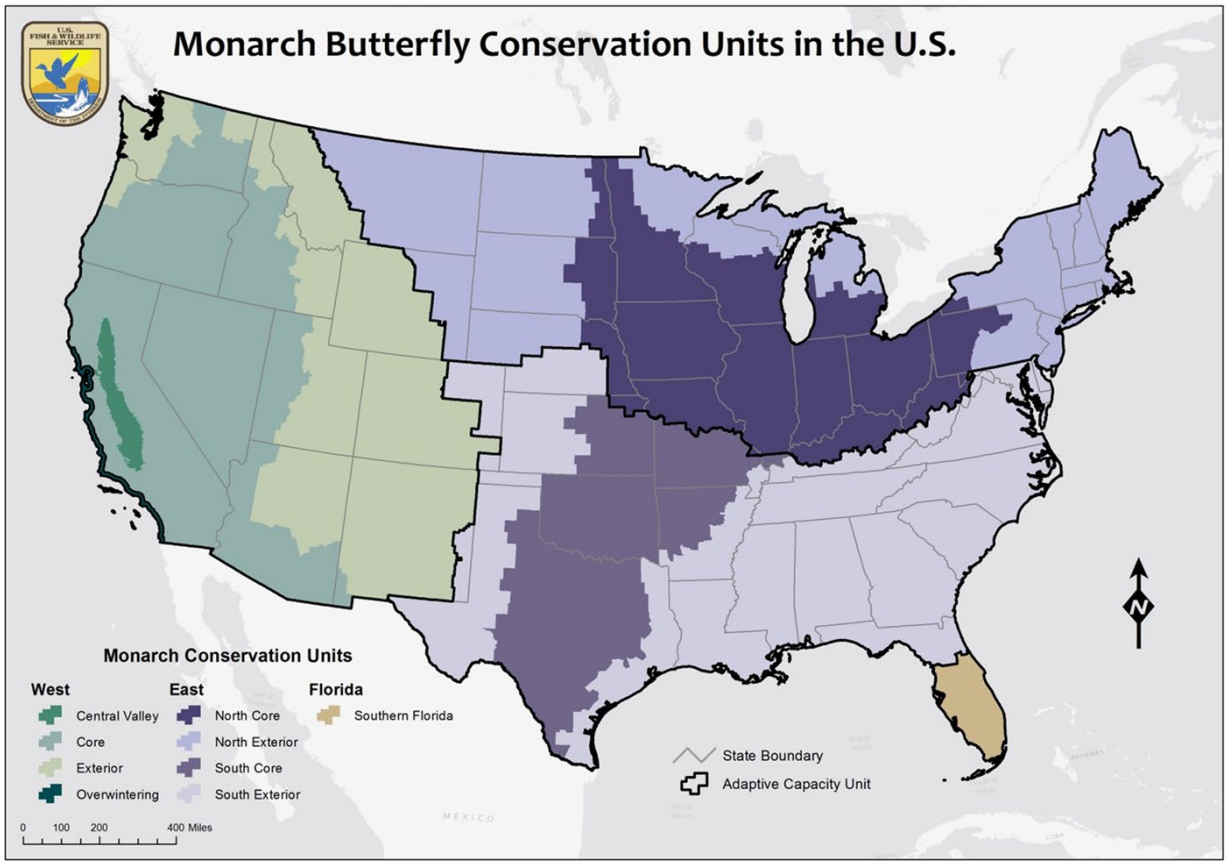


Figure 12. Map of monarch butterfly conservation units in the U.S.

5 ENVIRONMENTAL BASELINE

Environmental baseline refers to the condition of the listed species or its designated critical habitat in the Action Area, without the consequences to the listed species or designated critical habitat caused by the Proposed Action. The environmental baseline includes the past and present impacts of all federal, State, or private actions and other human activities in the Action Area, the anticipated impacts of all proposed federal projects in the Action Area that have already undergone formal or early section 7 conference, and the impact of State or private actions which are contemporaneous with the conference in process. The impacts to listed species or designated critical habitat from federal agency activities or existing federal agency facilities that are not within the agency's discretion to modify are part of the environmental baseline. [50 CFR 402.02 "Environmental baseline"]

5.1 CURRENT CONDITION OF THE SPECIES IN THE ACTION AREA

The best available information on trends in monarch numbers, reproduction, and distribution are discussed in the SSA (USFWS 2020), and it is likely that they reflect the current condition of the species within the Action Area. Over the long-term, census data show a decline in population abundance for both eastern and western populations of monarch (although numbers fluctuate year-to-year).

The Strategy defines monarch breeding and migratory habitat as "grassland and other areas that have nectar resources and/or milkweed present at the time of year monarchs are present on the landscape. This could include forested areas, wetlands, or shrub/scrub areas, among others. Unsuitable habitat in the Strategy is defined as developed areas that include but are not limited to some cantonment areas, some housing areas, industrial areas, highly developed training sites, and developed testing facilities."

Monarch may occur in suitable habitat throughout the Action Area. For the purpose of the Strategy, DOD used landcover data (grasslands and exotic herbaceous) to estimate the extent of monarch habitat on DOD lands (see section 5.1.1 below for additional discussion and support of this approach).

The Strategy used the MCUs to organize information across its over 24 million acres of land, spanning the lower 48 states, estimating roughly 1,800,000 acres of monarch habitat (summarized in Table 3, Figure 13). Additional detail with grassland acres by installation is provided in Appendix B.

Table 3. Number of installations and estimated monarch habitat by Monarch Conservation Unit, both for installations with INRMPs and those without INRMPs. For this table, installations with less than one acre of grassland were not included.

Department of Defense Military Installations within Monarch Butterfly Conservation Units - suitable habitat for monarch as estimated by grassland acres				
	INRMP		No INRMP	
MCU	No. Installations	~Acres	No. Installations	~Acres
North Core	33	38,200	67	3,500
North Exterior	49	111,000	67	14,000
South Core	32	244,000	32	5,000
South Exterior	98	336,000	114	6,500
West Core	59	484,700	46	12,000
West Exterior	27	480,000	29	8,800
Central Valley	7	18,903	9	50
Overwintering	9	55,000	9	100
Southern Florida	8	16,500	9	50
totals		**1,784,100**		**50,000**

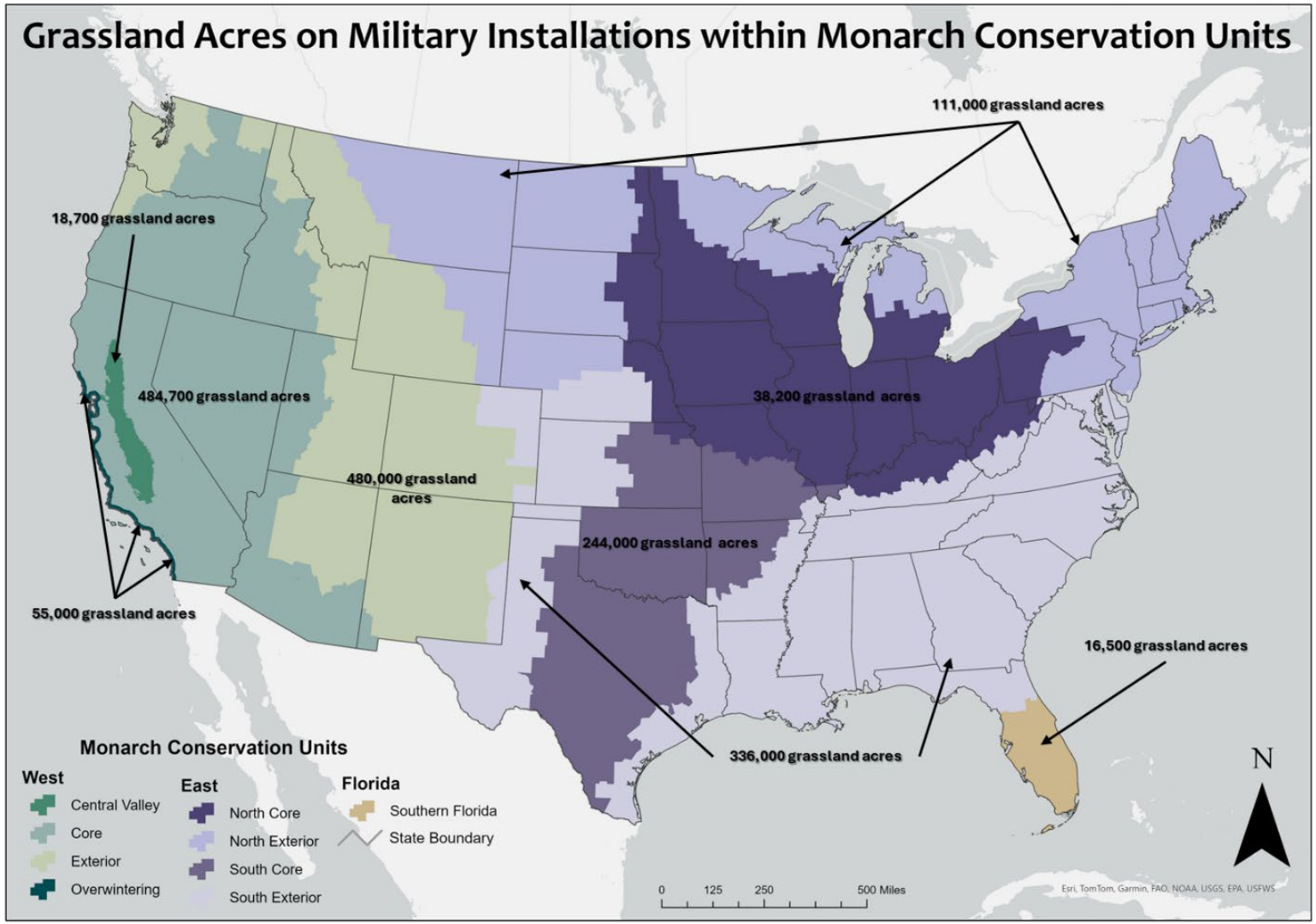


Figure 13. Grassland acres within Monarch Conservation Units across DOD lands

5.1.1 Support for Using Grassland Landcover to Estimate Monarch Habitat at a Landscape Scale

The USFWS used published literature to identify landcover types that may represent high quality for both milkweed and blooming nectar plants to determine the amount of potential habitat for monarchs currently on the landscape across its range. Although this effort was not related to this conference, we describe the process here to provide support for DOD's approach of using grassland landcover to estimate monarch habitat at a landscape scale. As we develop new resources and tools, there may be a better approach in the future for other agencies developing conservation strategies for monarch. Using grassland landcover for DOD's Strategy, however, is the best approach at the time of the Strategy's development. Because of the proactive nature of the Strategy (i.e., ahead of the species being listed), it was developed before USFWS consultation guidance has been developed.

> Koh et al. (2016) used expert elicitation to apply floral resource production scores (from 0.05 to 0.95) to 45 landcover types derived from the National Landcover Dataset (NLCD) and Cropland Data Layer (CDL) (Koh et al. 2016). Similarly, Thogmartin et al. (2017b) used expert elicitation to estimate baseline and potential densities of milkweed plants for 42 landcover types, also derived from NLCD and CDL, although this study was biased towards the Upper Midwest (Thogmartin et al. 2017b). Lukens et al. (2024) measured milkweed density and floral frequency and richness in the field using the standardized Integrated Monarch Monitoring Protocol, however only 5 landcover types were sampled enough to make inferences about suitability for milkweed and nectar. We also considered suitability models developed by Dilts et al. (2019) for both monarch adults, larvae, and eggs as well as 13 species of milkweed. However, we chose not to include these suitability models in our assessment as many older records of monarch and milkweed occurrence were included in the model and the results may represent formerly suitable habitat as opposed to currently suitable habitat. We then grouped similar landcover types together into broad categories (e.g. agriculture, developed, forest etc.) and assigned a classification of high, moderate, and low potential quality for milkweed and nectar plants based on relative rankings or scores found in the published literature.
>
> After identifying broad groups of landcover types that may represent high to moderate quality for milkweed and nectar resources, we calculated the total acreage of each landcover type within each Conservation Unit to estimate how much potential high to moderate quality habitat currently exists on the landscape. Expert elicitation and field surveys indicate that rights-of-way, grasslands, shrublands, wetland, pasture, and developed landcover types have relatively high to moderate densities of milkweed while wetlands, grasslands, shrublands, forests, and developed landcover types are relatively high to moderate in floral resources. Grassland was the only landcover type we anticipate will be high quality for both milkweed and nectar resources, and thus monarch.

Because grassland was the only landcover type that was estimated to be high quality for both milkweed and nectar resources, we use it for this conference as a way to estimate monarch habitat across the Action Area at the landscape level of the Strategy.

Natural resource managers will refine areas of suitable monarch habitat based on site-specific data for their installations during INRMP review (see Next Steps and INRMP Integration section). This will allow for greater specificity at the Strategy's implementation stage for the vast majority of DOD installations. Not every installation has an INRMP; the installation must have significant natural resources (e.g., wetlands; listed, rare or at-risk species; forestry; agriculture) to have a plan. In terms of scale of potential monarch habitat, there are approximately 1,784,100 acres of grassland covered under INRMPs compared to roughly 50,000 acres that are not covered under INRMPs (Table 3).

5.1.2 Availability, Spatial Distribution, and Quality of Milkweed in the Action Area

The availability of milkweed is essential to monarch reproduction and survival. Reduction in milkweed is cited as a key driver in monarch declines (Brower et al. 2012; Pleasants and Oberhauser 2013; Inamine et al. 2016; Thogmartin et al. 2017b; Waterbury and Potter 2018; Saunders et al. 2019; Solis-Sosa 2021).

As described previously, much of the milkweed loss across the range of monarch has occurred in agricultural lands, where intensive herbicide usage for weed control has resulted in widespread milkweed eradication. Given the small number of agricultural outleases on DOD properties, and their relatively small size in the context of their overall footprint across the DOD enterprise in continental U.S. (i.e., <0.2% of DOD land), the influence of agricultural outlease-related impacts to monarchs on DOD managed lands is minimal.

Similarly, although milkweed is also lost on the landscape through development and conversion of grasslands throughout the range of monarch (Lark et al. 2015), this is not the case throughout the Action Area. Grasslands on DOD installations are not faced with the same pressures from conversion, with only 0.15 and 0.07% change from grassland to developed and agriculture areas, respectively, occurring from 2014 to 2022 (see Strategy's Appendix C).

In addition, on military installations with INRMPs that include pollinators, existing habitat and vegetation management actions currently maintain, enhance, and promote the availability and quality of monarch habitat. Positive management outcomes are accomplished largely through proper ecosystem management that can be achieved by implementing regionally appropriate and site-specific management regimes such as prescribed burning, mowing or haying, and invasive/noxious species control, among others, which are outlined in each installation's INRMP.

5.1.3 Native Milkweed

5.1.3.1 Influence of Non-native Milkweed

Establishment of the nonnative tropical milkweed in the U.S., where it is not killed by winter freezes, has increased the prevalence of parasitic infections and has facilitated the establishment of newly resident monarch populations (Altizer et al. 2000; Satterfield et al. 2016; Crone and Schultz 2021). Tropical milkweed does not deteriorate in the winter when native milkweed does and becomes a supplemental year-round foliage source for breeding and oviposition when

monarchs would otherwise be in a state of reproductive diapause (Ducat 2020). Migration decreases incidence of the parasite *OE*, in populations. Migratory monarchs leave breeding areas where *OE* prevalence is typically high and migration culls infected individuals (Satterfield et al. 2015; 2016). Moreover, high larval densities in year-round resident populations can exacerbate the spread of *OE* (Lindsey et al. 2009; Satterfield et al. 2015). In California, *OE* infection rates were nine times higher in non-migratory monarchs than in migratory monarchs sampled at overwintering sites (Satterfield et al. 2016). Migratory monarchs can also suffer from increased infection rates when they interact with resident populations. In Texas, migrant sites with resident monarchs were 13 times more likely to be infected by *OE* (Satterfield et al. 2018).

Monarch use of tropical milkweed may also directly reduce migratory success and larval survival and may cause additional adverse effects at increased temperatures that may result from climate change. Monarchs fed on the tropical milkweed had shorter, wider, and thinner forewings than those that fed on swamp milkweed and common milkweed, which have low and intermediate levels of cardenolides, respectively (Decker et al. 2019; Soule et al. 2020). Shorter and wider forewings are considered poorer for the gliding flight that is used during migration. At elevated temperatures designed to reflect future conditions caused by climate change, cardenolide levels increased in tropical milkweed (Faldyn et al. 2018). In addition to shorter forewings, monarchs that fed on the tropical milkweed grown under the simulated warming scenarios had lower adult survival and mass (Faldyn et al. 2018).

The DOD PCRG's monarch BMPs include "eliminate invasive plants and nonnative tropical milkweed, which is believed to promote spread of disease in migratory monarchs"; thus, installations have been advised to remove tropical milkweed where monarch occur throughout the Action Area, since the DOD PCRG's publication in 2018. For installations implementing the DOD PCRG, we expect the prevalence of tropical milkweed in the Action Area to be less than elsewhere in the range of monarch.

5.1.4 Availability, Distribution, and Quality of Breeding Range Nectar Resources in the Action Area

Reductions in nectar resources are also cited as a potential key driver in monarch declines (Thogmartin et al. 2017b). Losses of nectar resources are due to the same stressors identified above for milkweed resources (conversion of grassland to agriculture and development, herbicide use), and are lesser in the Action Area than elsewhere due to DOD's commitment to land management under Sikes Act (see discussion above in 5.1.2 Availability, Spatial Distribution, and Quality of Milkweed in the Action Area section related to conversion of grassland to agriculture) and commitment to limiting herbicides (discussed in more detail below in Insecticide Exposure in the Action Area section).

5.1.5 Availability, Quality, and Spatial Distribution of Migration Resources in the Action Area

Losses of nectar sources during migration have also been implicated as a potential key driver in monarch declines (Inamine et al. 2016; Thogmartin et al. 2017b; Saunders et al. 2019). Losses of nectar resources are due to same stressors identified above for milkweed resources. Additionally,

with a warming climate, drought impacts may become more important, especially in the western population and in the migratory bottleneck for the eastern population.

Similar to milkweed, a driver of nectar plant loss at the landscape scale is through development and conversion of grasslands (Lark et al. 2015). Grasslands on DOD installations, however, are not faced with the same pressures from conversion, with only 0.15 and 0.07% change from grassland to developed and agriculture areas, respectively, occurring from 2014 to 2022 (see Strategy's Appendix C). In addition, existing habitat and vegetation management actions on military installations currently maintain, enhance, and promote the availability and quality of monarch habitat, including nectar resources during migration.

5.1.6 Availability and Quality of Overwintering Habitat in the Action Area

DOD NRMs have been working with the Xerces Society and U.S. Forest Service (USFS), among others, to protect and restore overwintering sites on and near DOD lands in the west (California). As described in the Description of the Proposed Action, DOD applies BMPs for overwintering habitat that reduce or eliminate many threats to overwintering habitat that occurs on military lands. These actions primarily include reducing disturbance when monarchs are present, implementing vegetation management activities that minimize destruction or disturbance of monarchs, and enhancing nectar resources near overwintering sites and along the coast. See Figure 14 for a map of overwintering sites managed by DOD.

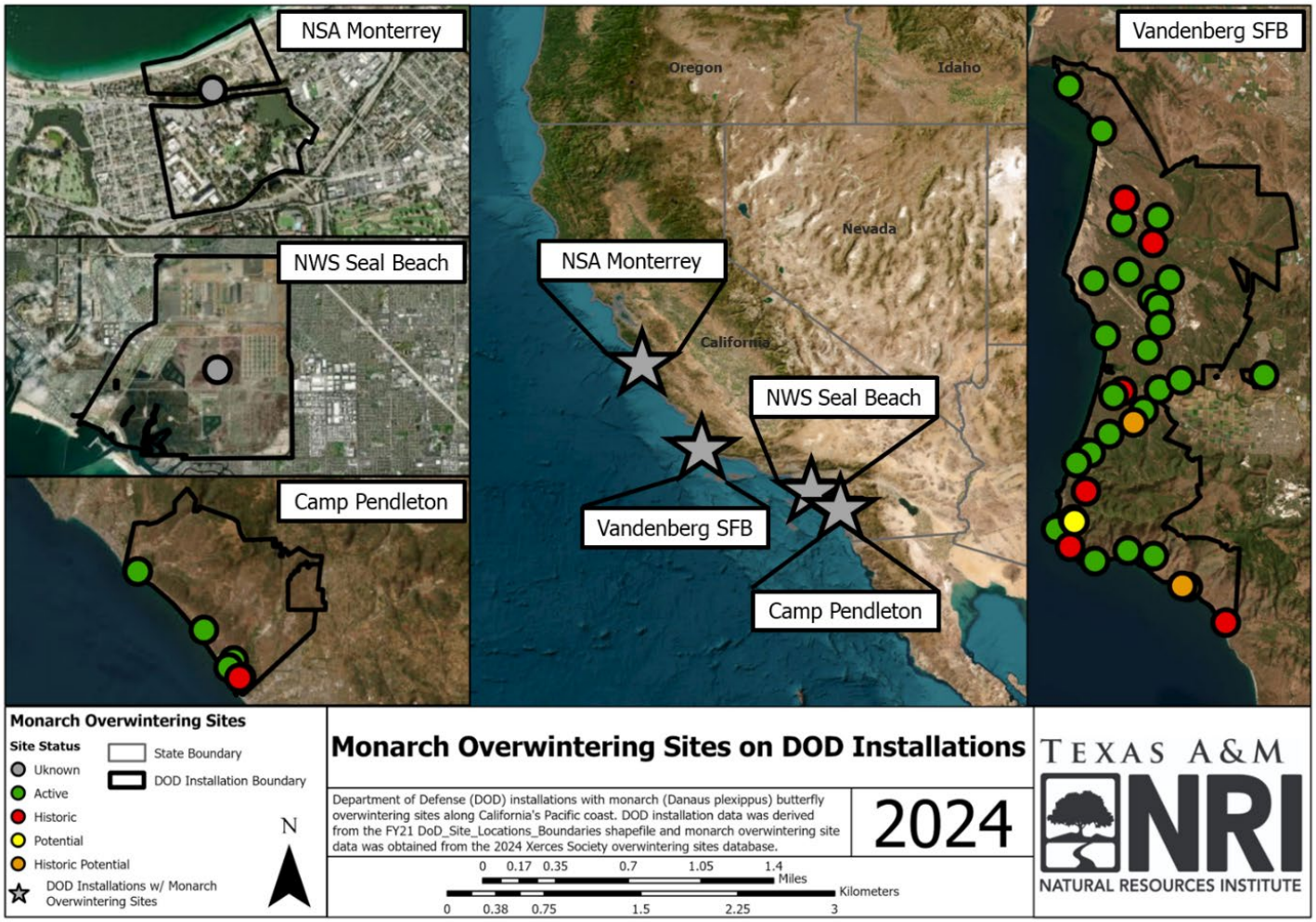


Figure 14. Monarch overwintering sites on DOD installations.

5.1.6.1 Vandenberg Space Force Base

Vandenberg Space Force Base (SFB), formerly Vandenberg Air Force Base, is a military installation located in Santa Barbara County, California that consists of >99,000 acres of largely undeveloped habitat and 42 miles of Pacific coastline. According to the Western Monarch Count (WMC) Overwinter Sites database, Vandenberg SFB has a total of 37 monarch overwintering sites widely distributed throughout the installation. Of the 37 sites, 31 are active or potential overwintering sites. The first documented overwintering counts were conducted by Calvert during the 1989 overwintering period. Overwintering surveys were conducted sporadically following Calvert's 1989 survey, and no overwintering surveys were performed during the 1991-1994, 2002-2004, and 2008-2010 overwintering seasons. Two overwintering sites on Vandenberg SFB were identified in the top 50 overwintering site priority list (Pelton et al. 2016). This top 50 list was developed to identify sites that are most critical for protection and active management when dealing with limited resources. These sites were identified based on their percent decline from the 1997-2001 count average versus the 2010-2014 count average coupled with the proportion of the remaining total population in 2010-2014 at the site. In short, sites were ranked higher if they had undergone the greatest declines yet still hosted the largest proportion of the remaining population. The two sites identified on Vandenberg SFB were the only sites from the list located on DOD property.

Recognizing its importance to western overwintering monarchs, Vandenberg SFB has cooperated with the USFWS, California Department of Fish and Wildlife, Xerces Society, and other organizations for many years to survey and monitor monarch utilization of the installation. Although no breeding surveys for monarchs have occurred, many of the overwintering sites are monitored annually by Vandenberg SFB biologists, interns, students, as well as Xerces Society staff and volunteers. In March 2017, the Colorado State University's Center for Environmental Management of Military Lands (CEMML) prepared and distributed a Monarch Butterfly Report for Vandenberg SFB (CEMML 2017). The report summarizes the past efforts and current status of monarchs on Vandenberg and provides habitat management and survey recommendations as well as suggestions for INRMP updates. In addition to the report generated by CEMML in 2017, two additional reports were produced in 2023 by Xerces Society staff. The purpose of these visits was to assist the DOD in cataloging and documenting the current quality of overwintering habitat for migratory monarchs.

Furthermore, Vandenberg SFB is a participant in the Western Monarch Overwintering Science Initiative (MOSI) a new, evolving and highly collaborative group of people and partners interested in exploring what overwintering monarchs need to thrive, where and when the butterflies move, and how to more meaningfully engage the diversity of Californians in community science efforts as well as applied research projects. Funding for MOSI's two current projects is provided by the U.S. Forest Service International Program (USFSIP) and the Legacy Program. The first initiative is the Forest Structure and Cluster Location project which is a multi-phased project that aims to address how forest structure affects wind attenuation at overwintering sites, how monarchs respond to disturbances like strong winds, whether monarchs respond to vibration events due to military operations, and how knowledge of cluster location and wind

attenuation can be applied to management at overwintering sites. On Vandenberg SFB modified infrared cameras and wind sensors will be installed to track monarch cluster location and movement over the season. Additionally, a drone-based LiDAR sensor will be used to build a model of forest structure at the pilot locations. The second initiative is the Movement Ecology and Motus project, which aims to address the following questions: how can the Motus network benefit migratory insect studies; how do different radiotags impact monarch movement and survival; how can radiotags, telemetry, and Motus be used to answer questions about western monarch migratory and overwintering movement and; how can movement ecology studies using this technology inform habitat management actions at overwintering sites. In the late fall and winter of 2024-2025, Xerces Society and Point Blue will work with Vandenberg SFB staff and Environment for the Americas (EFTA) interns to study if and when monarchs move among numerous overwintering sites at Vandenberg SFB. Up to 60 monarchs will be tagged and tracked throughout the overwintering season.

5.1.6.2 Marine Corps Base Camp Pendleton

Marine Corps Base (MCB) and Marine Corps Air Station (MCAS) Camp Pendleton collectively occupy approximately 125,488 acres in northwestern San Diego County of southern California. In October 2023, Xerces Society staff, MCB Camp Pendleton personnel, Vandenberg SFB biologists, and others met to visit monarch overwintering sites within the boundaries of the installation. The purpose of this visit was to share cross-installation knowledge between base biologists and Xerces Society staff to identify priority areas for management of monarch overwintering habitat on MCB Camp Pendleton. Six overwintering sites have been identified on MCB Camp Pendleton, two of which were determined by Xerces Society staff to be unlikely to support overwintering monarchs. However, four winter roosts have been documented and surveyed annually as part of the WMC regional monitoring program for overwintering monarchs. MCB Camp Pendleton biologists continue to collaborate with Xerces Society biologists to improve and refine surveys for monarchs and discuss maintenance of tree groves to benefit overwintering monarchs.

5.1.6.3 Naval Support Activity Monterrey

Naval Support Activity (NSA) Monterrey is a military installation comprised of an assemblage of properties totaling 563 acres located in Monterey County, California. One of the properties that comprises NSA Monterrey is known as the Dune/Research Area and encompasses 55 acres. This site harbors a grove of blue gum eucalyptus and likely provides overwintering habitat for monarchs.

5.1.6.4 Camp San Luis Obispo and Camp Roberts

Camp Roberts and CSLO are two military installations located in California occupying 42,784 and 5,612 acres, respectively. While CSLO is located entirely within San Luis Obispo County, Camp Roberts is in both Monterrey and San Luis Obispo counties. While both Camp Roberts and CSLO have conducted surveys for overwintering monarchs, none were observed at either site, despite CSLO having an apparently suitable grove of blue gum eucalyptus. Overwintering surveys conducted at Camp Roberts determined that there was no suitable overwintering habitat

on site, but they did find 30 low to high density milkweed patches that represent important breeding habitat to the species (Althouse and Meade 2021a, 2021b).

Several locations on CSLO have previously been identified as potential habitat for overwintering monarchs to cluster. An assessment of overwintering habitat on CSLO found one grove of blue gum eucalyptus offered potential overwintering habitat, however no overwintering monarchs were observed (CSLO 2022). Additionally, a natal habitat assessment and breeding survey were completed on CSLO in 2021 (Althouse and Meade 2021b). A low density of narrow leaved milkweed was detected, and no breeding monarchs were observed. In the fall of 2023, the Xerces Society surveyed four locations for monarch activity and overwintering habitat assessments at each site. Of the four sites surveyed, the Colusa and Tehama Ave site was determined to be the grove most likely to support overwintering monarch habitat. As such, it was recommended by the Xerces Society to prioritize monitoring at this location over other potential sites, particularly if resources are limited. If possible, it was recommended that the San Benito site continue to be monitored as well. The remaining two sites were determined less likely to be monarch overwintering sites based on the condition of the groves and monarch activity observed. As such, these sites are a lower priority for monitoring. Nonetheless, continued surveys for the next few years may help establish true absence (or presence) of clustering monarchs at these locations. It is common for some overwintering locations to have no monarchs some years and then have clusters appear at a later date.

Despite the lack of observed overwintering monarchs on both Camp Roberts and CSLO in recent surveys, both installations have received funding to conduct a monarch butterfly conservation project. Both Camp Roberts and CSLO fall within a Priority 1 PAZ as delineated by the Xerces Society (see Figure 11). The primary goals for this PAZ are to protect and restore overwintering and breeding habitat with an emphasis on planting pesticide-free native nectar plants. As such, the overall objectives of the monarch conservation project on these installations is to: 1) establish baseline conditions for restoration sites, 2) enhance and revegetate monarch overwintering and breeding sites through plantings of native roost trees, insecticide-free native milkweed as well as nectar resources, and 3) monitor restoration sites upon project completion for monarch presence to evaluate success of restoration and efforts and provide recommendations to improve monarch conservation efforts on both Camp Roberts and CSLO.

5.1.6.5 Naval Weapons Station Seal Beach

Historic records from overwintering surveys obtained and maintained by the Xerces Society indicated an overwintering grove on Naval Weapons Station (NWS) Seal Beach. A single record for NWS seal beach from the Western Monarch Thanksgiving Count in November of 1998 reported 200 monarch butterflies, but the exact location for this report is unspecified. In November 2018, a WMC volunteer visited NWS Seal Beach from the visitor parking lot. The volunteer did not observe any monarch butterflies in the eucalyptus and canary island pine (*Pinus canariensis*) trees near the visitor center. In 2022 during the mid-season count, another volunteer was granted access onto NWS Seal Beach but did not observe overwintering monarchs. This volunteer also noted the eucalyptus trees near the entrance at the intersection of Seal Beach Blvd and Forrestal Lane. Recent surveys have been focused near this intersection, as it appears to be the only area on NWS Seal Beach with trees. However, based on aerial imagery

these trees do not appear to be suitable for monarch overwintering habitat. As a result of the single original observation from November 1998 not specifying the exact location the overwintering grove was observed the resulting Western Monarch Overwintering Site polygon delineating this site is quite large. In turn, it is plausible that the location of the overwintering monarchs was not on NWS Seal Beach, but a grove of trees nearby such as the USFWS Seal Beach Wildlife Refuge.

5.1.7 Insecticide Exposure in the Action Area

Insecticides are pesticides with chemical properties that are designed to kill insects, and most are non-specific and broad-spectrum in nature. That is, insects exposed to these insecticides are susceptible to mortality and/or sublethal effects. Furthermore, the larvae of many Lepidopterans are considered major pest species and insecticides are tested specifically on this taxon to ensure that they will effectively kill individuals at labeled application rates. Monarchs may also be exposed to insecticides in areas beyond the insecticide application points due to drift (Olaya-Arenas and Kaplan 2019; Halsch et al. 2020).

The monarch is widely distributed across the U.S., occurring in a variety of urban and rural habitat types that include milkweed plants and other flowering forbs. Insecticide impacts to monarchs are primarily influenced by the extent to which monarchs are exposed to insecticides throughout their range. Although insecticide use is most often associated with agricultural production (for example, between 2005 and 2012, 60% of insecticide applied occurred on agricultural lands, EPA 2017), any habitat where monarchs are found may be subject to insecticide use. Insecticides can be used for insect pest control anywhere there is a pest outbreak or for general pest prevention. Homeowners may treat yards and gardens to protect plants from pests or purchase plants from nurseries that sell neonicotinoid-treated plants as ornamentals. Natural areas, such as forests and parks, may be treated to control for insects that defoliate, bore into wood, or otherwise damage trees. Outbreaks of pests such as gypsy moths, Mormon crickets, or grasshoppers may trigger insecticide treatments over larger areas to control populations. Use of insecticides in vector control, especially pyrethroids and organophosphates, may be significant in areas of the country where mosquitoes pose a public health threat or reach nuisance levels. The use of insecticides in the U.S. is ubiquitous; in 2012 for example, expenditures on insecticides topped $5 billion in the U.S., with 64 million pounds used for agriculture, home and garden, and other purposes (USEPA 2017).

The most widely used classes of insecticide include organophosphates, pyrethroids, and neonicotinoids. Neonicotinoids entered the market in the mid- to late-1990s, and because of their high insecticidal activity at low application rates, they are now the most used class of insecticides in the world (Braak et al. 2018). By 2008, for example, neonicotinoid insecticides accounted for 80% of global seed treatment sales (Jeschke et al. 2011), and by 2011, >79% of the corn hectares and 34% to 44% of soybean acreage in the U.S. were planted with neonicotinoid-treated seeds (Douglas and Tooker 2015). Neonicotinoid insecticides are absorbed into plants and distributed throughout their tissues to their stems, leaves, roots, fruits, and flowers. They kill and injure insects by attacking their central nervous system.

Studies looking specifically at dose-response of monarchs to neonicotinoids, organophosphates and pyrethroids have demonstrated monarch toxicity (Krischik et al. 2015; James 2019; Bargar et al. 2020; Krishnan et al. 2020). Moreover, the magnitude of risk posed by insecticides may be underestimated, as research usually examines the effects of the active ingredient alone, while many of the formulated products contain more than one active insecticide (Krishnan et al. 2020) – e.g., Swagger contains bifenthrin and imidacloprid (Krishnan et al. 2020), but see Oberhauser et al. (2009). The additional risk posed from compounds added to improve the kill rate (referred to as synergists) are often not assessed. The use of synergists is not uncommon. Olaya-Arenas and Kaplan (2019), for example, reported that fungicides (often used as a synergist) were most commonly detected on milkweed samples (e.g., 98% of the milkweed sample in one year contained the fungicide, Propiconazole) and, in many of these cases, co-occurred with insecticides like deltamethrin and thiamethoxam.

Within the Action Area, existing DOD policy limits use of pesticides, reducing the risks associated with this stressor when compared to elsewhere within the range of the species. DOD policy and guidance includes the following BMPs:

- Minimize the use of pesticides, including herbicides, in sensitive habitat sites (DODI 4150.07, DOD Pest Management Program). IPMPs identify how, when, and where pest species are treated while striving for continued reduction and reliance on pesticides, herbicides, and insecticides across all DOD lands.
- Eliminate or reduce the use of pesticides in areas that support monarch (DOD PCRG).
- If pesticides are used, select pesticides to reduce risks to non-target species; time applications to avoid monarch activity periods; minimize drift to non-target areas; and use targeted application (e.g., ground applications instead of aerial applications) ("Pollinator Friendly Pesticide Applicator Best Management Practices", developed by NAVFAC).

5.1.8 Climate Change

A significant portion of the discussions below is adapted from the 2020 SSA (USFWS 2020).

Projected changes in the breeding-season climate threaten to decrease abundance of the monarch in the eastern U.S. (Zylstra et al. 2022). Climate change can affect monarchs both directly and indirectly on both the overwintering and breeding grounds (Nail and Oberhauser 2015). In the Action Area, eastern monarchs overwinter in some coastal U.S. areas (Kendrick and McCord 2023) and western monarchs overwinter in both Arizona and coastal California. In California, climate change is predicted to cause a significant change in the distribution of overwintering monarchs. Results from climatic niche modeling by Fisher et al. (2018) suggest that climate change will result in an inland and upslope displacement of suitable overwintering conditions.

Climate change impacts, particularly increasing temperatures and heatwaves, may impact monarch fecundity (Oberhauser 1997), mating success (Solensky and Oberhauser 2009), caterpillar success (Yang et al. 2022), survival during migration and while overwintering (Masters et al. 1988, Alonso-Mejia et al. 1997), and may cause monarchs to cease fall migration and to instead reproduce (James 2024).

Laboratory studies indicate optimal temperatures for monarch range from 27–29°C with sublethal effects beginning around 30–36°C range, with an upper lethal thermal limit of 42°C (Zalucki 1982; York and Oberhauser 2002; Zalucki and Rochester 2004; Nail et al. 2015). Nail et al. (2015) found nighttime temperatures of 34°C during periods with daytime temperatures of 38°C resulted in lower survival, indicating that respites from elevated temperatures are important in allowing monarchs to survive temperature stress (Nail et al. 2015). Temperatures consistently above 33°C to 35°C are unsuitable for monarchs and may account for their general absence from southern U.S. states after spring (Malcolm et al. 1987; Zalucki and Rochester 1999). High temperatures and drought conditions may be particularly impactful during the crucial spring migration (Chip Taylor, pers. comm. 2020).

A warming climate may influence breeding habitat by altering suitable locations for both monarchs and their milkweed host plant (Batalden et al. 2007; Lemoine 2015; Zylstra et al. 2022). Drought may also influence the amount and availability of nectar needed for migrating butterflies and the supply of nectar in key areas like south-central Texas (Stevens and Frey 2010; Brower et al. 2015; Espeset et al. 2016; Saunders et al. 2019). The coastal non-migratory population may also be impacted by loss of habitat through rising sea levels due to climate change (Tampa Bay Climate Science Advisory Panel 2015). While drought and increased temperatures may reduce monarch habitat in some areas, the climatically suitable niche for monarchs may increase, potentially increasing their summer breeding grounds if both monarchs and milkweed are able to adapt while also negatively impacting monarchs by lengthening fall migration distances (Lemoine 2015).

Climate change may additionally impact monarchs in ways that are more difficult to measure. This may include phenological mismatch (e.g., timing of milkweed and nectar sources not aligning with monarch migration; Thogmartin et al. 2017) or range mismatch with associated species (e.g., changed environmental suitability of monarch natural enemies; Mccoshum et al. 2016).

5.1.9 Conservation Efforts

While many factors have been implicated in the decline in monarch populations, the loss of milkweed and nectar resources (i.e., breeding and migratory habitat) has been targeted as the threat that can be most easily addressed through conservation efforts. Protection, restoration, enhancement and creation of habitat is a central aspect of recent monarch conservation strategies, thus highlighting the importance of restoring and enhancing milkweed and nectar resources (Oberhauser et al. 2017, Pleasants 2017, Thogmartin et al. 2017b, MAFWA 2018, Pelton et al. 2019, WAFWA 2019). Improved management at overwintering sites in California has also been targeted to improve the status of western North American monarch butterflies WAFWA 2019).

In the Action Area, DOD has conducted targeted conservation efforts for monarch and other pollinators for more than a decade. Efforts include ecosystem management resulting in habitat protection, restoration, and enhancement for monarch across millions of acres; protection of overwintering sites in California; research; outreach efforts; and strategic partnerships that leverage conservation of monarch within and beyond DOD lands. Monarch populations have

benefited from DOD efforts and will continue to benefit through implementation of the Strategy. Some examples of prior conservation efforts that are part of the Baseline are highlighted here:

5.1.9.1 Legacy Program

Dating back to 1991, the Legacy Program has funded approximately 70 pollinator-related projects totaling nearly $17 million. Of those 70 projects, six of them totaling just over $12 million have focused specifically on monarch conservation. In fiscal years 2022 and 2023 alone, the Legacy Program contributed nearly $10 million in funding to support monarch conservation projects through an Interagency Agreement with the USFSIP that has and will continue to increase the efficiency and effectiveness of managing habitat for monarchs on DOD, tribal, federal, state, and private lands. The purpose of this collaboration is to advance a coordinated and comprehensive approach for DOD's participation and leadership in monarch conservation.

5.1.9.2 Interagency Agreement with U.S. Forest Service: Monarch Butterfly Conservation Projects

Initiated in Fiscal Year 2022, the DOD entered into an ongoing Interagency Agreement with the USFS to support six focal monarch butterfly conservation projects under the Legacy Program. The aim of these programs was to increase knowledge and data to enhance military readiness by enabling DOD managers to balance habitat protection with training activities and other land uses. Projects included:

- Research to determine seasonal timing of western monarch butterflies in locations across the west, and to use this information to increase the efficiency and effectiveness of managing habitat for monarchs on DOD lands in the west. As of FY 2023, the project had supported field research across five western states including working with installation staff to conduct research at Beale Air Force Base (CA), Fallon Naval Air Station (NV), Mountain Home Air Force Base (ID), Naval Weapons Systems Training Facility Boardman (OR), Vandenberg SFB (CA), and Yakima Training Center (WA). Data and research collected in and around these installations includes breeding phenology, larval performance, monarch movements (Motus tagging), and native bee monitoring.
- DOD NRMs have been working with the Xerces Society and USFS, among others, to protect and restore overwintering sites and restore habitat where monarchs breed on and near DOD lands in the west. The multi-year grant is working towards 1) developing management guidance for monarch overwintering habitat on DOD installations, 2) developing site-specific management guidance for monarch breeding habitat on DOD installations in western states, 3) identifying and funding priority research, monitoring, and habitat enhancement projects to advance western monarch conservation, and 4) expanding western monarch community science programs.
- Monarch Joint Venture (MJV), a partnership of federal and state agencies, non-government organizations, businesses and academic programs that work together to protect the monarch migration across the U.S., has been working since 2022 to increase monitoring, conservation, and connectivity of DOD lands with other public and private lands. This effort focused on three key activities: data collection and monitoring, the provision of training and educational resources for DOD staff and partners, and technical

assistance for habitat management for pollinators. Through robust monitoring efforts and educational opportunities that fostered collaboration to improve and increase monarch habitat across the landscape, the MJV has made great progress in safeguarding monarch butterfly populations. As such, the MJV's efforts during this period have not only strengthened partnerships but also laid a solid foundation for future initiatives aimed at conservation of monarch on military lands.

- EFTA implements an internship program that places people from diverse backgrounds in conservation fields. Through this partnership, EFTA is expanding their internship program to focus on monitoring and habitat assessment for monarch butterflies on and near military installations and DOD lands. In addition, EFTA has launched outreach, education, and training programs along the western and eastern flyways that connect military families and community level groups to monarch conservation. A special emphasis is placed on connectivity of habitat, promoting conservation actions, and boosting awareness of monarchs and other pollinators. As of FY 2023, EFTA had directly engaged with Vandenberg SFB with plans to expand their reach.
- California Association of Resource Conservation Districts (CARCD) is an organization that provides technical support, funding, and coordination for conservation work implemented by the 95 resource conservation districts (RCDs) in California. In this partnership, CARCD provides support to RCDs for planning and implementation of monarch and pollinator habitat restoration projects on or near DOD lands in Early Breeding Priority Action Zone 1 (see map in section 4.8.1). CARCD is working closely with five military installations focusing on various aspects of monarch conservation and management including habitat restoration and pollinator-friendly resource management.
- Deschutes Land Trust and Western Monarch Advocates implemented flood plain restoration and community education and engagement projects in both central and western Oregon. Additionally, they have expanded the distribution of native milkweed and other native pollinator-friendly plants throughout central Oregon to build western monarch migration corridor connectivity, increase monarch conservation awareness, and inspire community engagement. The objectives of the floodplain restoration projects are to expand the native plant palette of large-scale floodplain restoration projects in central Oregon to include more native milkweed and other native pollinator-friendly plants to better support western monarchs, hummingbirds, bats, and bees. Community education and engagement have also occurred through a variety of events with central Oregon communities and Tribes.

Refer to Description of the Action for ongoing conservation programs.

6 EFFECTS OF THE ACTION ON THE MONARCH BUTTERFLY

Regulations implementing section 7 (50 CFR §402.02) define effects of the action as all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action but that are not part of the action. A consequence is caused by the proposed action if it would not occur but for the

proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action.

The regulations for section 7(a)(2) note that "a conclusion of reasonably certain to occur must be based on clear and substantial information, using the best scientific and commercial data available" [50 CFR § 402.17(a)]. When considering whether activities caused by the proposed action (but not part of the proposed action) or activities reviewed under cumulative effects are reasonably certain to occur, we consider factors such as 1) past experiences with activities that have resulted from actions that are similar in scope, nature, and magnitude to the proposed action; 2) existing plans for the activity; and 3) any remaining economic, administrative, and legal requirements necessary for the activity to go forward.

The Proposed Action includes 1) approval and implementation of the DOD's 7(a)(1) Conservation Strategy, including land management activities (i.e., ecosystem management under Sikes Act authorities), future implementation of existing policies and procedures (e.g. to reduce use of pesticides), and its various conservation program actions for monarch and other pollinators (to include strategic partnerships, outreach events, funding for pollinators including monarch), and 2) future (i.e., continuation of current) military mission and sustainment actions.

For the purpose of this Opinion's contemplation, land management includes timber management and forest thinning; prescribed fire; use of pesticides; use of insecticides and herbicides; planting and seeding; invasive species control, agricultural outlease (row crop production, grazing, haying), and efforts to manage overwintering habitat. Land management also includes conservation actions targeting monarch and other pollinators, such as planting milkweed and nectar resources, managing overwintering sites, and removing invasive species in suitable habitat.

Also included is DOD's non-land management based efforts include participation in research to support monarch and pollinator conservation; outreach and environmental education (e.g., promotional videos and social media, events); research funding (Legacy, Strategic Environmental Research and Development Program/Environmental Security Technology Certification Program [SERDP/ESTCP]); volunteer efforts (NPLD); pollinator gardens; and partnership work (Sentinel Landscapes, RASP). We include Motus tracking as part of research efforts funded by DOD.

Each action can include multiple components, or sub-activities, that may cause stressors to monarch. For example, mowing can result in the obvious changes to vegetation structure but can also result in less obvious effects to individuals from noise. If using heavy equipment, mowing can result in ground disturbance or soil compaction which could indirectly affect vegetation. For the purpose of this analysis, we consider impacts to monarch as a result of land management and conservation programs using the following high-level sub-activities: 1) human induced, unintentional disturbance (including noise and vehicle mortality), 2) vegetation management (including soil amendments, seeding/planting, mowing, prescribed fire, forestry management, grazing, brush management, use of herbicides), 3) pesticide exposure, 4) ground disturbance, and

5) wholly beneficial activities. Table 4 crosswalks the DOD activity with the potential sub-activities described below.

Table 4. High level activity and corresponding sub-activities for land management and conservation programs

High-level Activity under 7(a)(1) Strategy with corresponding sub-activities	**Vegetation Management**	**Ground disturbance**	**Human induced, unintentional disturbance**	**Pesticide exposure**	**Unlikely to generate stressors**
Land Management					
Forest/brush management (cut/remove woody veg)	x	x	x	x	
Mowing (cut and remove herbaceous veg)	x	x	x		
Prescribed fire	x	x	x		
Invasive species control	x	x	x	x	
Planting and seeding	x	x	x		
Agricultural outlease - grazing	x	x	x		
Agricultural outlease - haying	x		x		
Agricultural outlease - row crop	x	x		x	
Vehicles and site access			x		
Overwintering habitat management	x	x	x	x	
Conservation Programs					
Outreach and education					x
Funding for research					x
Partnership and volunteer efforts					x
Pollinator gardens					x

In addition to the land management, policies and procedures, and conservation programs detailed in the Strategy, the Proposed Action also includes routine mission and mission sustainment activities that may affect monarch habitat and/or individuals, to include ground-based training, aviation training, impact areas, and construction and maintenance (see 6.2 Military Mission and Sustainment Activities).

6.1 LAND MANAGEMENT

6.1.1 Human-induced, Unintentional Disturbance – Including Noise and Vehicle Mortality

Many of the proposed land management actions have the potential to produce, either directly or indirectly, some level of noise and physical disturbance because they involve the presence of humans and/or associated equipment, vehicles, or machinery if they are applied in/near occupied habitats. Sources that generate noise and disturbances might include the use of both motorized (e.g., vehicles, chainsaw, weed trimmer) or nonmotorized (e.g., machete) equipment/ tools as well as heavy equipment (e.g., skid-steer, tractor, all- terrain vehicle [ATV], utility task vehicle [UTV], bulldozer), or any pull-behind or mounted equipment (e.g., bush hog or mulcher).

Monarch caterpillars respond to sounds between 50 and 900 Hz (Taylor and Yack 2019) by freezing, contracting, falling to the ground, flicking their thorax in a vertical direction (Minnich 1936), releasing volatile chemicals (Rothschild and Bergström 1997), and increased heart rate (Davis et al. 2018). The primary "sound" receptors on caterpillars are a pair of long hairs on upper thorax (i.e., upper thoracic trichoid sensilla) (Taylor and Yack 2019). Repeated or chronic exposure of traffic noise causes habituation was shown to not result in significant obvious physiological responses in caterpillars (Davis et al. 2018). Adults lack auditory-sensing structures, so it is unlikely that noise causes physiological responses in adult monarchs.

Vehicle use as part of implementation of the Strategy could have impacts to monarch in addition to noise. Vehicles kill millions of monarchs every year, with especially high mortality seen during migration where they concentrate into "funnels" in the eastern and central U.S. (Tracy et al. 2019). In a recent unpublished preprint (prior to undergoing peer review), Momeni-Dehaghi (2024) contend that roadkill is a major factor in monarch population declines. This study acknowledges a high degree of uncertainty. The SSA (USFWS 2020) found that the best available information is insufficient to conclude that the threat of vehicle collision was increasing or is a primary driver in monarch declines but that it "warrants future attention." As the SSA was peer reviewed and included expert elicitation on the subject, it represents the best available information on the risks related to vehicle mortality.

Implementation of the Strategy will involve some use of vehicles for site access to and during land management and travel during conservation program activities, but it is not likely to result in large numbers of road collision of monarchs within the Action Area. The noise associated with use of equipment may cause stress in monarch caterpillars if it occurs when they are present on the landscape and not habituated to the noise. BMPs identified in the Strategy and described below will be applied to vegetation management activities and will reduce the risks associated

with this adverse effect by encouraging the timing of management to avoid when monarchs are present.

6.1.2 Vegetative Management

6.1.2.1 Soil amendments

The addition of soil amendments sometimes occurs before planting during habitat restoration or enhancement work. Because the land would be devoid of suitable vegetation, assuming that vegetation removal occurs before soils are amended, there would be no appropriate habitat for monarchs, therefore no effects. If soil amendments or nutrients were applied before vegetation were removed, then any monarch eggs, larvae, or pupae that are present could be crushed by equipment resulting in injury or mortality. Adults could be disturbed or displaced.

6.1.2.2 Actions which Establish, Seed or Otherwise Plant Vegetation

With prepared land (pre-existing vegetation removed and soils amended, if required), there would be no effects to monarchs from seeding or plantings, as no suitable habitat for monarch butterflies is likely to be present. If there were a case of seeding that occurred before vegetation were removed, or in cases when vegetation removal is incomplete, then any monarch eggs, larvae, or pupae that are present could be crushed by equipment resulting in injury or mortality. Adults could be disturbed or displaced.

6.1.2.3 Actions which Temporarily Affect Vegetative Structure and Composition

Maintenance and management activities include light disking; interseeding; vegetation management using mowing, prescribed burning, grazing, haying, and spot use of pesticides (herbicides).

The effects of these activities to monarchs are similar and are described below. Monarchs may be present depending on the cover, location, and time of year (Figure 5). Direct mortality to all monarch life stages could occur during management activities. As with establishment activities, some vegetation management takes place when monarchs are not present. Prescribed fire is sometimes carried out, for example, before monarchs have returned in the spring. DOD's Strategy includes several BMPs related to timing of management to minimize adverse effects to monarch by adjusting seasonal timing of implementation.

Light disking and interseeding typically are linked activities as disking sometimes occurs prior to interseeding to prepare soil for seeding and to increase germination and seed survival. Light disking and interseeding could employ tractors or other similar equipment. This could lead to effects on all life stages present at the time of disking and interseeding when monarchs may be present. Direct effects could include crushing, collisions, displacement, and general disturbance. Stressors would be from disturbance of any milkweed or nectar sources present.

6.1.2.3.1 Effects of mowing and cutting herbaceous vegetation (including haying)

Cutting and mowing herbaceous vegetation is the removal of above-ground parts of nonwoody plants. The scale of activities and equipment used can vary, from removal over a large area using large mowers to removal in smaller areas with a push mower or weed eater.

Cutting and mowing herbaceous vegetation can crush, injure, and kill early life stages (eggs, caterpillars, and pupae) by direct contact with parts of equipment (e.g., wheels, mower blades, weed eater strings). The potential for killing early life stages vary by type of equipment and equipment adjustments. Bar mowers (blades on a non-rotating bar) contact fewer caterpillars, and presumably fewer pupae, than rotary mowers (multiple rotating blades); and adding a conditioner to a mower (a device that crushes grass after cutting) increases the potential for contact (Humbert et al. 2010). Steidle et al. (2022) found significantly fewer adult *Lepidoptera* in roadside grassland after mowing with a conventional mowing head compared to the use of an 'arthropod friendly' mowing technique.

Several BMPs can reduce adverse effects associated with mowing. Using mowers designed to minimize effects to insects or mower additions such as flushing bars can decrease the potential for effects to adult *Lepidoptera* (Oppermann et al. as cited in Steidle et al. 2022; Steidle et al. 2022). Setting a higher cutting height may avoid some caterpillars and pupae. Mowing during warmer times of the day when monarchs are more active may allow for them to flee. Vegetation removal using push mowers and weed eaters would occur in smaller areas, minimizing the chances of removing vegetation occupied by caterpillars and pupae. Cutting and mowing with small mowers and weed eaters has lower potential to harm monarchs due to the slower speeds of the equipment and the opportunity for the operator to identify and avoid milkweed.

Effects on Milkweed Resources

Cutting and mowing milkweed reduces the surface area of milkweed plants available on the landscape. This could reduce the area available for eggs and larvae. The likelihood and magnitude of effects depends on the amount of plant removed (i.e., height of mowing or cutting), the timing of cutting and mowing relative to presence of monarchs, and the frequency of cutting and mowing.

It is difficult to evaluate the effect that a reduction of milkweed surface area in a single location would have on monarchs. Several studies have cited loss of milkweed on a landscape-level as a potential key driver in monarch declines (Brower et al. 2012; Pleasants and Oberhauser 2013; Inamine et al. 2016; Thogmartin et al. 2017; Waterbury and Potter 2018; Saunders et al. 2019). The effects of milkweed reduction in a specific area likely depends on the size and quality of the milkweed patch and the availability of milkweed in surrounding areas. Based on the biology of the monarch, when suitable milkweed becomes less available on the landscape, female monarchs will have to travel further to find sites to lay eggs. If milkweed becomes too scarce or difficult to access, reproduction could decrease.

Cutting and mowing could also potentially improve milkweed for monarch reproduction, though this depends on timing and likely varies by milkweed species. Effects on monarch reproduction from mowing common milkweed, a clonal species, have been mixed. Fischer et al. (2015) and Knight et al. (2019) both found significantly more eggs in mowed than in unmowed plots. However, He and Agrawal (2020) reported no differences in egg-laying in mowed versus unmowed common milkweed plots. Haan and Landis (2020) also found higher survival of second instar larvae on regenerating stems than on uncut controls of common milkweed. Additionally, mowing milkweed may reduce predation risk to monarchs by removing aphid-

infested stems that attract predators (e.g., ants) and by promoting earlier phenologies that typically host lower predator densities (Haan and Landis 2019). Cutting and mowing to improve monarch reproductive success would have to be strategically timed to produce a net benefit to monarch productivity.

Effects of Mowing on Nectar Resources

Cutting and mowing flowering plants, including milkweed, can reduce the number of flowers available on the landscape. This could reduce nectar resources available for breeding, migrating, and overwintering adult monarchs. The likelihood and magnitude of effects depends on the number of flowers removed; the species of flowers removed and the quality, quantity, and availability of their nectar; the timing of removal relative to presence of monarchs; and the frequency of cutting and mowing.

It is difficult to evaluate the effect that the reduction of nectar resources in a single area would have on monarchs. Several studies have cited loss of nectar resources on a landscape-level as a potential key driver in monarch declines (Inamine et al. 2016; Thogmartin et al. 2017; Saunders et al. 2019). The effects of the loss of flowers in a specific area likely depends on the size of area, the quality of the nectar resources, and the availability of nectar resources in surrounding areas. Based on the biology of the monarch, when suitable nectar resources become less available on the landscape, monarchs will have to travel further to find nectar to support all phases of their life cycle. If milkweed becomes too scarce or difficult to access, survival will decrease.

Cutting and mowing during the flowering period will remove some flowers and may result in plants producing fewer flowers in the short-term (Haan and Landis 2020). However, mowing could extend the blooming season of plants (Haan and Landis 2020), which, depending on the species of plant and timing of monarchs presence, could potentially offer monarchs more nectar resources during a specific timeframe. Cutting and mowing to benefit monarchs depends on plant species and would have to be optimally timed.

An analysis of monarch occurrence records in the eastern U.S. (Inamine et al. 2016) found that the threats driving the decline in abundance occur during the migratory phase and are not driven by milkweed abundance but by the importance of nectar resources during migration.

Effects of Mowing on Predator Avoidance

Disturbance (e.g., mowing) may reduce predation pressure on caterpillars indirectly by removing aphid-infested stems that attract predators (e.g., ants) and by resetting milkweed phenology (Haan and Landis 2019). Regenerating milkweed stems host lower predator densities (Haan and Landis 2020).

Mowing BMPs

DOD's Strategy includes BMPs that advise adjusting timing of mowing to not interfere with monarch breeding or nectaring and recommends additional mowing practices that further reduce the potential for adverse effects (See BMP section).

6.1.2.3.2 Effects of Prescribed Fire

Habitat responses to fire are complex and highly varied, with numerous past studies investigating the effects of fire on butterflies and other invertebrates (Dana 1991, Swengel and Swengel 1999, Panzer 2002). While some studies have noted negative outcomes following prescribed burns others have found fire produces positive results in the long-term. Flowering may be reduced among species that would typically bloom in the first phenoperiod immediately following a fire (Miller et al. 2019; Pavlovic et al. 2011). After a March fire, for example, flowering of species that typically bloom in Midwestern oak savannas in April or May might be reduced in the year of the burn, whereas summer and fall blooming species may be unaffected (Pavlovic et al. 2011). Mid-summer fires are likely to decrease forage availability immediately after the fire within the affected growing season, but then increase blooming of early-season species the following spring (Pavlovic et al. 2011). Overall, prescribed burning has been shown to have positive impacts to health and biodiversity in systems where fire was present historically while also decreasing the risk of catastrophic wildfires that would extensively damage vegetation and seed banks.

Mason et al. (2021) conducted a meta-analysis of the effects of fire and responses of bees, butterflies, and ground beetles with over 100 pyroentomology studies evaluated. The main conclusions were as follows:

- For butterflies, fires that occurred in coniferous forests significantly increased richness, but significantly decreased abundance. Mason et al. (2021) attributed this to fires eliminating individuals, but also creating a more open environment where other, non-forest specialist butterflies can colonize (Kwon et al. 2013).
- High severity fire significantly decreased butterfly abundance, but low severity fires had positive effects, with the authors concluding that this might be due to more plant species surviving lower severity fires compared to higher severity fires thus increasing food availability, and surviving plants creating refugia for individuals, regardless of their developmental stage.
- Lastly, even though the 0 year and 1–5-year post fire characteristics showed no statistically significant effect for species richness, the mean effects for each grouping increased. This suggests that butterfly species richness does not benefit from fires in the short term but can gradually increase over time.

It is largely accepted and understood that North American grassland ecosystems were historically shaped and maintained by processes such as pyric herbivory which is the combination of fire and grazing by large native ungulates (Fuhlendorf and Engle 2001). In turn, modern disturbances such as prescribed fire, grazing, and haying play an important role in maintaining native prairie by thwarting invasive species spread, preventing woody encroachment, and promoting overall productivity (Vogel 1974; Shuey 1997). Moreover, research has indicated that fire can encourage the growth of forbs (Moranz et al. 2014), control woody vegetation (Bragg and Hulbert 1976; Abrams and Hulbert 1987; Briggs et al. 2002; 2005; Lett and Knapp 2005), and promote the growth of dominant warm-season grasses, particularly big bluestem (*Andropogon gerardii*) (Collins 1990).

Studies conducted on the regal fritillary (*Argynnis* [*Speyeria*] *idalia*), a large prairie-obligate butterfly also in the family Nymphalidae have found that prescribed burning, particularly rotational burning and/or patch-burn grazing can be a compatible management strategy for the species (Huebschman and Bragg 2000; Powell et al. 2007; Moranz et al. 2014; Henderson et al. 2018; McCullough et al. 2019). Many studies have found that adult regal fritillary can and do recolonize sites following burns, and numbers can reach pre-burn levels or greater in relatively short time spans (Huebschman and Bragg 2000; Henderson et al. 2018). Likewise, studies on monarch butterflies have found their abundance to be higher in burned sites versus sites that were grazed, particularly those grazed with high stocking rates (Leone et al. 2019). Additionally, green milkweed typically senesces in August but after summer fires in Oklahoma, monarchs continued to lay eggs on the species into late August and September (Baum and Sharber 2012). At the Konza Prairie Biological Station in Kansas, Ricono et al. (2018) found that burning increased milkweed abundance overall, especially common milkweed.

The timing, intensity, and frequency of prescribed burns and supporting actions (e.g., fire lines, staging equipment), can have detrimental effects on monarchs through the killing of eggs, larvae, pupa or adults. Monarchs, especially at the egg, larval, and pupal stages have limited mobility and likely would not escape from the fire. However, research on the regal fritillary documented observations of larvae in areas that had been burned ≤61 days post burn. This suggests prescribed fire does not result in complete mortality of eggs and larvae (McCullough et al. 2017). Monarchs at the immature stages may also be crushed by equipment, burned during the prescribed fire itself, or trampled by human presence in the affected area.

Prescribed fire BMPs

Prescribed burning is used frequently and extensively on DOD installations to maintain native ecosystems and reduce wildfire risk. DOD's Strategy includes BMPs for prescribed fire including timing fire when monarchs are absent from suitable habitat to avoid direct impacts and leaving unburned patches (of at least 1/3 the area) to leave refugia (nectar and breeding resources) for monarch. In addition, post-fire restoration and rehabilitation will include native monarch nectar plants and milkweed species.

6.1.2.3.3 Effects of Forestry Management

Forested areas are not currently considered a landcover type containing extensive monarch resource needs (Bhowmik and Bandeen 1976; Hartzler and Buhler 2000; USFWS 2020). However, some studies have documented forested land uses as migratory stopover habitat (Rudolph et al. 2006a). Importance or use of forested habitats and related forest management stressors are not available but are anticipated to be minor and infrequent across the Action Area. Inferences from other pollinators and other butterflies to ascertain stressors are summarized below.

As a group, pollinators are generally more abundant in open forests (i.e., more sunlight reaching the ground) relative to closed forests (i.e., limited sunlight reaching the ground) (Fye 1972; Hanula et al. 2016), although information on forest-obligate species remains limited (Winfree 2010). Methods used to create these open forest habitats include prescribed fire (Grundel et al. 2010; Taylor and Catling 2011), harvesting or thinning (Fye 1972; Fultz 2005; Romey et al.

2007; Taki et al. 2010; Proctor 2012; Neill and Puettmann 2013), shrub removal (Hanula and Horn 2011a, 2011b; Hudson et al. 2013), or a combination (Rudolph and Ely 2000; Campbell 2005; Campbell et al. 2007a; Campbell et al. 2007b; Rudolph et al. 2006a, 2006b). Dense shrub layers negatively impact herbaceous plant cover and diversity (e.g., Woods 1993; Baker and Van Lear 1998; Collier et al. 2002; Gerber et al. 2008; Hudson et al. 2014) and, in turn, pollinators (McKinney and Goodell 2010; Hanula et al. 2011a, 2011b; Hudson et al. 2013; Hanula et al. 2015).

Forest actions similar to those described above which focus on forest management that benefit other pollinators (prescribed fire, forest stand improvement, thinning actions) are expected to also benefit butterflies, including monarch. Restored sites of fire-maintained shortleaf pine-bluestem communities in the Ouachita Mountains in west Arkansas support a higher abundance of the monarch during migration than un-restored, fire-suppressed controls (Rudolph et al. 2006b). Similar results were found for fire-maintained pine communities in eastern Texas (Rudolph and Ely 2000) and within longleaf pine ecosystems of the North Carolina sandhills (Moylett et al. 2020). In northern hardwood forests, group-selection silviculture in hardwood forests is beneficial to native pollinating insects by increasing nectar plant composition in the resulting forest canopy gaps (Procter et al. 2011).

Forestry management actions can adversely affect the monarch by altering the abundance of flora resources, disturbing and removing migratory staging and concentration areas, and disturbance to adults during all seasons when present in the immediate vicinity of a treatment area. The most plausible and significant effects that occur because of forest management in the Action Area, however, come from overwintering habitat management, discussed below.

6.1.2.3.4 Effects of Grazing

Given the small number of agricultural outleases on DOD properties and their relatively small size in the context of their overall footprint across the DOD enterprise in continental U.S., the influence of agricultural outlease-related threats to monarchs on DOD managed lands is minimal.

The specific literature on the effects of grazing livestock on monarchs is limited. Much more research is available on the effects of grazing management systems on floristic resources, focused on other species of butterflies and moths, other pollinators, and in the context of specific vegetative communities. The literature on the effects of grazing on other pollinators can provide insight to help evaluate the effects of grazing on monarch butterflies.

Positive, neutral, and negative effects from grazing on pollinators have been reported in the literature (Thapa-Magar et al. 2022; Hanberry et al. 2021; Glenny et al. 2022). Response of pollinators to grazing include life history of the specific pollinator, type of grazers, grazing intensity and duration (stocking rate), plant and pollinator community composition, climate, and interactions with other disturbances (Vogel et al. 2007; Kimoto et al. 2012; Moranz et al. 2014; Cutter et al. 2022). In addition, both the direct and indirect effects from grazing on butterflies varies across ecoregions (Bussan 2022). Most of the research on the effects of grazing on milkweed and monarchs has occurred in the Midwest (Poynor 2019; Dickson et al. 2023).

The presence of livestock may create physical disturbances to monarch and its habitat. Livestock grazing may adversely impact butterfly populations directly by trampling during immobile life stages (egg, larvae, and pupae) or when weather conditions restrict adult movement (Warren 1993). Grazing may also adversely impact butterfly populations indirectly by altering plant community composition (Stoner and Joern 2004), removing adult nectar resources, introducing invasive weeds (Hayes and Holl 2003), and changing hydrology in mesic/hydric habitats (Belsky et al. 1999). Grazing can also result in benign or even beneficial effects on butterflies, depending upon stocking densities and location. Light rotational grazing has been shown to maintain vegetation heights and habitat heterogeneity favorable to some butterflies (Ravenscroft 1994).

Effects on milkweed resources

Grazing can directly reduce milkweed abundance as some species of *Asclepias* are palatable forage by cattle.

- In Nebraska, Poynor (2019) found that even when cattle grazed grasses less in some burn patches, they still grazed milkweed the same amount, suggesting preferential milkweed grazing. Further, it was concluded that experimental removal of flowers did not significantly affect monarch egg laying or milkweed growth but clipping of stems had large effects. These results suggest spring cattle grazing causes declines in milkweeds and monarch egg laying.
- Leone et al.(2019) found that in Minnesota tallgrass prairie, monarchs were more abundant at sites managed with prescribed fire than with grazing, but found no difference in milkweed and forb frequency between burned and grazed prairies. A subsequent study by Leone et al. (2022) also found that monarch abundance was higher in areas managed with fire when compared to those that were grazed. In this follow-up study, the stocking rate and the number of years a site was grazed were not correlated with butterfly abundance, but the authors acknowledge that there may be indirect effects of grazing that they were not able to quantify. For example, fire may increase nectar availability while grazing could reduce the amount or quality of floral resources.
- Johnson (2023) found that modified twice-over rest-rotation grazing led to higher milkweed abundance than patch-burn or season-long grazing and that milkweed is highly correlated with both monarch adult and juvenile abundances. As with other accessed literature, the species of milkweed in the area was important because cattle disproportionately grazed common (*A. syriaca*) and showy (*A. speciosa*) milkweed more than oval-leaf (*A. ovalifolia*). Overall, the conclusion was that rangelands may benefit monarchs, but the outcome likely depends on selected management, milkweed species, and time of season (Johnson 2023).
- Dickson et al. (2023) summarized that milkweed abundance was significantly higher in ungrazed than grazed grassland units, with average milkweed abundance across the growing season ranging from 34- to 185-fold higher in ungrazed than grazed grassland units. Conclusions were that cattle grazing on common/showy milkweed has adverse consequences to monarch reproductive success.

Although monarchs utilize a variety of milkweed species as obligate host plants (Mattila and Otis 2003), common milkweed (*A. syriaca*) may be more important for the species than other *Aslepias* species (Malcolm and Zalucki 1996). Varied responses of individual species of milkweed from management actions such as grazing and fire appear to be specific and thus have consequences to monarch reproduction success and utilization. For example, grazing and use of fire was assessed over a 27-year period within the tallgrass prairies in the Flint Hills Region of Kansas (Ricono et al. 2018) on eight (8) species of milkweed and results indicate that:

- Grazers were found to have a negative effect on abundance for most milkweeds. However, 2 species of milkweed did not decrease in cover (*A. stenophylla* and *A. viridis*); these species have higher cardenolide content and are considered more toxic to livestock.
- *Asclepias* species overall increased in the presence of burning (alongside grazing) but individual species' response varied as follows:
    - *A. viridiflora* and *A. viridis* decreased in abundance when burning without grazing was applied, although *A. tuberosa* and *A. stenophylla* increased at relatively low rates compared to other milkweeds studied.
    - *A. syriaca, A. languinosa*, and *A. verticillata* all dramatically increased in abundance in burned plots that were not grazed, while *A. verticillata* also increased at a similar rate in plots that were not burned.
    - Decline in *A. syriaca* abundance in the presence of grazing and burning was stronger than declining patterns observed in other *Asclepias* species studied.

Effects on Nectar Resources

Grazing can affect forb abundance (Collins et al. 1998) and cover (Davies et al. 2009), though the outcome strongly depends on stocking rate (Wallis DeVries et al. 2007) and spatial and temporal variation in grazing patterns (Whitt and Wallander 2022) as well as ecotype. Within California's mesic grasslands, Hayes and Holl (2003) found that native grass cover and species richness did not differ in grazed and ungrazed sites but cover and species richness of native perennial forbs were higher in ungrazed sites.

Within North Dakota (Missouri Coteau Region), Patton and Nyren (2015) presented results from a study ongoing since 1989 (27 years) on the effects of grazing intensity on plant species and the sustainability of forage production in pasture landuses. Five treatments were included: no grazing; light (65% forage retention), moderate (50% forage retention), heavy (35% forage retention) and extreme (20% forage retention) grazing. For each intensity treatment, plant density and composition of shrubs, forbs and bunch grasses were assessed. Conclusions and recommendations specific to forbs (and thus relevant to monarch) from this study are:

- Total forb density was highest on the extreme treatment and lowest on the light and ungrazed treatments.
- Forb production – expressed in pounds/acre – was highest in the moderate grazing treatments but not significantly different than the heavy grazing treatments.

- Prior-year condition of these pastures and adapting to weather trends early in the grazing season are key management metrics in optimizing plant-grazer relationships as temperature and precipitation affects available forage conditions throughout the utilization period.

Research in central IA in oak-hickory dominated woodlands found strong differences in vegetation between plots in currently and recently grazed woods compared to plots in ungrazed woods (Mary 2002). Specifically:

- All species associated with ungrazed plots were native, and there were a high number of perennial herbs, and herbs with fleshy roots associated with these plots. They also had more species characteristic of moist forests with closed canopies and habitats with little human disturbance, and with ranges restricted to the eastern U.S. hardwoods.
- Conversely, 30% of species associated with grazed plots were exotic. Species associated with grazed sites were also more likely to be annuals, have fibrous roots, occur in a wide variety of habitats, and to have a cosmopolitan distribution.

A meta-analysis on grazing within California grasslands found that exotic forbs showed a dramatic uniform increase in cover with grazing – especially on dry sites, but that native forb increased in cover and richness when grazed during the wet season (Stahlheber and D'Antonio 2013). These results lend support to the use of grazing to enhance native forb richness and native grass cover in some settings although this must be weighed against increases in the cover of exotic forbs. Evans et al. (2023) also concluded from an 8-year study on California grasslands that targeted grazing strategies produced greater cover of native annual forbs and simultaneously controlled invasive grasses. Alternatively, Lesage et al. (2022) found over a 15-year period that although grazed prairies continued to have greater native annual forb richness than ungrazed sites, native annual forb richness declined and concluded that drought and increasing aridity may be driving declines in native annual forb richness instead of grazing pressure.

Light to moderate levels of grazing usually result in a richer diversity of plant species than do heavy levels of grazing or no grazing at all, especially in the more humid grasslands such as the tallgrass prairie in the U.S. (Risser et al. 1981; Hartnett et al. 1996; Collins et al. 1998; Thacker et al. 2012). In the sand sage brush grasslands in the southern Great Plains, one study found that richness in annual forb was not affected by stocking rates, including heavy grazing, and forb populations were more responsive to weather (Gillen and Sims 2004). Moderate grazing by cattle also increased plant biodiversity on tallgrass (Collins 1987), mixed-grass prairie (Biondini et al. 1998), and shortgrass steppe (Milchunas et al. 1990, 1992). However, very heavy grazing that removed 90% of above-ground biomass reduced diversity on mixed-grass prairie (Biondini et al. 1998).

Direct effects of grazing include effects on life functions, including ovipositing, incubation, larval foraging, nectaring, and pupation. Further, grazing when the monarch is present creates a hazard to all life stage(s) from crushing or accidental ingestion, but data are lacking on this stressor.

In summary, stressors created from grazing include alteration of blooming flower abundance and diversity, changes in physical structure of vegetation, changes in the composition and availability of milkweeds, alteration of soil characteristics, and negative effects on microhabitat temperature and moisture (see Hanberry et al. 2021; Fleischner 1994; DeBano 2006; Kimoto et al. 2012; Schmalz et al. 2013; Moranz et al. 2014; Buckles and Harmon-Threatt 2019). However, depending on location as well as grazing intensity and timing, grazing can have positive impacts on quantity and quality of nectaring resources for monarch. It is important to note that there are some variations in reported plant species response – ranging from adverse to benign, to beneficial.

Generally, Hatfield et al. (2015) recommended that grazing periods compatible with butterfly persistence should be short with relatively long recovery periods for the habitat, and grazing should not take place during the adult flight period since butterflies are utilizing nectar sources and looking for oviposition sites during this time.

BMPs for Grazing

Despite the relatively small area exposed to grazing on DOD lands, BMPs for grazed lands were included in the Strategy. Specifically, if an area is grazed then land managers will control the amount of grazing to avoid eliminating flowering plants, reduce soil compaction, and prevent overgrazing. In addition, they will include native flowering plants used by pollinators when grazing areas are re-seeded, unless inconsistent with grazing practices. See BMP section for additional recommended BMPs.

6.1.2.3.5 Effects of Brush Management

Brush management is the practice of removing, reducing, or manipulating woody vegetation to achieve a desired plant community condition (structure and composition). Unwanted brush can be managed by chemical or mechanical methods, fire, or improved grazing management. Vegetative treatments involving brush management generally involve more intensive mechanical methods (larger equipment, more vegetative and earth disturbances) than previously outlined and many include grubbing, mastication (i.e., grinding, shredding, or chopping) and mulching.

Brush management includes removal of invasive, exotic, or aggressive woody plants. Removal may be done by hand with motorized (e.g., chainsaw, weed trimmer) or nonmotorized (e.g., machete) tools, heavy equipment (e.g., skidder, tractor, ATV, UTV, bulldozer) and any pull-behind or mounted equipment (e.g., bush hog, mulcher), bush hog and stump spray (i.e., cutting down vegetation with the bush hog, then applying herbicide to stumps), and/or herbicide application (including basal, hack-and-squirt injection, cut stump, foliar, or soil treatment). Herbicides may be applied manually (e.g., stem injection, hack-and-squirt injection, direct streamline stem spray, or direct foliar spray from backpack applicators) or mechanically from the ground (e.g., sprayers mounted to an ATV or tractor). Manual application methods are more precise and can be used to spot treat in an area to avoid exposure of nontarget plants.

Limited information is available on specific effects to monarchs. We reviewed existing literature on forb responses and similar species responses (e.g., pollinators/other Lepidoptera) and draw the following inferences:

- Control of honey mesquite (*Prosopis glandulosa*) using herbicide treatments concluded that annual forbs responded favorably to herbicide treatments of mesquite (Ansley et al. 2021).
- After chaparral (*Calystegia* sp.) dominated plant communities were masticated, they tended to have an expansion of nonnative grasses and a reduction in native forbs 3 to 7 years after treatment (Perchemlides et al. 2008; Potts et al. 2010; Potts and Stephens 2009).
- Harrington et al. (2021) concluded that directed foliar spray was the most effective treatment for achieving many of the desired understory characteristics of a longleaf pine woodland in South Carolina, including a diverse understory dominated by herbaceous vegetation, although shredding, stem injection, basal spray, and directed foliar treatments increased herbaceous species richness by 7 to 11 species over that observed in the non-treated control. Further, collateral damage to the herbaceous community from several of the herbicide treatments (e.g., vegetation gaps around trees in the stem injection and directed foliar treatments, bare-ground conditions in first year after the broadcast foliar treatment) appeared to be short term, and recovery of herbaceous species richness in these treatments was evident by the second year.
- Reinhardt et al. (2017) evaluated the effectiveness of oak savanna restoration and management involving mechanized strategies (bulldozing, masticating, and shear cutting) in combination with prescribed burning and native seed treatments and vegetative response in context with the needs of the Karner blue butterfly (*Lycaeides melissa samuelis*) on 13 sites in Michigan. All of the mechanical methods were effective for promoting management goals of higher herbaceous plant cover, higher wild lupine cover, reduced woody plant cover, and lower invasive species cover. Further, follow-up actions such as prescribed fire and seeding appears to be effective for furthering these management goals by reducing woody plant cover, creating more exposed soil for plant colonization, and promoting desired cover types, while minimizing undesired cover types.
- Within degraded woodlands in New Mexico, Kleintjes et al. (2004), evaluated the effects of an overstory reduction and slash mulching treatment over a 2-year period upon butterfly abundance and species richness between a pair of treated and control watersheds. They found that that butterfly abundance and species richness were significantly greater on the treated watershed in both years, and these measures were correlated with significant increases in forb and grass cover in the treated watershed.
- McIver and Macke (2014) evaluated the response of butterflies to sagebrush steppe restoration treatments (16 sites in the states of CA, ID, NV, OR, UT, and WA over 7 years) that involved a combination of prescribed fire, mechanical and herbicide methods. Among their conclusions:
    - Spatial (among-site) and temporal (among-year) variation in butterfly community structure was very high and tended to overwhelm patterns of treatment response;

  - When species and species groups did respond to treatment, response was generally positive regardless of treatment type, with response to prescribed fire versus its mechanical surrogates (clear-cutting, mastication) more similar than expected;
  - Similarity in response among treatments was likely due to the fact that woody vegetation removal, whether by fire or by machine, enhanced grass and forb production in turn provided more resources for butterfly larvae (host plants) and adults (nectar);
  - When a positive response was found, these positive effects generally persisted through 4-years posttreatment, indicating that the mechanisms behind treatment response are long lasting.

- Shinneman et al. (2023) completed a meta-analysis of the ecological effects of various vegetative treatments on six widespread pinyon and juniper tree species of the interior western U.S. that primarily occupy semi-arid environments. The authors assessed and summarized the potential effects of pinyon and juniper removal on plant and wildlife communities, as well as several non-living ecosystem components and processes (for example, bare ground, hydrologic, litter). This included results from 48 studies conducted between 2014 and 2021 (treatment studies and results on federal lands) in the states of AZ, CO, ID, MT, NM., NV, OR, UT, WA, and WY). This meta-analysis included the work of McIver and Macke (2014) summarized above on butterflies. The following summarize the relevant conclusions from this analysis:
  - Abundance of native herbaceous plant species was found to increase more often after mastication than following cutting;
  - Consistently more positive than negative responses for general understory vegetation (that is, including both native and exotic species) among nearly all treatment types (except pile burning);
  - Cutting and mastication without secondary treatments resulted in more positive than negative responses for perennial plant species abundance (However, depending on the abundance and composition of exotic species, such understory responses may also result in enhanced fire risk, loss of native diversity, and inadequate wildlife habitat conditions.)

In conclusion, the effects of brush management methods on the monarch will be dependent upon the treatment method, location, the amount of plant material removed, as well as the presence of monarch during the treatment(s) as well as the distribution and abundance of milkweed and floristic resources within the treated areas. Some specific vulnerability of soils to erode or compact was noted as a consequence of mastication (Jain et al. 2018), thus some aspects of brush management may generate long term adverse effects on site recovery and associated loss of use by monarchs. Generally, brush management can adversely affect the monarch by changes in availability and abundance of milkweed resources, changes in nectar resources, and direct

mortality of instars, eggs, and caterpillars. Brush management can result in a positive response in available forbs and nectar resources, inferring an overall benefit to the monarch.

6.1.2.3.6 Effects of the Use of Herbicides to Support Vegetation Management

Generally, herbicides may be used to support implementation of vegetative management objectives (i.e., suppress shrubs and hardwoods to control understory/midstory conditions in forested landscapes; suppress select weedy, invasive, or aggressive undesirable plant species associated with a habitat management objective) and are used in conjunction with physical or mechanized treatments to generate a desired vegetative condition and structure in all land uses.

Effects to monarchs may include exposure to herbicides in all land use types through both direct contact (spray drift/ residues) or ingestion of plant material and through possible runoff into water resources . However, specific studies on the monarch from the effects of herbicides were not discovered in the available literature. In evaluating the literature, several inferences can be drawn from systematic literature reviews specific to either established effects on changes in vegetative structure (and specifically to effects on forb or nectar resources) or where available responses of other butterfly/pollinator species. Results were especially concentrated in southern pine systems.

In Forested Systems

Forestry land uses throughout the Action Area may rely upon herbicides to assist in achieving desired conservation outcomes, including improve forest productivity, facilitate regeneration, and restore ecological function (Society of American Foresters 2019). Toxicity and risk data suggest that the many herbicides used for forested lands (e.g., glyphosate, triclopyr) are generally safe to mammals, birds, and other wildlife if used in accordance with the manufacturer label (USFS 2011a; 2011b). Additionally, risk and exposure of these compounds is reduced as treatments involving the use of herbicides are generally infrequent during a typical stand rotation. For example:

- Within southern pine (Pinus spp.), specific conditions always dictate treatment schedules, but generally herbicides are generally applied a maximum of 3–4 times (in many stands only 1–2 times) over the life of a southern working pine stand managed for sawtimber (~25–35-year rotations) (Briggs et al. 2024). In these pine forests, applications are typically made on 1) recently clearcut sites for site preparation before planting to reduce woody vegetation such as trees, shrubs, and vines; 2) newly planted seedlings (1–2 years) to reduce competition from herbaceous (grass or broadleaf weeds) vegetation; 3) juvenile (2–4 years) stands to control woody competitors not controlled during site preparation; and 4) mid-rotation (> 14 years) stands to reduce competing hardwood trees (Fox et al. 2007; Shepard et al. 2004).
- In Northern Forests, such as within the State of Washington, current guidance indicates that herbicides are typically applied once or twice in the 40–65-year life span of managed conifer stands (Washington State Department of Natural Resources 2024).

- Within hardwood forests in Pennsylvania, guidance indicates that only one application is made over an 80- to 100-year rotation for hardwood regeneration establishment (Jackson and Finely 2007).

A review of available information on the effects of forest herbicide in working pine (*Pinus* spp.) forests in the southern U.S. on insects including butterflies concluded that: 1) herbicides have few reported long-term impacts on understory herbaceous cover and species richness/diversity when applied according to labeled uses and application rates; 2) the method of chemical treatment (e.g., broadcast spray or banded application) may influence understory plant structure and composition; 3) responses of insects to herbicides were species- and taxa-specific and highly variable given their forage/habitat requirements and life histories; and 4) long-term research is needed to evaluate the effects of herbicides on vegetation-associated insects to provide a comprehensive profile of herbicide nontarget impacts (Briggs et al 2024).

Within shortleaf pine-oak-hickory forests in LA, Kohlman (2023) evaluated restoration efforts using three different management regimes: 1) prescribed burning with active herbicide treatments for non-desirable plant species, 2) burning only, and 3) no active management on pollinators. Greater diversity, evenness, and richness where burning occurred was greater compared to no management; and the combination of burning and herbicide treatment produced ~1.5 times higher diversity than no management sites.

A literature review was completed for the effects of forest herbicides on wildlife taxa on Pacific Northwest Ecosystems (National Council for Air and Stream Improvement 2009). The authors concluded that: 1) studies have shown that herbicides have low toxicity to wildlife, tend to dissipate quickly, have limited mobility (rapidly fixed in environments), and do not bioaccumulate; 2) forest herbicides can enter aquatic ecosystems via accidental runoff or drift, but this riparian contact is minimized through the use of vegetation buffers, drift prediction models, application timing, and droplet size; and 3) when herbicides are applied at recommended rates in managed forests, direct toxic effects on wildlife and fish – including insects – are not expected.

In Grassland and other non-Forested Land Uses

The Proposed Action includes the use of herbicides to treat woody plant species and inhibit succession, control and eliminate invasive species, and to accelerate restoration and management objectives within non-forested land uses.

Spot pesticide applications to control invasive plants or pests may be used on suitable vegetative cover for monarch. Application can be accomplished using backpack applicators, cutting and dab the cut stems, hoses from vehicle mounted spray tanks, or other spot treatment methods as needed.

Herbicides can have indirect negative effects on pollinators (Bohnenblust et al. 2016; Abraham et al. 2018; Latty and Dakos 2019; Iriart et al. 2020). However, when used in combination with other restoration techniques, such as supplemental plantings, grazing, and prescribed fire, herbicides are a necessary component of management actions that can result in long term benefits in restoring and managing grassland systems, including enhancing nectar resources for

the monarch and other pollinators (D'Antonio and Meyerson 2002; Kelley et al. 2013; Reid et al. 2009; Kyser et al. 2013; Davies et al. 2020; Espinoza et al. 2020; Miller 2021).

Most herbicides used in rangeland applications have low toxicity for insects (DiTomaso et al. 2010); however, rangeland herbicides may reduce pollinator insects through indirect toxic effects such as insects feeding on treated plants (Bohnenblust et al. 2013) and by killing plants important to insects (Black et al. 2011).

The direct impacts of herbicide exposure to the monarch butterfly could result in sublethal to lethal effects depending on the exposure pathway (contact or dietary) and life stage exposed. Herbicide use could directly reduce milkweed and nectar resources. Such direct interactions and effects to resources could affect all monarch life stages.

BMPs for herbicide use

If herbicides are used, the Strategy includes BMPs to ensure DOD will apply when plants are more responsive to treatment and when monarchs and other pollinators are less likely to be nectaring on the plants. DOD policy requires installations to minimize use of herbicides see 3.2.1.2.1 Limiting Pesticide Exposure, and all application will follow label requirements.

6.1.2.3.7 Synthesis - Species Response to Vegetative Manipulation Actions

Various vegetative management actions as described above include targeted use of herbicides, removal of dense woody vegetation, mowing, prescribed burning, brush management, seeding of native species and associated site preparation, control of invasive or defined noxious or undesirable species, prescribed grazing, and enhancement of species-specific life history conditions.

If monarchs (of any life stage) are present, the following adverse effects could occur: disturbance; injury or death to eggs, larvae, and pupae from trampling, vehicles, or equipment; harassment of adults due to smoke and fire; incineration of caterpillars and instars from fire; ingestion of all limited mobility life stages by livestock; mortality or injury from the effects of human presence; and lethal and sublethal effects from herbicides. These activities may also disrupt essential behaviors such as feeding and resting. These stressors would not immediately manifest when the species is not present on the site, but latency impacts may occur.

Additional stressors to monarchs include removal or disturbance of changes in the characteristics or suitability of vegetative cover - potentially including adverse effects on milkweed and nectar sources. Latency effects are likely variable but could result in both acute and chronic effects. For individual monarchs, vegetation removal could result in mortality, displacement, disturbance, reduced reproduction and decreased egg laying, pupation, and foraging success. Both long- and short-term effects on certain life stages are expected, but absolute trend and scope cannot be surmised. Many positive impacts to monarch in the long term are expected from these vegetation management activities. Those benefits are summarized in Section 6.2.1.

6.1.3 Pesticides

Direct effects include lethal and sublethal toxicity of monarchs exposed to pesticides as well as the uptake and accumulation of insecticides by milkweed and nectar plants, leading to exposure by foraging larvae and adults.

6.1.3.1 Types of Exposure to Insecticides

Insecticide exposure pathways to both monarch adults and larvae include the ingestion of insecticide on or within plant tissue and direct contact with airborne insecticides. Specifically, exposure can result from direct contact with insecticides or uptake via dietary pathways.

Pesticide drift off the application site as droplets, vapor, or dust can cause direct or dietary exposure. Exposure to drift is influenced by atmospheric conditions, application equipment, and application best practices. This makes testing the effects of the full range of scenarios difficult (H. Zhu et al. 1994, Teske et al. 2002, Hanna and Schaefer 2009). Increasingly, pesticide labels require drift reduction measures such as setbacks from natural areas, installing vegetated filter strips or buffers, avoiding applications near pollinators or flowering plants, and use of drift controls.

Systemic exposure from plants taking up some insecticides into their tissues, resulting in dietary exposure to adults and larvae. Neonicotinoid insecticides are taken up by plant tissues (Goulson 2013). Monarchs may be routinely exposed to one or more neonicotinoid insecticides in milkweed near corn and soybean fields, but maximum concentrations may be below levels that would adversely affect monarch larvae (Hall et al. 2022).

6.1.3.2 Effects of Insecticides

Once monarchs are exposed to insecticides, the effects could result in lethal and sublethal effects, depending on the degree of exposure and toxicity of the pesticide. Several studies indicate that certain pesticides cause harm to monarchs at various life stages. Described here are recent peer-reviewed papers that have examined the exposure and effects of pesticides. It is important to note that toxicity studies are designed to determine the level or "dose" of a substance that will produce measurable undesirable effects. In the case of pesticides, such studies are used to inform label requirements, legally enforceable instructions on how to safely handle and use pesticides.

A laboratory study by Barger et al. (2020) examined the transfer of the neonicotinoid clothianidin from soil to milkweed to larvae and to adult. At label application rates approved for greenhouse use (9.4 to 881.7 grams of active ingredient per acre), concentrations in leaves, larvae, and adult monarchs were not detectable and no significant effects to larval growth and survival, pupae and adult mass were observed. However, at application rates greatly exceeding label requirements (ranging from 228 to 3,553.8 grams of active ingredient per acre) this study did demonstrate for the first time, the transfer of clothianidin from soil to milkweed to adult monarchs. At these higher application rates, consumption of exposed leaves negatively affected both larval growth and adult survival.

Krishnan et al. (2021) conducted contact and dietary toxicity tests on monarch butterfly larvae at each life stage for five insecticides registered for foliar application on maize and soybean: a pyrethroid (beta-cyfluthrin), an anthranilic diamide (chlorantraniliprole), an organophosphate

(chlorpyrifos), and two neonicotinoids (imidacloprid and thiamethoxam). Contact and dietary effects differed among larval stages with first instars being the most sensitive followed by third and fifth instars. Beta-cyfluthrin – the pyrethroid – and chlorantraniliprole were the most toxic insecticides across all instars. For the neonicotinoids, clothianidin was more toxic to larvae than both imidacloprid and thiamethoxam.

Grant et al. (2021) used the larval dose-response curves generated from the Krishnan et al. (2021) toxicity studies to model monarch mortality rates caused by insecticide drift exposure downwind from sprayed crop fields. Two scenarios were modeled - predicted spraying for soybean aphid and true armyworm (a corn pest). For aerial applications using beta-cyfluthrin and chlorantraniliprole for the soybean aphid management, models predicted larval mortality between 100 and 32 percent at distances 0-60 meters downwind based on contact toxicity. Dietary toxicity data predicted larval mortality was between 100 and 10 percent at 0-60 meters downwind. Larval mortality for chlorpyrifos, imidacloprid, and thiamethoxam, (using contact toxicity data) was 99, 91, and 67 percent. For the same insecticides, larval mortality was 96, 80, and 83 percent based on dietary toxicity data. Modeling for high ground boom applications produced similar predictions; however, lower mortality was predicted at distances 15, 30, and 60 meters downwind compared to aerial applications. Across the scenarios, the mortality rates were generally highest for the first instars and lowest for fifth instars. The lowest percentage of monarch mortality was modeled at 60 meters downwind from the crop edge. Although Grant et al. (2021) estimated high monarch larval mortality rates downwind of maize and soybean fields treated with foliar insecticide applications, they noted that changes in wind speed and direction could mean different field edges will experience different levels of insecticide exposure.

Monarch larvae "exposed to the highest dose of clothianidin (51–70 ng/g) experienced pupal deformity, low survival to eclosion, smaller body size, and weaker adult grip strength. This effect was most evident for monarchs reared on the lowest cardenolide milkweed in the study – swamp milkweed. Although neonicotinoid residues are ubiquitous on milkweeds in agricultural and ornamental settings, commonly encountered doses below 50 ng/g are unlikely to cause substantial declines in monarch survival or migratory performance (Prouty et al. 2021) Results show that adult monarchs tolerate field-relevant doses as high as 54 ng/mL for imidacloprid and 75 ng/mL for clothianidin, with minimal lethal or sub-lethal effects until much higher doses are supplied. Prouty et al. (2023) concluded that adult monarchs are more tolerant of ingested clothianidin and imidacloprid than indicated by previous research. Monarchs are also able to adjust egg laying and foraging behaviors "based on which pesticides are present on their host-plants", a behavior that has been demonstrated at field-relevant pesticide concentrations (Olaya-Arenas et al. 2020). In Iowa restored prairies in or near corn and soybean fields, Hall et al. (2022) detected noenicitinoids in 80% of milkweed samples, but at concentrations 10-130-fold below levels indicative of chronic adverse effects to monarch larvae.

6.1.3.3 Pesticide Effects Summary

Krishnan et al. (2021) and Grant et al. (2021) found that multiple pesticides pose risks to the monarch based on laboratory toxicity tests. When these effects were incorporated into a model to predict risk from drift, all pesticides resulted in mortality up to 60 meters of a field, as described

above in section 6.1.3.2. Despite this, the authors suggest that establishing monarch habitat in agricultural landscapes could still benefit the monarch because of its population dynamics and vagile behavior – i.e., females will lay eggs after spraying and larvae will develop when residual insecticide concentrations have fallen below adverse levels. The authors state that monarch production would be maximized if measures were employed to reduce initial losses due to drift, but that the conservation of North America's eastern monarch butterfly population will require the establishment of milkweed and nectar plants in agricultural landscapes.

In summary, lab toxicity testing is important to discern levels of toxicity of pesticides on the tested species and can result in dose-response information. Linking lab toxicity data to in-field exposure can present challenges. Often lab tests involve use of pesticides at rates that far exceed label requirements to produce measurable responses. Additionally, a range of environmental factors influence pesticide application and drift including weather conditions (humidity, temperature, wind), topography, surrounding vegetation, application methods, and employed BMPs. Studies that utilize toxicity data to project biologically relevant exposures utilize various modeling and in-field research. Understanding drift is a key component to estimating exposure potential for monarch butterflies. With a focus on factors that are manageable through conservation actions directly related to land use practices – managing insecticide exposure can reduce risk to the monarch.

BMPs for Pesticide Use

The Strategy includes BMPs for use of pesticides that limit their use. If they are used, the application is targeted and timed to minimize impacts (i.e., by establishing buffers, minimizing non-target drift, and timing applications to avoid monarch activity).

6.1.4 Ground Disturbance and Habitat Loss

For this section, we consider effects of land management where temporary or permanent habitat removal occurs.

In many cases, ground disturbance (e.g., grading, fill) will be temporary and will be followed by restoration to include native plants. If the habitat prior to the earth work was suitable for monarch, this would result in a short-term loss of suitable habitat. If monarch were present during the ground disturbance, eggs, caterpillars or pupae could be crushed by equipment. Ground disturbance will result in the loss of vegetation of the impacted area, which could include milkweed. This would reduce available food resources for monarch caterpillars, thus resulting in lower numbers of successfully eclosing adults by reducing oviposition opportunities and caterpillar fitness (Pleasants and Oberhauser 2013).

Some land management actions include the placement of water control structures, which could result in inundation of monarch habitat. Inundation of lands can injure and kill caterpillars by drowning eggs, caterpillars, or pupae. This will result in direct mortality to any early life stages within the project footprint. Inundation could result in the reduction, loss, or occlusion of vegetation in the impacted area, which could include milkweed. Further, this would reduce available food resources for monarch caterpillars, thus resulting in lower numbers of successfully eclosing adults by reducing oviposition opportunities and caterpillar fitness (Pleasants and

Oberhauser 2013). Lastly, inundation could also result in the loss of migration resources such as nectar resources.

Similarly, land management actions could result in other changes in hydrology – including using dewatering techniques or involving water diversions from previously used areas by monarchs, e.g., actions involving restoration and management of riparian and aquatic habitats. Dewatering and diversion activities may result in collateral, incidental, or accidental inundation of adjacent areas. Dewatering activities have the potential to change the local hydrology upon which milkweed plants depend. In cases where milkweed plants are deprived of the necessary water for physiological processes, they may experience wilting, reduced growth, or mortality. Diversion activities also have the potential to change local hydrology. These changes can include increasing or decreasing the soil moisture content such that it exceeds the tolerances of milkweed plants.

Dewatering and diversion can injure and kill caterpillars by changing the hydrological conditions such that areas occupied by caterpillars are changed that could result in milkweed loss or inundation of caterpillar habitat.

Changes to local hydrology could result in changes to existing vegetation, runoff, and waterways. Hydrological impacts that change vegetation could impact both milkweed and nectar plant availability, density, and vigor in adjacent areas, which would impact monarch at all stages. Changes to runoff patterns may increase the amount of toxins associated with the purpose of the hardscaping (e.g., petroleum products used in machinery), which could result in lethal or sublethal toxicity to caterpillars that consume plants absorbing these toxins (Bohnenblust et al. 2016; Gove et al. 2007; Halsch et al. 2020; Oberhauser et al. 2009; Olaya-Arenas et al. 2020). Waterway changes may impact caterpillars by changing the vegetation community such that it no longer supports milkweed or creates local flooding which would drown eggs, caterpillars, or pupae resulting in mortality.

Synthesis of Expected Habitat Losses and Associated Earth Disturbances

If land management actions are conducted when monarch adults, pupae, larvae, or eggs are present, they could be directly affected. Direct interactions would include crushing, drowning, collisions, burning, disturbance, displacement, or sublethal toxicity (in the case of herbicide application (Olaya-Arenas et al. 2020)). Additional effects to resources upon which monarchs depend could include loss of vegetative cover, potentially including milkweed and nectar sources. These direct interactions and stressors could affect ovipositing, incubation, foraging by larvae, pupation, and nectaring. For any individual monarch that may be present, vegetation removal could result in mortality, displacement, avoidance, decreased dispersal, disturbance, reduced reproduction, and decreased foraging success.

For land management activities that result in temporary habitat losses and earth disturbance actions which may be associated with the restoration or rehabilitation of areas – any resources that may be present for the monarch before vegetation removal would likely be replaced within few or several months, resulting in short-term loss of resources rather than permanent loss.

6.1.5 Overwintering Habitat Management

Although the sub-activities of the work conducted to manage overwintering habitat are discussed above, it is worth additional discussion to add additional information on the contribution of overwintering habitat management to conservation of monarch. Overwintering sites benefit from DOD's active management to address issues of grove senescence, disease, and pest infestations, and ensure tree regeneration or replacement (Xerces 2018). BMPs in existing guidance (i.e., reducing disturbance when monarchs are present; avoid tree removal and trimming at overwintering sites unless they pose a human safety risk; develop long-term management plans to include planting native trees and nectar resources; and consulting with monarch expert and arborist prior to cutting or thinning where monarch overwinter and conduct when they are not present) ensure long-term benefits to the species by maintaining suitable overwintering habitat (via improved roosting success and thermoregulation).

BMPs for Overwintering Habitat

DOD has agreed to implement several additional BMPs through the Strategy that will further improve overwintering success of monarch on DOD lands (see BMP section). Reducing fuel loads helps to minimize risk of catastrophic wildfire within overwintering habitat. Use of pesticides will be avoided within 500 feet of overwintering sites when monarchs are present. Further, planting nectar resources to include fall/winter/early spring blooming native forbs within overwintering sites and within 5-miles of the coast will reduce distances needed to move for foraging and, in turn, increase foraging success. Surveys and research of overwintering monarch sites support overall understanding of the western population's status. Collectively, efforts over the overwintering sites managed by DOD provide significant contribution to the conservation of monarch.

6.2 Beneficial Effects to Monarch as a Result of Land Management

Land management activities can have short-term effects on populations through the loss of individual eggs, caterpillars, pupae, or adults, as discussed above. With implementation of BMPs, those effects are greatly minimized. In this section, we describe the long-term benefits of maintaining, enhancing, and increasing monarch habitat on the landscape throughout DOD lands.

6.2.1 Benefits Associated with Vegetative Management of Grassland

The disturbance components of vegetative management actions such as burning, grazing, mowing, and brush management are expected to be beneficial to the monarchs' conservation needs primarily through enhancements of the migratory and nectar resources by removing or reducing unwanted invasive woody vegetation, replanting desired plant species, and by generating a compatible disturbance regime on these land uses.

Temporary adverse effects are possible from all the actions that affect vegetative structure and composition, especially when monarchs are present on the treated area(s). Alternatively, some studies have documented large numbers of eggs and larvae on regenerating milkweed stems as many milkweed species regrow after disturbances from mowing, haying, and burning (Baum and Sharber, 2012; Fischer et al. 2015; Alcock et al. 2016; Haan and Landis 2019; Knight et al. 2019). Taken together, this evidence suggests growing season disturbance could potentially be

used to enhance monarch breeding habitat and help stabilize the population (Hann and Landis 2020). It is, however, unclear if this landscape and population level expression(s) of benefit compensates or effectively nullifies adverse effects if the activities are conducted when the monarch is present. Further, establishing specific associations between these anthropogenic sources of stressors is difficult to parse from factors such as precipitation and longer phase influences such as drought and soil conditions (Hernández et al. 2021; Liang et al. 2018; Souther et al. 2020; Orr et al. 2022).

Restoration and planting actions are also expected to enhance reproductive success of monarchs. Cutting and Tallamy (2015) found that areas planted and designed specifically to cultivate milkweed and nectar producing species of flowers enhanced monarch ovipositing as compared to unmanaged sites (monarchs oviposited at 2.0 and 6.2 times more eggs per plant per observation in the two-year study).

An assessment of managed and unmanaged sites in Nebraska concluded that by choosing a diverse seed mix of native plants with a milkweed component and undertaking conservation-based management practices, a land manager increases the chances of providing monarch breeding habitat (Manzanares et al. 2022). Similarly, a study in Illinois reported that agricultural areas that were not managed for pollinators had fewer milkweeds than natural areas (e.g., grasslands, wetlands, and forests) and that sites planted with low-diversity seed mixes or those frequently mowed or sprayed with herbicides, as well as those that are overgrazed, provide poor monarch habitat (Zaya et al. 2017). In West Texas' arid rangelands, restoration strategies that maximize the first-year survival of milkweed may be the most effective at maintaining plant numbers over time and should be prioritized (Brym et al. 2021).

Lastly, there is data that monarchs can benefit from growing-season disturbance to grassland habitats in their breeding range, with regenerating stems of milkweed host plants supporting more oviposition and lower densities of arthropod predators (Haan and Landis 2020). Milkweed that regrows after disturbance is very attractive to ovipositing monarchs; several studies have documented large numbers of eggs and larvae on regenerating stems (Fischer et al. 2015; Alcock et al. 2016; Haan and Landis 2019; Knight et al. 2019). These stems also contain fewer predatory arthropods for the first several weeks of regeneration (Haan and Landis 2019). Since predation rates on early-stage monarchs are quite high (Prysby 2004; Oberhauser et al. 2015; Myers et al. 2019), the reduction in predators following disturbance could provide them with enemy-free space.

6.2.2 Benefits Associated with Marginal Areas

Even semi-natural areas (e.g., rights-of-way, parks, yards, crop fields) with planted forbs and other flowering plants can provide resources for monarch. For example, incorporating prairie strips into corn and soybean fields can reduce erosion and nutrient loss while increasing biodiversity (Shulte et al. 2017). Modeling suggests that isolated patches of milkweed distributed at low density across the landscape could profoundly increase the number of eggs that a monarch lays during its lifetime (Zalucki and Lammers 2010).

Butterfly biodiversity increases with restoration actions that increase planting diversity for both habitat generalists and specialized species of conservation concern (Farhat et al. 2014). While marginal grasslands associated with agriculture are not equivalent to lands managed specifically for conservation, these areas may still remain valuable to butterfly conservation, which includes the intrinsic value they provide as corridors and stepping stones for migration and dispersal (Farhat et al. 2014; Panzer et al. 2010; Dover and Settele 2009). Small, linear grasslands have conservation value, even beyond their roles as connective corridors (Saarinen 2002; Tscharntke et al. 2002; Davis et al. 2007; Hopwood 2008).

DOD has BMPs in their Strategy to incorporate monarch-friendly planting into hedgerows, orchard understories, pivot corners, crop margins, riparian buffer strips and corridors, or other out-of-production areas, which can have benefits over a relatively small area of land.

6.2.3 Benefits Associated with Forest Management

Forested habitats offer some support to migratory monarchs. Land management actions such as forest thinning, patch-cut, shelterwood cut, gap creation, brush management, and uses of prescribed fire and other methods to manage forest succession, reduce fuel loads, suppress the shrub layers, or target tree selection strategies are all expected to generate benefits to the forb and floristic resources within the range of the monarch and therefore support the monarch resource needs. A summary on forest management activities and expected benefits to pollinators is provided in Hanula et al. (2016). Responses of pollinators that appear to be consistent across forest types are as follows:

- In New York state, results from 30, 60, and 100% overstory tree removal indicated that the greater the forest cover removed, the higher the bee abundance and diversity in the openings (Romey et al. 2007).
- Within the Ponderosa Pine forest of the southwestern U.S., forest thinning and prescribed burning actions nearly doubled native cover and increased native species richness by about 50% relative to untreated controls (Springer et al. 2023). These effects persisted for over a decade after treatment, even under the influence of significant and persistent drought.
- An examination of seven forest types typical of the Piedmont region of the southern U.S. indicated that lower leaf area index (i.e., more light) resulting from lower stand densities (basal area) was associated with greater numbers and species richness of bees (Hanula et al. 2015).
- Higher butterfly species diversity was found in burned forests compared to unburned conifer forests in Oregon and California (Huntzinger 2003). These results were attributed to higher total areas of sunlit patches in burned forests.
- Within southern Appalachian hardwood forests, removal of a native understory shrub through prescribed burning and shrub removal followed by burning resulted in increased butterfly use of the area (Campbell et al. 2007a).
- Wagner et al. (2003) stressed the need for prescribed fire, mechanical cutting, or a combination of both for maintaining the open-canopy shrubland barrens required by rare butterfly and moth species in northeastern U.S. forests.

Operational components of timber harvests within larger forested landscapes also create valuable foraging areas to monarchs and other pollinators, including landing sites. For example, timber harvests created open conditions with high floral abundance which serve as concentrated resource hubs for bees and butterflies (including monarchs specifically identified in this research) (Lee et al. 2021). Further, forest thinning and other timber harvest actions provides increased sunlight penetration and corresponding understory plant diversity, including forbs and nectaring plants. Within the longleaf pine ecosystem in the southeastern U.S., management actions such as prescribed fire, forest thinning, control of mid-story hardwood and/or invasive understory plant species are expected to benefit monarchs and other pollinators by sustaining or facilitating understory conditions conducive to the species (Sheehan and Klepzig 2022). While southern pine forests are not presently considered significant areas for migrating monarchs, efforts to create and sustain open understory conditions will enhance forbs and other floristic resources important to the monarch's migration and nectar resources.

6.2.4 Benefits Associated with Brush Management

In the southern Great Plans, especially Texas, Kansas, Oklahoma, and New Mexico, control of aggressive and invasive species such as mesquite (*Prosopis* spp), eastern red cedar (*Juniperus virginiana*), and buffelgrass (*Pennisetum ciliare*) is crucial to restoring and maintaining areas that were historically open grassland. An estimated 25% of Texas' grasslands have brush encroachment and 16 million acres (6.5 million hectares) are so invaded that it is suppressing the majority of grass/forb production (Brown and Archer 1989) and native plant diversity (Murray et al. 2021). The geographic extent of the affected area overlaps with the monarch migration concentration area in southern Texas. Strategies to decrease brush and woody encroachment including seeding of native species, uses of herbicide, prescribed fire, and high-intensity, short-duration grazing have been all been found to restore diverse, native warm season perennial grasslands and create better habitat for native grassland bird species and pollinators (Murray et al. 2021). Gowdy et al. (2022) documented increases in butterfly species richness and relative abundance – including monarch - over an 8-year grassland restoration effort in southern Texas using prescribed fire, multiple discing and herbicide applications, and native-plant seeding. DOD has been an example of how to maintain open grasslands and combat woody encroachment through prescribed burning and other brush management control techniques. Maintaining these open areas is essential for ensuring military training can continue in these areas and, consequently, simultaneously benefiting monarchs and other pollinator species that rely on open grassland habitat.

6.3 CONSERVATION PROGRAMS

We separate "Conservation Programs" from "Land Management" to aid in organization of this Opinion, though we want to emphasize the land management under the Sikes Act clearly and significantly contributes to the conservation of the species.

In this section, we discuss the effects to monarch of the Proposed Action's non-land management actions, which we are calling "Conservation Programs". These programs contribute substantially to the conservation of monarch and other pollinators through research and funding; strategic

partnerships; and outreach and volunteer efforts. This section discusses the effects of continued implementation of these programs on monarch.

The Strategy describes DOD's efforts to support our collective understanding of monarch's conservation needs, as described in the Conservation Programs section. Research and funding efforts support conservation projects that aim to increase knowledge and data to enhance military readiness by enabling DOD managers to balance habitat protection with training activities and other land uses. These efforts also provide information to help NRMs understand western monarch butterflies and improve efficiency and effectiveness of habitat management on DOD lands. Ongoing research projects contribute to the conservation of the species by increasing the scientific understanding of high priority monarch areas in California and providing monitoring and habitat assessment for monarch on military installations and DOD lands. Efforts also seek to increase monitoring, conservation, and connectivity of DOD lands with other public and private lands via data collection and monitoring, provision of training and educational resources for DOD staff and partners, and technical assistance for habitat management. Ongoing efforts have clear and considerable benefits to monarch populations.

In addition, DOD continues to implement large-scale conservation programs and initiatives that benefit monarchs and a variety of other species and ecosystems. Implementation of the RASP, for example, supports ongoing natural resource management and partnership efforts to address imperiled species, important habitats, invasive species, and other key natural resources, which in turn helps avoid or minimize mission impacts while enhancing species conservation and increasing habitat connectivity.

The REPI program provides direct funding for projects that protect and restore the ecosystems outside of military installation boundaries that monarchs rely on while simultaneously combatting encroachment that could otherwise limit or restrict military training actions. In addition, REPI seeks to prioritize landscape-scale initiatives by participating in the Sentinel Landscape Partnership, a coalition of federal agencies, state and local governments, and non-governmental organizations that work with willing landowners and land managers to advance sustainable land use practices around military installations and ranges. Each of these partnerships prioritizes supporting and funding of large-scale restoration, management, and protection of ecosystems including the promotion of sustainable land uses, wildlife corridors, and research, to name a few. These partnerships promote resilient landscapes that can support their individual, population, and species needs, creating synergy and significant contributions to monarch conservation.

The DOD Legacy Resource Management Program also continues to fund monarch-related research and conservation projects. In 2022 and 2023 alone, this program contributed nearly $10 million in funding to support monarch conservation. Through continued implementation of these funding programs and partnerships, installations continue to work with experts in the field of monarch research and conservation while obtaining technical assistance, site-specific monarch guidance, assistance with INRMP updates, support with monitoring efforts, and implementation of habitat restoration activities.

Monarch research, funded through DOD conservation programs, could include monitoring effort that could have impacts to monarchs via stress or injury to individuals. Handling individuals

(e.g., for mark-recapture studies) and using radio telemetry (e.g., Motus tagging) to study monarch migration could result in injury, reduced fitness, or mortality. For example, the full effects of significant weight transmitters on long-distance travel are not well understood, but attaching a transmitter to a monarch could affect its ability to fly and behavior (Kissling et al. 2014). Fisher et al. (2020) found monarchs with transmitters weighing 31-73% of an individual's body weight exhibited more resting behavior than those without transmitters, but their behavior following environmental stimulus was similar to untagged monarchs. Lighter transmitters are likely to have a lesser effect on individuals. In studies of butterflies and moths with attached transmitter weight equaling up to 15% of their body weight, flight ability was not affected (Srygley and Kingsolver 2000, Liegeois et al. 2016). In a study of bumblebees (Bombus sp.), heavier transmitters (66–100% body weight) resulted in increased resting, fewer flower visitations, and more time spent on a single flower (Hagen et al. 2011). The ability to use radio telemetry contributes to conservation of the species by providing important details about movement and migration that can help with conservation planning. DOD partners with leading scientists and conservation organizations to ensure the benefits of research outweigh the risks related to attaching transmitters or handling. If monarch is listed, researchers must obtain and follow USFWS 10(a)(1)(A) permit conditions, as appropriate.

The Legacy Program also provides support for National Public Lands Day efforts with programs that are specifically geared towards pollinators. Efforts include invasive species removal and adding pollinator gardens with native wildflowers to promote pollinator habitat.

DOD has exceptional capacity to reach the public through social media, promotional videos, and other outreach efforts. They have unique ability to create and maintain influential partnerships that increase their footprint of conservation actions and impacts at large landscape scales. Their funding efforts ensure better understanding of monarch needs so that conservation efforts can be informed by the best science possible. In total, the conservation programs have a significant benefit to monarch.

6.4 SUMMARY OF SCOPE OF BENEFICIAL EFFECTS

Monarch butterflies can be found throughout almost the entire continental U.S. during the breeding season (Jepsen et al. 2015), with most monarch breeding east of the Rocky Mountains appearing to occur in a region stretching from Texas to Ohio (Flockhart et al. 2013).

DOD's ecosystem management approach under the Sikes Act, coupled with policies like the DOD PCRG, a 2014 Presidential Memorandum that led to the National Strategy to Promote the Health of Honey Bees and Other Pollinators and the "Pollinator-Friendly Pesticide Applicator BMPs", and DODI 4150.07 DOD Pest Management Program, together provide for habitat for monarch and other pollinators on a landscape-scale. The Strategy furthers DOD's commitment to conservation of monarch. Implementation of the Strategy will have continuous beneficial effects to monarch populations. The primary benefit comes from the actions that promote vegetation management, including plantings, removing/halting exotic species degradation of native habitats, and establishing and maintaining appropriate disturbance regimes in grasslands, that create and maintain monarch resource needs. Forest management actions conducted by DOD include prescribed fire, thinning, re-planting, brush management, maintaining early successional forest

stand conditions, and general forest health actions such as patch cuts and other techniques that create open canopies or improve understory conditions. Such treatments are expected to produce forest conditions that are beneficial to the monarch by opening forest canopies, and directly or indirectly increasing the availability of native forb and nectar plant sources. We expect benefits to the monarch will be generated through forest management actions which control invasive species and promote early successional forest stand conditions. Although on a relatively smaller scale, similar benefits can occur in rangelands where grazing practices control brush and implement BMPs to maintain a diversity of flowering plants that are resources for monarch and other pollinators.

Managing over a million acres of grasslands, and other suitable areas of habitat for monarch, will have large scale impacts which are important to monarch. Without active management (e.g., mowing, prescribed fire), grasslands can become degraded through increase in woody vegetation or invasive species, resulting in loss of suitable monarch habitat. Further, BMPs ensure the minimization of adverse effects to monarch as a result of implementing management actions and, in some instances, result in increases to habitat quality.

Further, implementation of conservation programs significantly contributes to conservation of monarch and other pollinators through outreach efforts, building strategic partnerships, funding to support monarch conservation, and contributions to knowledge of monarch through research.

6.5 MILITARY MISSION AND SUSTAINMENT ACTIVITIES

In conducting the effects analysis for the Proposed Action, several key assumptions are necessary due to 1) the large geographic scope of the Action Area, 2) acknowledgment that utilization of DOD-managed lands changes over time to meet the evolving military mission needs, and 3) inability to quantify the location, timing, frequency, duration, extent, and intensity of mission and mission sustainment activities at the programmatic level. The key assumptions are as follows:

1. Outside of the critically important monarch overwintering sites, all areas (i.e., fence line to fence line) within DOD-managed lands within the Action Area may be utilized for carrying out mission and mission sustainment activities at any given time. However, it is highly unlikely that conducting the military mission on DOD-managed installations, individually or collectively, in any given year would result in harm to a significant proportion of existing natural resources. Moreover, by maintaining and restoring native ecosystems on installations, the DOD creates the tactical environments necessary for mission readiness by providing realistic training environments. As such, ensuring installations have healthy ecosystems is paramount for effective military testing, training, and operations. Subsequently, it is not beneficial to the DOD to conduct mission and mission sustainment activities that degrade all or significant portions of the native ecosystems in which installations are located.
2. Impacts from many military training activities are temporary, and the most destructive training activities are usually confined to repeatedly used impact areas. Even in these repeatedly used impact areas, vegetative cover remains largely intact. Therefore, it is not guaranteed that areas where military training activities are carried out will result in long-

term negative consequences to monarch habitat or have any impact to existing monarch habitat. In fact, monarch host and nectar plants often thrive in areas that have been disturbed, including areas where military training activities take place.

3. Implementation of the Strategy will ensure that monarch habitat on DOD lands continues to be maintained, enhanced, and/or increased and, in instances where the mission requires permanent loss of habitat, it will be limited.
4. The DOD mission is being conducted in what is considered a managed landscape, the vast majority (approximately 25 million acres or 90%) of which is covered under the Sikes Act, which over the years has been significantly strengthened, and its scope expanded, such that it now represents a comprehensive law mandating the conservation of all aspects of natural resources on military lands. DOD complies not only with this law but numerous other affirmative laws, regulations, and programs in addition to the Strategy to sustain and enhance these managed landscapes.
5. As the utilization of DOD-managed land changes to meet the evolving military mission needs, the extent of effects to monarch and its habitat can also change; these effects will vary across installations and over time.

Decades of implementation demonstrate the compatibility of military mission implementation and conservation (Boice 2006; Rabung and Toman 2022). Installations manage their lands to provide realistic environments for training and testing, as healthy and well-managed natural ecosystems play an essential role in maintaining the readiness of military troops (to ensure access to those realistic environments). While it is important to reemphasize the mission comes first, in practice, DOD has a long and successful history of managing natural resources on its lands to support military mission requirements, while at the same time conserving biodiversity (Stein 2021). In theory, any land could be needed for training at any time, as mission implementation shifts and changes over time. But as has been demonstrated over recent decades, and as directed under the Sikes Act, lands are managed for ecosystem function; as a result, many species and species groups benefit, including pollinators. In fact, DOD has the highest density of species listed as threatened and endangered under the ESA of any federal land management agency. DOD is responsible for managing approximately 550 threatened and endangered species and more than 550 species at-risk of needing listing protections on its installations and ranges. Of those, 54 listed species and 74 at-risk species exist only on DOD lands.

Some of the finest remaining examples of rare wildlife habitats are found on military installations because DOD property is protected from extensive development and habitat loss (Stein et al. 2008). Even mission and mission sustainment activities can provide benefits to species from temporary disturbance (e.g., fire, vegetation removal for line of sight, disturbance from mounted and dismounted maneuvers, among others) and/or rely on early successional habitats. For example, a study conducted at Fort McCoy, Wisconsin, investigated the effects of disturbance by military maneuver training on the density of wild lupine and Karner blue butterfly, and suggested that maintenance of lupine habitat can be achieved in tandem with military training (Smith et al. 2002). Specifically, Smith et al. (2002) found that both the abundance of lupine and nectar resources was greater in areas where military vehicles had traveled than where they had not. Additionally, they found the proportion of lupine stems with Karner blue butterfly larvae feeding sign was greater in areas where military vehicles had

traveled versus areas where they had not. Lastly, their findings demonstrated that the proportion of lupine stem density was also positively correlated to the occurrence of prior bivouacs and fires caused by military munitions. Similarly, the Fort Indiantown Gap National Guard Training Center in Pennsylvannia, is home to one of the last remaining populations of eastern regal fritillary (*Argynnis* [*Speyeria*] *idalia idalia*) butterflies. Research conducted on Fort Indiantown Gap indicated that training activities involving mounted and dismounted maneuvers likely led to frequent disturbances that favored early successional grassland that may have contributed to the species stability on the installation (Zografou et al. 2017). Another study investigating the role of disturbance in habitat restoration and management for the eastern regal fritillary found that mounted maneuver training activities maintained populations of the species larval host plant (*Viola* spp.) more effectively than combinations of light soil scarification, mowing, and removal of mowed biomass (Latham et al. 2007). Like the aforementioned Lepidoptera examples, and mentioned previously specific to land management for monarch, there are clear benefits to monarch in regeneration of milkweed and nectar resources post-management and restoration. It is also worth noting that recent research identifying migratory habitats essential to western monarchs found that despite the U.S. federal government managing 53% of the land in the western U.S., nearly 85% of spring and more than 70% of fall migratory habitat is located on privately managed lands (McIntyre et al. 2024).

DOD's request for voluntary conference included high-level details about military training and operations to help us assess effects to monarch as a result of those activities. Table 5 includes the high-level military training and operations actions and corresponding stressors under consideration. Some of the effects of military mission and sustainment actions are discussed above (see 6.1 Land Management).

Table 5. High level activity and corresponding subcomponents/stressors for military mission and sustainment

Mission and Mission Sustainment Activities	**Noise and Vibration**	**Light**	**Smoke, Fog Oil, and Obscurants**	**Introduction of Invasive Species**	**Introduction of Pollutants**	**Soil and/or Ground Disturbance**	**Change in Vegetation Composition and/or Structure**	**Wildfire**	**Rotor Wash**	**Collisions/Strikes/Crushing**
Ground-based Training										
Mounted Maneuver Training	X	X		X	X	X	X	X	X	X
Dismounted Maneuver Training	X			X	X	X	X			X
Live-Fire Training	X		X				X	X	X	X
Bivouacking and Assembly	X	X				X	X			X
Communications	X									
Digging				X	X	X	X			X
Aviation Training										
Fixed Wing	X			X	X		X		X	X
Helicopter	X			X	X		X		X	X
Unmanned Aerial System (UAS)/ Unmanned Aerial Vehicle (UAV)	X			X	X		X		X	X
Pickup Zone, Landing Zone, and Drop Zones	X			X	X	X	X		X	X
Impact Areas										
Dudded	X		X			X	X	X		X
Non-Dudded	X		X			X	X	X		X
Construction and Maintenance	X	X		X	X	X	X			X

Because the full details on the extent, timing, and duration of these actions are not known at the programmatic level, details on these impacts will be provided during INRMP review. For the jeopardy analysis in this Opinion, we consider extent of training based on our understanding of current and recent history of military mission and operations implementation. This extent can and will change over time for individual installations and varies widely among installations. We are not providing a limit or ceiling. Rather, we are basing our jeopardy analysis on the current proposed action and current level of extent of military mission. Because decades of implementation have occurred and been compatible with creation of grassland habitats suitable for monarch, we expect monarch habitat to continue to be available across the Action Area at relatively consistent levels. If this changes to the extent that our analysis is no longer valid, reinitiation of this voluntary conference may be requested. NRMs will have detailed site- and activity- specific details on the effects of mission and mission sustainment activities for a given installation and will confirm their non-jeopardy conclusion for all operations at the INRMP stage (see Appendix A).

6.5.1 Effects of Military Operations

Implementation of military mission may result in adverse effects to monarch through some of the same stressors described above, such as ground disturbance/habitat loss, noise, and vehicle mortality. This section describes stressors that occur as a result of military operations, including vibration and noise; lighting; smoke; fog oil and obscurants; introduction of invasive species; introduction of pollutants; soil and/or ground disturbance; changes in vegetation composition and/or structure; wildfire; rotor wash; and collisions/strikes/crushing.

6.5.1.1 Vibration and Noise

Military mission can cause noise through various activities including ground-based and aviation training, detonations and live-fire, and noise generated during rocket launches. This type of noise is temporary (lasting the duration of the training activities). The noise generated during rocket launches or re-entry, for example, creates noise lasting up to several minutes and a sonic boom lasting less than a second, similar to thunder (Department of Defense 2021). The amplitude of the launch noise is dependent on the thrust of the vehicle and the proximity of the receptor (monarchs) to the launch site (Department of Defense 2021). Close to the launch site (within half a mile), the noise generated by a launch vehicle could cause changes in hearing sensitivity and could provoke strong behavioral reactions in some species of wildlife (Department of Defense 2021). Effects to monarchs depend on the life stage present and proximity to the source of the noise.

Nymphalidae, the group that monarchs belong to, have been shown to detect sounds, particularly at low frequencies (Mikhail et al. 2018). While recent research indicates monarch larvae can hear and exhibited responses to sounds (Taylor and Yack 2019), adult monarchs do not have any known auditory sensory structures and are thought to be unable to hear. Because adult monarch butterflies apparently cannot hear, the effects of noise is not likely to adversely affect monarchs at this life history stage. In contrast, Taylor and Yack (2019) found that fourth and fifth instar larvae responded to sounds by freezing, contracting, and flicking their thorax. These behavioral responses were measured following a playback of 200 Hz to increasing sound levels (72, 75, 78,

81, 84, 87, 89, 92 dB SPL). For context, 45 dB would be equivalent to a quiet library while 75 dB would be like standing next to a busy freeway. Additionally, when presented with a consistent 200 Hz sound, larvae appeared to become habituated and no longer exhibited a response to the sound. This study is consistent with others that have found that monarch larvae responded to the presence of passing aircraft (Rothschild and Bergström 1997) and traffic noise (Davis et al. 2018). It is suspected that hearing in monarch larvae serves as a defensive reaction against aerial insect predators and parasitoids (Taylor and Yack 2019). The ability for monarch larvae to become habituated to sound after repeated exposure suggests that larvae exposed to anthropogenic noise may be at a greater risk of parasitism (Taylor and Yack 2019). The effects of noise on monarch larvae from mission and mission sustainment activities are expected to be minimal because noise disturbance will be temporary and the likelihood that it will intersect with the larvae stage is expected to be low.

Another type of "noise" that may affect monarch is anthropogenic electromagnetic noise. The increasing use of electromagnetic fields for communication technologies may have subtle effects to insects (reviewed in Thill et al. 2023 and Balmori 2021). Examples of anthropogenic sources of high frequency electromagnetic fields include radar and 5G, used for communication. Monarchs use an internal magnetic compass for navigation, and anthropogenic electromagnetic fields could alter their ability to orient themselves under certain conditions. The extent to which electromagnetic noise could affect monarch migration or other behaviors is not well understood.

6.5.1.2 Lighting

Artificial lighting at night can influence monarch biological cues. Artificial lighting at night may arise from a variety of sources, including streetlights, buildings, and temporary activities (e.g., construction), and include short-term pulses (e.g., from passing vehicle headlights) or persistent night-long emissions (e.g., streetlights) (Gaston et al. 2017). There is no anticipated effect of artificial lighting at night on milkweed or other nectar resources (Haynes et al. 2023). Monarch larvae, however, increased feeding frequency when exposed to artificial light at night. Despite this effect on feeding frequency, there were no significant effects on speed of development (i.e., the time it took to go from second instar to pupation), or pupal mass (Haynes et al. 2023). Effects appear to be life-stage specific. Negative effects as a result of artificial lighting have been reported in adult monarchs due to changes to circadian-clock mediated migratory behaviors (Parlin et al. 2022).

6.5.1.3 Smoke, Fog Oil, and Other Obscurants

A variety of smokes and obscurants are used in military training and operations (e.g., for screening, signaling, etc.) (National Academy Press 1997). Smokes are produced by burning or vaporizing various products (e.g., diesel, hexachloroethane), and obscurants are particles suspended in the air that block or weaken transmission of parts of the electromagnetic spectrum (e.g., infrared radiation or microwaves). Fog, dust, and mist are examples of obscurants that may be used in training. Fog oil is a type of oil smoke generated by heating severely refined mineral oil.

6.5.1.3.1 Smoke

Research of painted lady butterflies (*Vanessa cardui*) examined the impacts of smoke on flight behavior (Liu et al. 2021). Fine particulate matter in the air (a component of smoke) had a strong negative correlation with flight speed (i.e., as particulate matter increased, there as a linear decrease in flight speeds); however, at very high levels of particulate matter (above ~3.4 mg m^{-3}), painted lady butterflies increased speed possibly to escape the polluted conditions. The longer the exposure, the more obviously their flight behaviors were impacted (in terms of speed, duration, and distance). These effects could be more consequential during migration. It is possible that decreased flight behavior could be caused by closure of the insect spiracle valves (Liu et al. 2021). Sweat bees (Halictidae spp.) exposed to a polluted environment demonstrated reduced flight activity compared to those exposed to clean air (Tan et al. 2018). Poor air quality could cause insects to close their spiracle valves longer, decrease oxygen intake, and reduce metabolism (Tan et al. 2018). Toxic compounds found in haze smoke (from fire) may also negatively influence butterfly flight performance by affecting insects' body functions. Cecropia moths (*Hyalophora cecropia*) are sensitive to changes in concentrations of carbon dioxide and oxygen levels, resulting in spiracle closures (Burkett and Schneiderman 1974).

There are several types of chemical smoke used in military training, for example hexachloroethane/terephthalic acid smoke (HC/TA). HC/TA smoke mixtures may differ in composition depending on manufacturer and use; some are generated with zinc oxide and others with titanium dioxide, and toxicity varies depending on the mixture (with zinc-containing products having greater toxicity than titanium-containing mixtures (National Academy Press 1997). Once applied and smoke has formed, 5% or less of the HC remains in the air (von Stackleberg et al. 2004). Much of the toxicology research focuses on effects to mammals. We were unable to find literature on the effects of HC/TA mixtures on Lepidoptera, but HC does not appear to accumulate in terrestrial food webs (von Stackleberg et al. 2004). There are effects to aquatic invertebrates (*Daphnia*) primarily due to zinc toxicity (Fisher et al. 1990), but it is unclear whether similar effects would be seen in Lepidoptera.

Similarly, little information was found on the effects of CS (tear gas) on Lepidoptera. CS has been shown to cause contact damage to terrestrial plants but did not cause appreciable damage at typical field concentrations (Keller et al. 1986).

6.5.1.3.2 Fog Oil and Other Obscurants

To evaluate the effects of fog oil on prey species, Driver et al. 2007 performed a series of screening tests exposing five species from different orders (a moth, roach, mosquito, ant and beetle) to a wind tunnel that replicated fog oil exposure in various simulated field conditions. Adults and larvae were exposed to simulated worst-case scenario (i.e., fixed location, 4-hour exposure duration at twice the field levels near the fog oil generator, and canopy density and wind speeds that would be worst case for the species) and another exposure with near-source (high) concentrations. No adverse effects from exposure to high concentrations of aerosolized fog oil were observed in either the larval or adult forms of the wood roach and beetle. Adult geometrid moths (Geometridae) were also unaffected by fog oil exposure at near-source concentrations. At twice the highest near-source concentration (916 mg/m3), however, activity,

flight, and response to touch stimuli were greatly reduced (this was for the "worst case" exposure scenario, which may be unrealistic in real field conditions in terms of exposure duration and concentration) (Driver et al. 2007). Getz et al. (1995), for example, indicates most smoke training exercises last 30 to 90 minutes – as opposed to the 4-hour exposure of the Driver et al. 2007 study. We were unable to find other studies evaluating the effects of fog oil on Lepidoptera. In terms of environmental fate, Getz et al. (1995) found that smoke dissipates within a few minutes under usual atmospheric conditions. Most of the fog oil evaporates rather than deposits onto the surface of plants, and any that does deposit on plants rapidly evaporates. Additional research is needed to fully understand the potential effects to monarch from exposure to fog oil.

Obscurants such as dust and mist are likely to have minimal impacts to monarch. For all types of smoke and obscurants, the effects would be localized and likely temporary, although the environmental fate of each varies depending on its chemical composition.

6.5.1.4 Introduction of Invasive Species

The movement of equipment, supplies, and people can unintentionally spread invasive plant seeds (transported by equipment or the soles of boots) or other invasive species (e.g., zebra mussels in ballast water). When areas are disturbed during training, it can increase the spread of invasive plants that could out-compete native nectar and host plant resources. Through restoration following training, NRMs use methods described previously to control invasive species.

As discussed previously, invasive milkweed can increase spread of disease in monarch. Through the DOD PCRG and the Strategy, NRMs work to eliminate invasive plants and nonnative tropical milkweed. Refer to Vegetative Management and Benefits Associated with Vegetative Management above.

6.5.1.5 Introduction of Pollutants

Use of vehicles and training procedures can result in the introduction of pollutants to the environment. For example, fuel spills or oil leaks could result in exposure of these chemicals to monarch at any life stage as well as the host plants and nectar resources they rely on. Potential impacts of spills include degradation of soils and vegetation, exposure of monarchs to chemicals or compounds that kill them directly, decreased survival, or reduced reproduction. Alteration of soils can also increase the likelihood of the establishment of invasive species. Policies and protocols are in place to avoid spills, and training is provided to ensure proper response in the event a spill happens. Spills have different regulatory definitions and requirements depending on the type and quantity of the chemical involved. Each installation has a local response protocol they must follow to ensure proper clean up and reporting. Many types of hazardous materials may be used, and it is beyond the scope of this Opinion to review all potential substances that could be used on installations across the nation.

6.5.1.6 Soil and/or Ground Disturbance

Many types of mission and sustainment actions could cause soil and/or ground disturbance including ground training; pick up, landing and drop zones; impact areas; and construction and maintenance. If monarch were present during the ground disturbance, eggs, caterpillars or pupae

could be crushed/trampled by vehicles or equipment. Ground disturbance could also result in the loss of vegetation of the impacted area, which could include milkweed or nectar resources. This would reduce available food resources for monarch caterpillars, thus resulting in lower numbers of successfully eclosing adults by reducing oviposition opportunities and caterpillar fitness (Pleasants and Oberhauser 2013). See also the effects described above in 6.1.5 Ground Disturbance and Habitat Loss.

6.5.1.6.1 Permanent hardscaping

Permanent hardscaping may be necessary for mission and sustainment through creation of infrastructure to support troops and training activities. Permanent hardscaping includes, but is not limited to the use of tarmac, asphalt, concrete, gravel, bricks, paving stones, and compacted soils to replace native or existing surfaces.

Permanent hardscaping can injure and kill caterpillars by direct contact with heavy machinery, paving substrate, staged materials, and associated preparatory measures. This will result in direct mortality to any caterpillars within the project footprint. Permanent hardscaping will result in the loss of vegetation within the impacted area, which could include milkweed or other nectaring resources. This would reduce available food resources for both adult monarchs and caterpillars, thus resulting in lower numbers of successfully eclosing adults by reducing oviposition opportunities and caterpillar fitness (Pleasants and Oberhauser 2013).

Changes from natural or other existing surfaces to permanent hardscaping will impact local hydrology that could result in changes to existing vegetation, runoff, and waterways. Hydrological impacts that change vegetation could impact milkweed availability, density, and vigor in adjacent areas, which would impact caterpillars by reducing the foodplant. Changes to runoff patterns may increase the amount of toxins associated with the purpose of the hardscaping (e.g., petroleum products used in machinery), which could result in lethal or sublethal toxicity to caterpillars that consume plants absorbing these toxins (Najar-Rodríguez et al. 2008). Waterway changes may impact caterpillars by changing the vegetation community such that it no longer supports milkweed or creates local flooding that would drown caterpillars.

Permanent hardscaping eliminates or severely inhibits vegetation growth within and in areas surrounding the footprint of the hardscaped area, including milkweed and nectar resources. Any milkweed within the project footprint will be eliminated by the hardscaping. Defects in the hardscaping may allow for milkweeds to germinate, however, it is unlikely that these plants would provide sufficiently dense or healthy populations of milkweed to allow for recruitment of migratory adults into the population. Runoff and hydrological impacts associated with reduced permeability could impact milkweed outside the hardscaped area by increasing toxins and altering seasonal water regimes, thus reducing nectar plant and milkweed expanse, density, and vigor (Hall et al. 2022; Najar-Rodríguez et al. 2008). As described previously, access to nectar resources may be especially important during the migratory phase. Analysis of monarch occurrence records in the eastern U.S. found that the threats driving the decline in abundance occurred during the migratory phase, which could be a result of a decrease in nectar plant availability (Inamine et al. 2016). Finally, removal of vegetation could affect adult predator avoidance by removing vegetation that could provide shelter from predators.

In instances where hardscaping eliminates vegetation cover or results in darkening of the existing surface (e.g., tarmac, asphalt), higher local temperatures could occur, which could affect larval

development such that physiological processes are interrupted or shifted to non-optimal conditions (York and Oberhauser 2002; Zalucki 1982).

An overarching conservation measure for the Strategy indicates permanent loss of monarch habitat will be limited (i.e., "• DOD will continue to maintain, enhance, and/or increase monarch habitat and will limit habitat loss in instances where the mission requires permanent loss of habitat" [emphasis added]).

6.5.1.7 Changes in Vegetation Composition and/or Structure

Training and operations may require vegetation removal or management to a desired composition or structure (e.g., for line of sight, cover). The effects of changes in vegetation composition and/or structure are described above in 6.1.2.3 Actions which Temporarily Affect Vegetation Structure and Composition.

6.5.1.8 Wildfire

Long-term fire suppression across the country has led to fuel buildup on and near installations, and climate change may result in weather conditions conducive to wildfire. Wildfire ignitions primarily come from civilian activities, lightning, and military operations (Beavers et al. 2017). Some types of military training (i.e., live-fire, impact areas) increase the risk of wildfire under certain conditions. Installations consider wildfire risk to protect infrastructure and reduce risks to their mission. Many installations, through their Sikes Act authorities, conduct management to reduce risks of wildfire, including vegetation management and prescribed fire. Military installations conduct risk assessments and evaluate the risks of wildfire in an effort to reduce risks to their installations and neighboring lands. Under REPI, for example, installations prepare for increased wildfires to increase installation resilience. Wildfires are generally much hotter than prescribed fires due to uncontrolled fuel buildup and weather conditions and have the potential to impact a much greater footprint. The effects to monarchs at all life stages from wildfires and wildfire suppression are expected to be similar to those described above in 6.1.2.3.2 Prescribed Fire but more severe. The extensive amount of prescribed burning (i.e, simulating historical fire regimes) that occurs on installations significantly decreases the potential of severe impacts caused by catastrophic wildfires to monarchs.

Reducing fuel load through prescribed fire or creating fire breaks could affect monarch; refer to 6.1.2 Vegetation Management and 6.1.5 Ground Disturbance for additional discussion.

Wildfire in overwintering areas could be significantly harmful to the western population of monarch. DOD's BMPs for overwintering areas include fuel reduction to reduce the risk of wildfire: reduce fuel loads and minimize risk of catastrophic wildfire within overwintering habitat through selective thinning of small diameter trees in the support zone and the shelter zone.

6.5.1.9 Rotor Wash

Rotor wash is the vertical displacement of air from a helicopter rotor. The rotor wash effect occurs out to a distance approximately three times the rotor diameter (DOI 1998). For example, a Chinook-47D has a rotor diameter of 60 feet, therefore, the rotor wash effect may occur in a

radius of 180 feet from the helicopter when landing, taking off, or hovering close to the ground. As rotor wash nears the surface, it spreads laterally as sidewash along the ground (Slijepcevic and Fogarty 1998). Rotor wash can cause saplings, decaying trees, and loose debris from treetops to fall and can create hazardous conditions from dust and flying debris under the helicopter (WCB 2005). The intensity of rotor wash is influenced by the helicopter's height above ground, forward speed, mass, and rotor span (Slijepcevic and Fogarty 1998). For example, a Bell 205A helicopter that is hovering 50 feet above ground level generates rotor wash wind speeds of approximately 60 mph at the surface. The same helicopter hovering at 100 feet above the ground would generate a rotor wash of approximately 35 mph at the ground level (Slijepcevic and Fogarty 1998). Large helicopters, such as the Chinook-47D, can generate rotor wash in excess of 120 mph directly below the helicopter (www.globalsecurity.org, 2010). Rotor wash can affect monarch both indirectly (plants and habitat) and directly (eggs, larvae, pupae, and adults).

Rotor wash can affect the vegetation in monarch habitat, and subsequently fitness of individual monarchs, by bludgeoning vegetation, particularly milkweed and nectar resources with wind speeds of up to 120 mph. Based on the continued existence of open habitats such as grasslands on military installations where helicopters land and hover frequently, it is unlikely that this activity completely removes the vegetation. However, there is no information to determine whether rotor wash removes flower heads or damages stems to nectar resources and monarch host plants. Without further information to analyze this potential effect, it is impossible to determine whether this activity has a significant effect on the vegetative community. Similarly, analyzing the effects of rotor wash on eggs, larvae, and pupa is difficult because of their inconspicuous nature. However, there is peer-reviewed published research attesting to the incredible strength of insects to hold on to even smooth surfaces (e.g., Federle and Endlein 2004; Van Griethuijsen and Trimmer 2014). Rotor wash may displace adult monarch butterflies, force them to land, or cause injury and/or mortality by thrusting them into objects. Due to their small size and large footprint of the Action Area it is not feasible to estimate the number of adult monarchs that could be injured or killed by rotor wash.

6.5.1.10 Collisions/Strikes/Crushing

Various military training operations could result in collisions or strikes of adult butterflies, including use of vehicles on the ground or in the air. Early life stages could be crushed through activities including ground training, impact areas, and construction and maintenance activities as described above in 6.5.1.6 Soil and/or Ground Disturbance. For adults, the risks associated with monarch collision with vehicles is described above in 6.1.1. Human-induced, Unintentional Disturbance – Including Noise and Vehicle Mortality and 6.5.1.9 Rotor Wash.

6.5.1.11 Digging

Digging is a stressor that can occur during many different mission and mission sustainment activities, including defensive fighting positions (foxholes), containment clean-up response, utility line placement, etc. All digging requires dig permits, which are reviewed for activities in areas where they may affect threatened and endangered species. Additionally, it is generally standard operating procedure to repair and revegetate areas that are dug up with native plants. Digging has the potential to affect monarchs both directly by killing or injuring eggs, larvae, and

pupa and indirectly by unearthing and killing or injuring nectar resources and host plants that could have been used by monarchs during various life history stages.

6.5.2 Summary of Effects from Military Mission and Sustainment Activities

Consistent with their authorities under the Sikes Act, implementation of the Strategy (including all conservation measures and BMPs) cannot result in a loss of the capability of military installation lands to support the mission of the installation. An overarching conservation measure of the Strategy is to continue to maintain, enhance, and/or increase monarch habitat and will limit habitat loss in instances where the mission requires permanent loss of habitat [emphasis added]. Training can result in the loss of habitat or direct interaction (e.g., crushing, collision), depending on the activity, but training often occurs in regularly utilized areas. When habitat loss happens in other areas, it is DOD procedure to repair and restore the land following its use. Further, these impacts are limited in terms of size compared with the extensive habitat that remains intact. Disturbance and restoration can result in creation and maintenance of habitat for many species, including monarch. Decades of implementation demonstrate the compatibility of military mission implementation and conservation.

6.6 IMPORTANCE OF ADAPTIVE MANAGEMENT

The Strategy includes principles of adaptive management to ensure it meets its goal to continue to conserve the monarch butterfly on DOD lands, while ensuring no net loss in the capabilities of the military missions and sustainment actions, through current and ongoing ecosystem management on a large scale, funding research, conducting outreach, and developing strategic partnerships.

From the DOD Strategy:

> (From the Strategy's Timeline and Revision section)
>
> Future and ongoing research will continue to modify the understanding of the needs of monarchs at the individual, population, and species levels as well as how these populations interact (i.e., genetics) and the factors that can influence monarchs during breeding, migration, and overwintering. It is imperative that new information and data is incorporated into this Strategy so DOD can adjust activities and, if needed, locations of emphasis to ensure that DOD conservation efforts maximize outcomes for monarch.
>
> To ensure this happens, DOD will regularly reevaluate this Strategy to ensure it continues to meet the standards of 7(a)(1). DOD will revise the guidelines in this Strategy, as necessary, to be consistent with the final listing rule of the monarch butterfly, future Recovery Plans, or incorporation of the latest and best scientific data available. This Strategy will cover a period of 25 years but will be reviewed every five years, per the adaptive management process (Section IX) for applicability and continued alignment between DOD and USFWS on its content. During the review to determine whether updates are needed under 7(a)(1), if there is significant new information, DOD and the USFWS will also consider whether to reinitiate conference/consultation under 7(a)(2).

(From the Strategy's Adaptive Management Section)

The agencies will employ adaptive management principles, including monitoring and evaluation of appropriate information to accomplish the following objectives:

- Monitor and evaluate the conservation results of the Strategy and its implementation
- Adapt the implementing strategies as necessary to accomplish identified conservation outcomes in light of:
  - Military mission conflicts with Strategy implementation,
  - Changes in military mission needs, and
  - Changes to information regarding monarch population or species needs or threats
- If the regulatory status of monarch at the installation changes due to either an improvement or decline in species condition (which may be as a result of species condition changes on or off installation), adaptive management will be used to support adaptation of the Strategy as appropriate when the Strategy is reviewed every five years.

Adaptive management is crucial for this successful implementation of this long-term (25 years) Strategy because it allows for continuous learning and provides flexibility in response to changing environmental conditions and new scientific understanding. Given the complexities and uncertainties related to a wide-ranging migratory species, conservation strategies will need to adjust over time. Adaptive management involves monitoring the effectiveness of the Strategy's implementation, assessing outcomes, and adjusting actions based on new information on priority needs of the species. This iterative process helps ensure that conservation efforts remain relevant and effective, optimize resources, and increase the likelihood of successful conservation of the species in the long-term. By accommodating change and uncertainty, the Strategy can adapt as we learn more.

DOD is on the leading edge on conservation efforts for monarch by implementing decades of conservation efforts and developing and implementing their 7(a)(1) Strategy before the species is listed under ESA. The USFWS is developing resources for monarch as a candidate species, but many are still under development at the time of this Opinion's writing. As new information becomes available, we will work collaboratively with DOD to ensure we consider the new information and adjust as needed.

6.7 MONITORING AND REPORTING

The Strategy includes monitoring and reporting. Monitoring efforts targeted at assessing occupancy by monarchs or specific habitat information (e.g., milkweed surveys, nectaring plant surveys) will continue on installations where existing monarch conservation efforts or monitoring is currently taking place subject to availability of funds and as practicable. Monitoring and reporting on DOD installations for the purposes of gauging Strategy effectiveness will focus on 1) high level geospatial monitoring of grasslands across DOD installations in each MCU, 2) qualifying when and where management of potential habitat or implementation of BMPs is occurring, and 3) assessing status and trends of monarch butterflies

and/or their habitat in high priority areas (i.e., overwintering habitat and the Central Valley). The information collected from these efforts, along with new any new data and information about monarchs or their habitat needs, will be gathered and used during the Strategy review that will take place every five years during the 25-year duration of the Strategy.

6.7.1 Geospatial Monitoring of Grasslands

Prior to the five-year review, DOD will analyze remotely sensed geospatial data to assess changes in grassland to other landcover types within DOD installation boundaries in each MCU.

6.7.2 Monitoring of Monarch, Monarch Habitat, or other Pollinator Projects

Participation in the Strategy and high-level metrics about grasslands will be reported annually by the Military Services to the Office of the Secretary of Defense through Environmental Management Review data calls. Installation-specific monarch projects and implementation of BMPs will be shared via the INRMP Stage Consistency Check form (Appendix A) that will be shared by installation NRMs and USFWS during existing INRMP review meetings that already occur at least every five years.

6.7.3 Monitoring of High Priority Sites

Within the western MCUs, overwintering sites along the southern California coast serve as a critical area for maintaining the monarch population (USFWS 2020). The Central Valley is also important to the health of the western monarch population because it is limited in size compared to other areas and serves as a critical location for the first generation of monarchs each spring. In addition, a large proportion of the monarch habitat has been lost in the region (Pelton et al 2019; USFWS 2020). The installations that occur within these high priority areas in the west will be the priority of monitoring for monarch and their habitats. Installations in these areas will conduct both habitat and monarch surveys each year as practicable and subject to the availability of funds.

Breeding and Migratory

Installations within the Central Valley in the west, and conducting surveys for monarch or monarch habitat, will focus on collecting habitat metrics within general land types that have been identified by Monarch Conservation Science Partnership and the Integrated Monarch Monitoring Program (IMMP) as potential habitat for monarchs (unclassified grassland, rights-of-way, developed areas) and, when necessary, outside of these land types to monitor changes in vegetation from conservation efforts (Thogmartin et al. 2017; Cariveau et al. 2019). If not already involved, these installations will implement an IMMP monitoring program that was begun through MJV (see Strategy's Section VII(A)(7)) and will conduct sampling and reporting for a variety of metrics including:

- Milkweed density and diversity
- Flowering plant abundance and richness
- Monarch egg and larval densities
- Milkweed species preferences
- Adult monarch presence/absence
- Adult nectaring preferences

- Impact of conservation actions on habitat quality

Overwintering

Installations with either confirmed or suspected groves of overwintering monarchs who choose to survey will follow the survey methods and protocols outlined in the Xerces Society's WMC and Monarch Overwintering Habitat Assessment (https://westernmonarchcount.org/downloads/). Adherence to the recommended protocols outlined in the Strategy will help facilitate data collection and reporting and ensure consistency among results within and among sites and across years.

7 CUMULATIVE EFFECTS

Cumulative effects are those effects of future State or private activities, not involving federal activities, that are reasonably certain to occur within the Action Area of the federal action subject to conference. [50 CFR 402.02 "Cumulative effects"]

The USFWS is not aware of any future State, tribal, local, or private actions that are reasonably certain to occur within the action area at this time; therefore, no cumulative effects are anticipated. Future federal actions, unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. Because all lands within the action area are administered by the Department of Defense, no cumulative effects are expected to occur.

8 INTEGRATION AND SYNTHESIS FOR THE MONARCH BUTTERFLY

The Integration and Synthesis section is the final step in assessing the risk posed to species and critical habitat because of implementing the Proposed Action. In this section, we add the effects of the action and the cumulative effects to the status of the species and critical habitat, and the environmental baseline, to formulate our opinion as to whether the Proposed Action is likely to: 1) appreciably reduce the likelihood of both survival and recovery of the species in the wild by reducing its numbers, reproduction, or distribution; or 2) result in the destruction or adverse modification of critical habitat. As monarch is a candidate for listing, there is no critical habitat to consider.

8.1.1 Status of the Species

The monarch butterfly in North America is generally in decline, with a particularly severe decline in the western U.S. Loss of breeding habitat (milkweed) from conversion of natural habitat into agricultural lands, loss of landscape wide nectar resources, loss of overwintering habitat in Mexico, exposure to pesticides, and climate change have led to declines of monarch numbers since detailed records began being kept in the mid-1990s. The recent SSA from the USFWS estimated a probability of extinction of 48 to 69 percent for migratory monarchs in eastern North America over the next 60 years, under current conditions (USFWS 2020). Low

abundance of monarchs along with important and unpredictable variations in abundance in eastern North America increase the risk of quasi-extinction (Thogmartin 2024). For monarchs in the west, modeled probability of extinction was 60 to 68 percent within the next 10 years, and 99 percent over the next 60 years under current conditions. See Status of the Species section for further details on Status.

8.1.2 Baseline

Baseline numbers of monarchs vary widely across the Action Area, as do estimates of milkweed stems across the Action Area. Baseline estimates using habitat as a surrogate estimate approximately 1,800,000 acres of potential monarch habitat (grasslands) within the Action Area.

8.1.3 Action Effects

Adverse effects from land management activities would be to individuals in the form of mortality through loss of eggs, larvae, and pupae, as well as displacement, disturbance, and mortality of adults. These effects would occur where activities described above take place during the time of year when monarchs are present. Land management efforts ensure monarch resources (e.g., milkweed, nectar plants) are available across DOD lands and protect overwintering habitat within the Action Area. With implementation of the BMPs in the Strategy and continued implementation of existing DOD policies (e.g., related to limited use of pesticides), effects to monarch at the population level are expected to be beneficial overall and contribute to conservation of the species through creation and maintenance of suitable breeding, migration, and overwintering habitat across the continental U.S. range of the species. Long-term adverse population-level impacts are not anticipated from activities undertaken to establish, maintain, and manage grassland and other habitats occupied by monarch on DOD lands. Based on DOD's commitment to the Strategy and its goals, we anticipate maintaining or increasing the extent and quality of available habitat for monarch on DOD lands through the 25-year duration of the Strategy. DOD's extensive conservation programs provide additional lift to the conservation of monarch across the U.S. (both on installations and off-installations) through funding, outreach efforts, and strategic partnerships, in addition to the benefits from land management activities under the Sikes Act.

Military mission and sustainment activities (training and operations) were considered as part of this Opinion. The nature and extent of these activities vary widely across installations, within installation boundaries over time, and based on the mission requirements, which change as military preparedness requirements change. Loss of monarch habitat will be limited to when necessary for mission fulfillment. When monarch habitat loss is necessary to fulfill mission requirements, it is DOD procedure to repair and restore the land following its use, when possible. The extent of these impacts is limited in terms of size when compared with the extensive habitat that remains undisturbed by military training across the DOD land base, and restoration of monarch habitat following use will ensure loss of habitat is likely short term. When considered in the context of the last decades of implementation of the military mission across the Action Area, the extent of military mission training and operations activities are small when compared to the totality of lands owned by DOD, ensuring vast areas of suitable grasslands exist spatially and temporally across the Action Area. For the duration of the 25-year Strategy, we anticipate the

extent of training and nature of activities to be consistent with past efforts and our analysis in this Opinion. The future of national defense and efforts necessary for military training and testing, however, are never certain and could change at any time; reinitiation of conference/consultation will follow 50 CFR 402.16 (required if monarch is listed).

8.1.4 Cumulative Effects

We did not anticipate any cumulative effects because all lands within the Action Area are administered by DOD and subject to future section 7 consultation should monarch be listed.

8.2 CONCLUSION

After reviewing the current status of the monarch, the environmental baseline for the Action Area, the effects of the Proposed Action and the cumulative effects, it is the USFWS's opinion that the action, as proposed, is ***not likely to jeopardize the continued existence*** of the monarch. We base our conclusion on the following:

- Monarch is currently a candidate species. Based on the past annual censuses, the eastern migratory population has been generally declining over the last 29 years. Similarly, the western migratory population has also been generally declining over the same number of years, despite an increasing number of sites being surveyed.
- Baseline numbers of monarchs vary widely across the Action Area, as do estimates of milkweed stems across the Action Area. Baseline estimates using habitat as a surrogate estimate approximately 1,800,000 acres of potential monarch habitat (grasslands) within the Action Area.
- We did not anticipate any cumulative effects because all lands within the Action Area are administered by DOD and subject to future section 7 consultation should monarch be listed.
- DOD committed to maintaining, enhancing, or increasing the extent and quality of available habitat for monarch through the 25-year duration of the Strategy, contingent upon appropriations and when consistent with their mission.
- Short-term impacts to monarch as a result of natural resource management efforts are expected to be minimal due to implementation of BMPs that minimize potential adverse effects and often lead to improved habitat quality over time:
    - Adhering to timing windows for management activities to avoid when monarchs are likely present.
    - Control extent of the management actions that will negatively impact monarch when present to allow for areas of refugia.
    - Reduce or eliminate use of pesticides in areas with monarch.
    - Increase, by planting or land management activities, native milkweed in breeding areas and nectar plans when monarchs are present to provide needed resources.
    - Extensive monitoring, protection, and management efforts within overwintering and Central Valley areas of California.
- Long-term benefits are expected through maintaining and enhancing monarch habitat on a landscape scale (approximately 1,800,000 acres of grasslands across the Action Area).

- Mission sustainment and operations efforts vary widely and are hard to quantify. Decades of implementation, however, demonstrate the compatibility of military mission implementation and conservation. DOD has a long and successful history of managing natural resources on its lands to support military mission requirements, while simultaneously conserving and maintaining biodiversity.
- Loss of monarch habitat as a result of mission and mission sustainment activities will be limited. When monarch habitat loss is necessary to fulfill mission requirements (e.g., use for training), it is DOD procedure to repair and restore the land following its use, to the greatest extent practicable.
- The extent of mission and mission sustainment activity impacts are limited in terms of size when compared with the extensive habitat that remains intact across the DOD land base, and restoration of monarch habitat following use will ensure loss of habitat is likely short term.
- Mission and mission sustainment activities do not always result in negative outcomes for species and their habitats, including the monarch. In many instances military training activities mimic traditional and/or historic ecosystem processes such as pyric herbivory. While these processes often result in some loss of vegetation quality or quantity, these losses are generally short-term and eventually result in a net gain through increases in open grassland habitat, reduction in woody vegetation, and increases in native forbs including milkweed and other important nectar resources for monarch.

In summary, DOD's extensive land management action under Sikes Act; implementation of existing policies and procedures that benefit pollinators, including monarch; and commitment to conservation programs (e.g., funding, outreach efforts, and strategic partnerships) all contribute to the conservation of monarch. Through their 7(a)(1) Strategy, DOD commits to measures to benefit monarch over the next 25 years. These commitments are proactive and voluntary (i.e., for a candidate species, not required by regulations) and extensive in geographic area. Effects resulting from activities associated with mission and mission sustainment activities are difficult to estimate or quantify at the programmatic level, but are not expected to result in significant permanent loss of habitat in the long term.

9 INCIDENTAL TAKE STATEMENT

In a conference opinion, the USFWS provides its finding as to whether the proposed action is likely to jeopardize the continued existence of a proposed species (or the destruction or adverse modification of proposed critical habitat). ESA take prohibitions do not apply to candidate or proposed species. An opinion issued at the conclusion of the conference may be adopted as the biological opinion when the species is listed or critical habitat is designated, but only if no significant new information is developed (including that developed during the rulemaking process on the proposed listing or critical habitat designation) and no significant changes to the federal action are made that would alter the content of the opinion. An incidental take statement provided with a conference opinion does not become effective unless the USFWS adopts the opinion once the listing is final.

For this conference, we are not providing an incidental take. If the monarch is listed, we will develop an incidental take statement as part of the process of adopting the Conference Opinion as a Biological Opinion or explain how incidental take will be addressed via a stepdown consultation process for individual INRMPs or projects (see also Reinitiation Notice).

10 NEXT STEPS AND INRMP INTEGRATION

Under the Sikes Act, the DOD is required to develop and implement INRMPs in cooperation with the USFWS and the respective State fish and wildlife agency for installation with significant natural resources. The plans represent the mutual agreement of the three parties and are reviewed for operation and effect at least once every 5 years. In addition to these processes under the Sikes Act, USFWS and DOD conduct section 7 consultation under the ESA on INRMP projects implemented in the furtherance of the INRMP, when appropriate, to ensure DOD installation activities are not likely to jeopardize the continued existence of any listed or proposed species, or adversely modify or destroy designated or proposed critical habitat. The Strategy will be integrated into DOD's exiting ESA, Sikes Act, or other applicable procedures (e.g., INRMP or NEPA review) and the process may vary based on the branch of Military Service and whether or not an installation has an INRMP. DOD will work with USFWS over the next 3 months to develop a process by which their Strategy will be delivered to installations, both with and without INRMP requirements, for implementation. Appendix A is an example draft form that USFWS and DOD may use or adapt to assist with this step-down process, or an alternative may be developed. The process will be documented and appended to this Opinion.

USFWS and DOD worked collaboratively to develop the Strategy and this Conference Opinion, and will continue to work together to ensure implementation of the Strategy contributes to conservation of monarch through a strong commitment to adaptive management. If the status of monarch changes, both agencies are committed to continued revision, or reinitiation as applicable (see Reinitiation), to include future adoption of this conference opinion as a biological opinion covering the Strategy and military mission and sustainment, upon listing of monarch as threatened or endangered. This proactive voluntary conference assists both agencies by continuing DOD's contributions to recovery of monarch while simultaneously ensuring necessary flexibility and sustainability for military actions through streamlining ESA procedures.

It was not practical to consider effects to other listed species as part of this Opinion, given the large extent of DOD lands and potential monarch habitat (and corresponding number of listed species) across the country. DOD will continue to follow existing ESA procedures for other listed species and will document their review as appropriate.

11 CONSERVATION RECOMMENDATIONS

Secion7(a)(1) of the ESA directs federal agencies to use their authorities to further the purposes of the ESA by conducting conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary activities that an Action Agency may

undertake to avoid or minimize the adverse effects of a Proposed Action, implement recovery plans, or develop information that is useful for the conservation of listed species. The USFWS offers the following recommendation that is relevant to the candidate species addressed in this CO and that is consistent with the authorities of the DOD:

1) Monitoring of monarch

The Strategy's monitoring plan focuses on the Central Valley and overwintering MCUs within the Western Population. While monitoring of these highest priority areas is imperative, monitoring within other parts of the range of monarch is also important to the collective understanding of the species' status. Many installations are already monitoring and should continue to do so when resources allow. Any reporting is valuable to our understanding of monarch distribution and status (e.g., when you see an adult monarch, report through Journey North).

For the Western Population, in addition to the Strategy's monitoring plan of the Central Valley and Overwintering MCUs, monitoring within the West Core and West Exterior MCUs is also recommended, when possible. Similarly, additional data on monarchs in the Eastern Population will contribute to our understanding of the species. Monarchs have been observed utilizing multiple behavioral strategies in the eastern U.S. including migratory, summer breeding, winter breeding, and resident, non-migratory populations (Satterfield et al. 2015; Kendrick and McCord 2023; Steele et al. 2023). These shifts in migratory strategies in the eastern U.S. population are still being investigated, but interactions between populations have important implications for disease dynamics, habitat restoration, and understanding future conditions that may impact the resiliency and long-term persistence of the eastern monarch population.

Consider collecting habitat metrics within general land types that have been identified by Monarch Conservation Science Partnership and the IMMP as potential habitat for monarchs (unclassified grassland, rights-of-way, developed areas) and, when necessary, outside of these land types to monitor changes in vegetation from conservation efforts (Thogmartin et al. 2017; Cariveau et al. 2019). If not already involved, installations should implement an IMMP monitoring program that was begun through MJV and conduct sampling and reporting for a variety of metrics including:

- Milkweed density and diversity
- Flowering plant abundance and richness
- Monarch egg and larval densities
- Milkweed species preferences
- Adult monarch presence/absence (including winter occurrences in southeast) reporting through Journey North
- Adult nectaring preferences
- Impact of conservation actions on habitat quality

12 REINITIATION NOTICE

This concludes the voluntary conference for DOD's approval and implementation of their 7(a)(1) Conservation Strategy and military activities. DOD may ask USFWS to adopt the conference opinion as a biological opinion if the species is listed. The request must be in writing. If USFWS determines there have been no significant changes in the action as planned or in the information used during the conference, USFWS will confirm the conference opinion as the biological opinion for the project and no further section 7 consultation will be necessary.

Because this Opinion does not include critical habitat, if critical habitat is proposed or designated, that represents new information for which we will need to address effects in any future biological opinion. In addition, USFWS is not providing an incidental take statement with this conference opinion, so an incidental take statement will need to be added to the updated biological opinion, as appropriate. If the monarch is listed, the USFWS can work with DOD to address these matters, in addition to the normal factors that the USFWS considers when determining whether it will adopt a conference opinion as a biological opinion [see 50 CFR 402.10(d)]. If we are unable to estimate take for a DOD action covered under the updated biological opinion at the programmatic level, additional, action-specific consultation may be necessary for certain activities in order to provide incidental take exemptions for them.

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Appendix A.

As described in the Conference Opinion, the Strategy will be integrated into DOD's exiting ESA, Sikes Act, or other applicable procedures (e.g., INRMP or NEPA review) and the process may vary based on the branch of Military Service and whether or not an installation has an INRMP. DOD will work with USFWS over the next 3 months to develop a process by which their Strategy will be delivered to installations, both with and without INRMP requirements, for implementation. This appendix is an example draft form that USFWS and DOD may use or adapt to assist with this step-down process, or an alternative may be developed.

DOD's 7(a)(1) Conservation Strategy for Monarch – DRAFT INRMP Stage Consistency Check

Purpose: This form documents consistency with Department of Defense's (DOD's) 7(a)(1) Conservation Strategy (Strategy) [add hyperlink] for monarch butterfly (*Danaus plexippus*), and the associated Conference Opinion (Opinion) [add hyperlink]. The Strategy and Opinion covers all land management under Sikes Act authorities and monarch conservation programs (outreach, funding, research, partnerships) as outlined in the Strategy. The intent of this form, along with the Natural Resource Manager Monarch Screening Criteria (Appendix D in Strategy) is to assist Natural Resource Managers in documenting consistency with the Strategy and to aid in communication regarding installation-level details with their local U.S. Fish and Wildlife Service (USFWS) Field Office during the Integrated Natural Resource Management Plan (INRMP) review process.

The goal of the Strategy is to continue to conserve monarch butterfly on DOD lands, while ensuring no net loss in the capabilities of the military missions and mission sustainment activities, through current and ongoing ecosystem management on a large scale, funding research, conducting outreach, and developing strategic partnerships.

To achieve these goals, the Strategy includes four overarching conservation commitments, as well as Best Management Practices (BMPs) that can be found here [add link].

Strategy overarching conservation efforts:

- DOD will continue to maintain, enhance, and/or increase monarch habitat and will limit habitat loss in instances where the mission requires permanent loss of habitat.
- DOD will conduct land management practices that provide resilient native ecosystems in accordance with the Sikes Act, DOD, and Military Service Policies and will directly consider conservation benefits for monarchs.
- DOD will implement applicable BMPs in suitable habitat for monarchs.
- DOD will continue to contribute to monarch conservation by conducting outreach activities, participating in partnerships, and contributing to research.

Background on voluntary conferencing for candidate or proposed species:

Conference requirements: A conference is a procedure under section 7(a)(4) of the Endangered Species Act (ESA) related to a proposed species or proposed critical habitat. An Action Agency can voluntarily conference for candidate species and conference when the action is not likely to result in jeopardy. Having a conference opinion can help the Action Agency (DOD) and the USFWS gain efficiencies in the consultation process and expedite consultation requirements for when a species is listed or critical habitat is designated.

ESA section 7(a)(4): Each agency shall confer with the Secretary on any agency action which is likely to jeopardize the continued existence of any species proposed to be listed under section 4 or result in the destruction or adverse modification of critical habitat proposed to be designated for such species.

Jeopardy: To engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing reproduction, numbers, or distribution of that species [50 CFR 402].

This form is valid while monarch is a candidate or proposed species. An updated form will be needed upon publication of a final rule listing monarch as threatened or endangered.

Name of installation: _____

1. **Determine potential for monarch habitat and presence. Does your installation have breeding, migratory, and/or overwintering monarch habitat present?**

The Strategy defines monarch breeding and migratory habitat as "grassland and other areas that have nectar resources and/or milkweed present at the time of year monarchs are present on the landscape." This could include forested areas, wetlands, or shrub/scrub areas, among others. Unsuitable habitat in the Strategy is defined as "developed areas that include but are not limited to some cantonment areas, some housing areas, industrial areas, highly developed training sites, and developed testing facilities." The installation also has the option to verify the absence of monarch habitat by utilizing the Integrated Monarch Monitoring Protocol (IMMP) sampling procedures for evaluating milkweed and blooming plant surveys once per month during the months when monarchs can be present (Monarch Joint Venture 2024; https://monarchjointventure.org/mjvprograms/science/integrated-monarch-monitoring-program/field-activities-protocols).

Overwintering habitat in the U.S. occurs along the Pacific coast of California. Overwintering sites have specific characteristics and the microclimate, location, and structure provided by these sites are necessary for overwintering monarch survival. The species composition of overwintering groves includes blue gum eucalyptus (*Eucalyptus globulus*), Monterey pine (*Pinus radiata*), and Monterey cypress (*Hesperocyparis macrocarpa*). For a more detailed description of monarch overwintering habitat see Section IV(B)(1) of the Strategy.

☐ Yes, potential habitat is present. *If your installation is in California, continue to question 2. Everywhere else in continental U.S., continue to number 6.*

☐ No, there is no monarch habitat on my installation. *Go to number 11 (conservation programs).*

2. **In California: Determine if your installation falls within potential overwintering areas or within the Central Valley (see Figure 1 or Monarch Conservation Opportunities Tool v.1).**

☐ My installation is within overwintering area: *Go to number 3.*

☐ My installation is within the Central Valley: *Go to number 5.*

☐ My installation is in California but outside of overwintering and Central Valley areas: *Go to number 6.*

3. **Do you have overwintering habitat?**

☐ No, my installation does not have overwintering habitat. *Go to number 6.*

☐ Yes, my installation has overwintering monarch habitat: *Go to number 4.*

4. **Overwintering sites are especially important to monarch conservation. Can you implement the following BMPs and monitoring to be consistent with the Strategy, (as practicable and subject to the availability of funds?):**

> **Strategy BMPs:** See Overwintering Management BMPs in Screening Criteria (Appendix D of Strategy) [Add Link to BMPs from Strategy here for easy access].
>
> **Strategy Monitoring:** Installations with either confirmed or suspected groves of overwintering monarchs who choose to survey will follow the survey methods and protocols outlined in the Xerces Society's Western Monarch Count (WMC) and Monarch Overwintering Habitat Assessment (https://westernmonarchcount.org/downloads/). Adherence to the recommended protocols outlined within the Strategy and other supporting documents will help facilitate data collection and reporting, ensure consistency among results within and among sites as well as across years.

☐ No, my installation cannot implement BMPs or monitoring and is not consistent with the Strategy or Opinion. Consult with your local USFWS Field Office.

☐ Yes, my installation is consistent with the Strategy for overwintering site management (BMPs) and monitoring. *Continue to number 6.*

5. **Monitoring in early breeding zones in the Central Valley (Figure 1) is a priority in the Strategy. Can you implement the following, as practicable and subject to the availability of funds?**

> **Strategy Monitoring:** Within the western Monarch Conservation Units (MCUs), overwintering sites along the southern California coast serve as a critical area for maintaining the monarch population (Figure 1). The Central Valley is also important to the health of the western monarch population because it is limited in size compared to other areas and serves as a critical location for the first generation of monarchs each spring. In addition, a large proportion of the monarch habitat has been lost in the

region). The installations that occur within the Central Valley and overwintering MCUs in the west (see Figure 1, and Appendix A in the Strategy) will be the highest priority for monitoring monarch and their habitats. Installations in these areas will conduct both habitat and monarch surveys each year as practicable and subject to the availability of funds.

Breeding and Migratory

Installations that fall within the Central Valley in the west (Figure 1) and are conducting surveys for monarch or monarch habitat will focus on collecting habitat metrics within general land types that have been identified by Monarch Conservation Science Partnership and the IMMP as potential habitat for monarchs (unclassified grassland, rights-of-way, developed areas) and, when necessary, outside of these land types to monitor changes in vegetation from conservation efforts. If not already involved, these installations will implement an IMMP monitoring program (see Section VII(A)(7)) and will conduct sampling and reporting for a variety of metrics including:

- Milkweed density and diversity
- Flowering plant abundance and richness
- Monarch egg and larval densities
- Milkweed species preferences
- Adult monarch presence/absence
- Adult nectaring preferences
- Impact of conservation actions on habitat quality

☐ No, my installation cannot implement monitoring and is not consistent with the Strategy or Opinion. Consult with your local USFWS Field Office.

☐ Yes, my installation is consistent with the Strategy. *Continue to number 6.*

6. **Using your site-specific knowledge of your installation, estimate the acres of monarch habitat on your installation.** See definition of monarch habitat from the Strategy in number 1. It is okay to estimate using remote landcover data if that represents the best available information for your installation. (See Conference Opinion Appendix A for an estimate of grassland landcover on your installation). *Continue to number 7.*

_____

7. **Identify actions that could impact monarch under the Strategy and estimate acres of each land management activity in potential monarch habitat on your installation.** Enter N/A if not applicable to your installation. *Continue to number 8.*

Activity	Conducted on your installation? (Y/N)	Estimated acres of activity in monarch habitat, if applicable
Mowing and haying grasslands		
Grazing		
Row crop production		
Prescribed fire		
Invasive species control including herbicides		
Application of pesticides and insecticides		
Grassland restoration activities		

8. **For each action you identified in the above table as an activity conducted on your installation, review the corresponding BMP list [add hyperlink for easy access].** Per the Strategy, these BMPs are to be implemented to the greatest extent practicable contingent on sufficient appropriations and prioritization of mission fulfillment. If you cannot implement BMPs per the Strategy, provide details here (enter details below or attach).

☐ My installation is able to implement some of the BMPs but not all due to insufficient appropriations or conflicts with mission fulfillment; provide details below.

☐ My installation is not able to implement BMPs due to insufficient appropriations or conflicts with mission fulfillment; provide details below.

☐ Yes, my installation is consistent with the Strategy. *Continue to number 9.*

9. **USFWS recommends monitoring throughout the range to contribute to our understanding of the species.** Although not required as part of the Strategy, monitoring is a conservation recommendation for all areas within the range of monarchs to provide important information on the species distribution and habitat availability. If feasible, Natural Resource Managers should consider the following recommended monitoring protocols to aid in recovery of the species. Any reporting is valuable to our understanding of monarch distribution (e.g., when you see an adult monarch, report through Journey North). *Continue to number 10.*

Conference Opinion Conservation Recommendation:

The Strategy's monitoring plan focuses on the Central Valley and overwintering MCUs within the Western Population. While monitoring of these highest priority areas is imperative, monitoring within other parts of the range of monarch is also important to the collective understanding of the species' status. Many installations are already monitoring and should continue to do so when resources allow. Any reporting is valuable to our understanding of monarch distribution (e.g., when you see an adult monarch, report through Journey North).

For the Western Population, in addition to the Strategy's monitoring plan of the Central Valley and overwintering MCUs, monitoring within the West Core and West Exterior MCUs is also recommended, when possible. Similarly, additional data on monarchs in the Eastern Population will contribute to our understanding of the species. Monarchs have been observed utilizing multiple behavioral strategies in the eastern U.S. including migratory, summer breeding, winter breeding, and resident, non-migratory populations (Satterfield et al. 2015; Kendrick and McCord 2023; Steele et al. 2023). These shifts in migratory strategies in the eastern U.S. population are still being investigated, but these interactions between populations have important implications for disease dynamics, habitat restoration, and understanding future conditions that may impact the resiliency and long-term persistence of the eastern monarch population.

Consider collecting habitat metrics within general land types that have been identified by Monarch Conservation Science Partnership and the IMMP as potential habitat for monarchs (unclassified grassland, rights-of-way, developed areas) and, when necessary, outside of these land types to monitor changes in vegetation from conservation efforts (Thogmartin et al. 2017; Cariveau et al. 2019). If not already involved, these installations should implement an IMMP monitoring program that was begun through MJV and conduct sampling and reporting for a variety of metrics including:

- Milkweed density and diversity
- Flowering plant abundance and richness
- Monarch egg and larval densities
- Milkweed species preferences
- Adult monarch presence/absence (including winter occurrences in southeast) reporting through Journey North
- Adult nectaring preferences
- Impact of conservation actions on habitat quality

10. **Consider other listed species separately**. Effects to other listed species must be considered pursuant to section 7 of the ESA via a separate consultation. *Continue to number 11*.

11. **Provide additional details about monarch conservation activities on your installation, e.g., conservation program actions (outreach, partnerships, research, funding) that**

benefit monarch and other pollinators. Enter details below or attach. *Continue to number 12*.

12. Consider military training and operations actions that may affect monarch (i.e., occur in monarch habitat on your installation during the time of year monarch is present in your area) that occur outside of regularly utilized training areas. Are the effects to monarch consistent with the effects analyzed in the Conference Opinion (i.e., ground-based training, aviation training, impact areas, and construction and maintenance) (see section 6.5 of the Conference Opinion [link])?

    ☐ Yes, military mission and sustainment actions are consistent with analysis of potential effects in Conference Opinion and are not at the level of jeopardy. *Continue to number 13.*

    ☐ No, military mission and sustainment actions are not consistent with Conference Opinion but do not rise to the level of jeopardy. *Continue to number 13.*

    ☐ No, military mission and sustainment actions are not consistent with Conference Opinion and are significant enough to need to closely evaluate jeopardy standard. Confer with local Field Office.

13. Participation in the Strategy and high-level metrics about grasslands will be reported annually by the Military Services to Office of the Secretary of Defense (OSD) through Environmental Management Review (EMR) data calls. Installation-specific monarch projects and implementation of BMPs will be shared via this INRMP Stage Consistency Check form that will be shared between installation Natural Resource Managers and USFWS during existing INRMP review meetings.

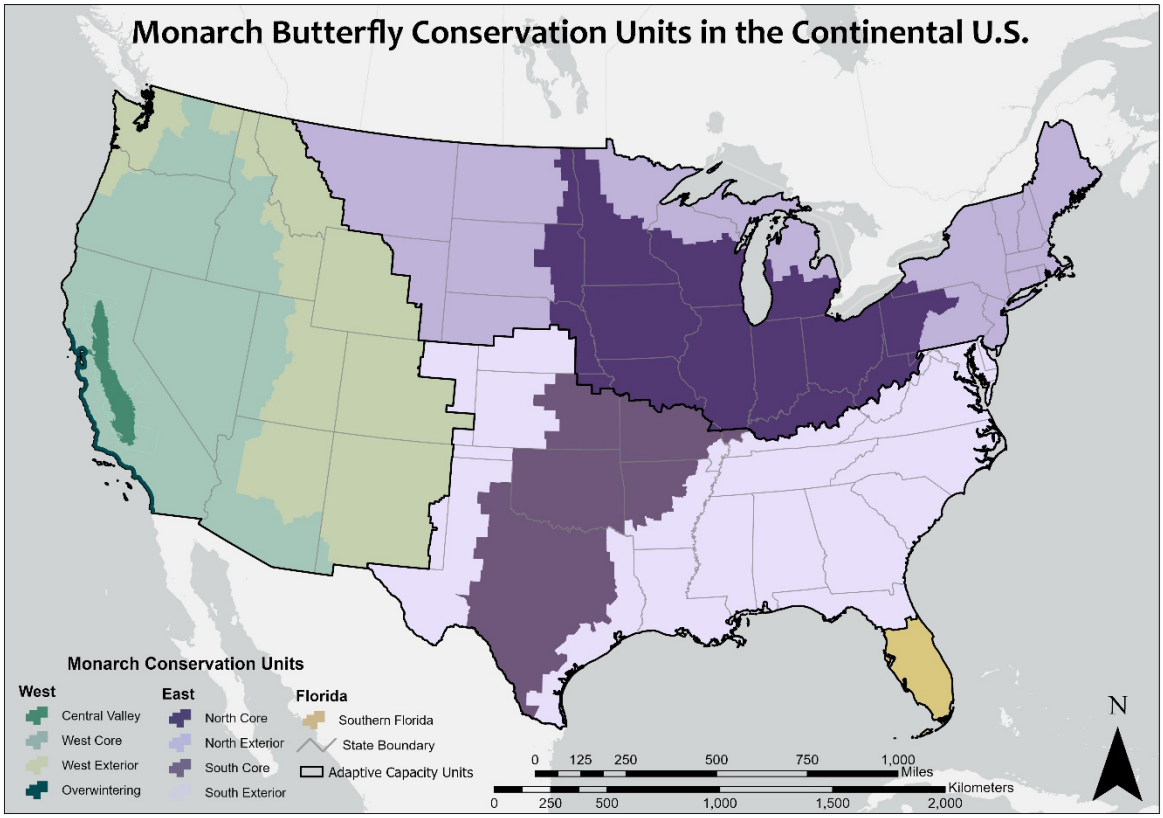

Figure 1: Monarch Conservation Units delineated by U.S. Fish and Wildlife Service to display approximate boundaries of areas important to monarchs (*Danaus plexippus*) and to aid in prioritizing needs across the species range in the continental U.S. Specifically, overwintering and Central Valley are the highest priority for the western population; "Core" areas have higher priority across the range than "Exterior" areas, although all areas can contribute to monarch conservation.

Appendix B. DOD installations in continental U.S. with estimated grassland acres

The following table shows Department of Defense (DOD) installations in the continental United States with Integrated Natural Resource Management Plan (INRMP) requirements. It includes the INRMP name, branch of service, state the installation is covered under the INRMP is located, approximate installation acreage followed by approximate grassland acres in parentheses, and the monarch conservation unit (MCU) the installation falls within. Approximate installation acreages were derived using the FY 2021 Defense Installation Spatial Data Infrastructure (DISDI) DOD_Site_Locations_Boundaries shapefile. Likewise, approximate grassland acres were calculated using the 2022 LANDFIRE Existing Vegetation Type data layer, specifically the EVT_PHYS attribute. After review of the LANDFIRE data, it was determined that the landcover types 'Grassland' and Exotic Herbaceous' best estimated grasslands in the continental United States and on installations. In turn, the landcover types 'Grassland' and Exotic Herbaceous' were combined to generate estimates of grassland acres. It is important to note that some installations are not contiguous and are comprised of geographically separated units (GSUs). For example, 88th Readiness Division installations are comprised of hundreds of GSU's that are dispersed across multiple states and subsequently have GSUs in more than one MCU. These installations are denoted by an (*) in the table. While the 88th Readiness Division installations are an extreme example, other installations with fewer GSUs and/or GSUs within the same state still had the potential to fall within different MCUs. These installations were placed into one of the nine MCUs. Additionally, some installations were missing from the DOD_Site_Locations_Boundaries shapefile such as Camp Peary. In these instances, approximate installation acres and grassland acres are not provided and denoted by a (-) in the table. Finally, the last row in the table contains the approximate installation acres as well as grassland acres for sites **NOT** covered by an INRMP. These installations were located within all MCUs and distributed across the continental United States in many different states. The branch of service of these installations is denoted by (***) in the table and the different branches of service are outlined in the Key at the end of the table.

INRMP Name	Branch of Service	State	~ Acres	MCU
102IW INRMP Otis Department of Air Force Base	Department of Air Force	MA	3,600 (2)	North Exterior
179AW Mansfield LAHM Department of Air Force Base	Department of Air Force	OH	300 (13)	North Core
Cannon Air Force Base and Melrose Air Force Range	Department of Air Force	NM	75,400 (65,900)	South Exterior
Barry M. Goldwater Range	Department of Air Force	AZ	1,050,300 (5,500)	West Core
Camp Adair Training Site	Army National Guard	OR	530 (25)	West Exterior
Camp Curtis Guild Training Site	Army National Guard	MA	700 (6)	North Exterior
Camp Grayling Maneuver Training Center	Army National Guard	MI	147,100 (11,100)	North Exterior
Camp Rilea Training Site	Army National Guard	OR	1,900 (200)	West Exterior
Camp Ripley Training Site	Army National Guard	MN	52,800 (4,000)	North Core
Camp Roberts	Army National Guard	CA	42,600 (24,000)	West Core
Camp San Luis Obispo	Army National Guard	CA	5,500 (2,000)	West Core
Clarks Hill Training Center	Army National Guard	SC	900 (20)	South Exterior
Department of the Air Force USAF Academy	Department of Air Force	CO	19,400 (4,500)	West Academy
Department of the Air Force Space Launch Delta 45	Department of Air Force	FL	19,000 (1,500)	Southern Florida
Department of the Air Force Arnold Engineering Development Complex	Department of Air Force	TN	38,900 (4,300)	South Exterior
Department of the Air Force Buckley - Cape Cod Space Force Station	Department of Air Force	MA	100 (0)	North Exterior
Department of the Air Force Davis-Monthan	Department of Air Force	AZ	10,600 (150)	West Core
Department of the Air Force Plan FE Warren	Department of Air Force	WY	5,900 (3,600)	North Exterior
Department of the Air Force MacDill	Department of Air Force	FL	5,700 (100)	Southern Florida
Department of the Air Force Scott Air Force Base	Department of Air Force	IL	3,000 (50)	North Core
Department of the Air Force Sheppard Air Force Base	Department of Air Force	TX	4,600 (1,000)	South Core
U.S. Army Garrison Fort Belvoir	U.S. Army	VA	9,200 (150)	South Exterior
Alpena Combat Readiness Training Center Department of Air Force Base	Department of Air Force	MI	700 (15)	North Exterior
Bangor Department of Air Force Base	Department of Air Force	ME	300 (<1)	North Exterior

INRMP Name	Branch of Service	State	~Acres	MCU
Fort Walker (formally Fort A.P. Hill)	U.S. Army	VA	74,600 (2,500)	South Exterior
Fort Custer Training Center	Army National Guard	MI	7,500 (300)	North Core
Fort Cavazos (formally Fort Hood)	U.S. Army	TX	219,350 (43,000)	South Core
Fort Indiantown Gap National Guard Training Center	Army National Guard	PA	18,000 (650)	North Exterior
Fort Leavenworth	U.S. Army	KS	5,700 (200)	South Core
Fort McCoy	U.S. Army Reserve	WI	59,700 (10,000)	North Core
Fort Wolters	Army National Guard	TX	4,100 (800)	South Core
Hill Air Force Base	Department of Air Force	UT	967,700 (18,500)	West Core
Volk Field Combat Readiness Training Center and Hardwood Weapons Range	Department of Air Force	WI	9,500 (300)	North Core
Fort Novosel (formally Fort Rucker)	U.S. Army	AL	58,150 (1,500)	South Exterior
Columbus Air Force Base	Department of Air Force	MS	5,300 (75)	South Exterior
Camp Ravenna Joint Military Training Center	Army National Guard	OH	21,700 (250)	North Core
Barnes Department of Air Force	Department of Air Force	MA	90 (<1)	North Exterior
Burlington Department of Air Force Base	Department of Air Force	VT	300 (2)	North Exterior
Camp Blanding	Army National Guard	FL	73,900 (13,000)	South Exterior
Fogarty Training Site	Army National Guard	RI	400 (5)	North Exterior
Camp Williams	Army National Guard	UT	24,150 (700)	West Exterior
Sparta Training Area	Army National Guard	IL	2,700 (1,000)	North Core
Fort Campbell	U.S. Army	TN	104,700 (7,200)	South Exterior
Fort Carson and the Pinon Canyon Maneuver Site	U.S. Army	CO	373,450 (282,000)	West Exterior
Gulfport Combat Readiness Training Cetner	Department of Air Force	MS	400 (0)	South Exterior
Jacksonville Department of Air Force Base	Department of Air Force	FL	550 (6)	South Exterior
Pease Department of Air Force Base	Department of Air Force	NH	220 (<1)	North Exterior
Pittsburgh Department of Air Force	Department of Air Force	PA	200 (<1)	North Core

INRMP Name	Branch of Service	State	~Acres	MCU
Portland Department of Air Force Base	Department of Air Force	OR	225 (0)	West Exterior
Smoky Hill Department of Air Force Range	Department of Air Force	KS	34,000 (27,100)	South Core
177th Fighter Wing Warren Grove Bombing Range, Coyle Field, and Atlantic City Department of Air Force	Department of Air Force	NJ	10,500 (1,300)	North Exterior
182nd Airlift Wing Department of Air Force Base	Department of Air Force	IL	400 (10)	North Core
Anniston Army Depot	U.S. Army	AL	15,600 (150)	South Exterior
Battle Creek Department of Air Force Base	Department of Air Force	MI	320 (20)	North Core
Bradley Department of Air Force Base and Orange Department of Air Force Station	Department of Air Force	CT	170 (2)	North Exterior
Brigadier General Thomas B. Baker Training Facility	Army National Guard	MD	-	South Exterior
Camp Atterbury Joint Maneuver Training Center	Army National Guard	IN	35,000 (3,000)	North Core
Camp Bowie	Army National Guard	TX	9,000 (2,600)	South Core
Camp Dawson Army Training Site	Army National Guard	WV	8,500 (200)	North Core
Camp Edwards Training Site	Army National Guard	MA	20,600 (800)	North Exterior
Camp Gruber Training Center	Army National Guard	OK	33,500 (4,300)	South Core
Plan Camp Maxey	Army National Guard	TX	6,500 (650)	South Core
Plan Camp Swift	Army National Guard	TX	11,750 (2,000)	South Core
Camps Beauregard, Minden, and Villere	Army National Guard	LA	32,000 (1,800)	South Exterior
Center for Security Forces Detachment Kittery (SERE East)	U.S. Navy	ME	12,500 (35)	North Exterior
Channel Islands Department of Air Force Station	Department of Air Force	CA	200 (20)	West Core
Command Sergeant Major Harold L Disney Training Center	Army National Guard	KY	550 (<1)	South Exterior
Defense Distribution Depot San Joaquin	U.S. Army	CA	1,000 (3)	Central Valley
Defense Fuel Support Point San Pedro	U.S. Navy	CA	350 (100)	West Core
Delaware Army National Guard Bethany Beach Training Site	Army National Guard	DE	100 (<1)	South Exterior
Delaware Army National Guard River Road Training Site	Army National Guard	DE	200 (15)	South Exterior

Devens Reserve Forces Training Area	U.S. Army Reserve	MA	5,100 (360)	North Exterior
INRMP Name	Branch of Service	State	~Acres	MCU
Eastern Kentucky Training Site	Army National Guard	KY	550 (5)	North Core
Fires Center of Excellence and Fort Sill	U.S. Army	OK	93,750 (66,000)	South Core
Naval Observatory Flagstaff Station	U.S. Navy	AZ	300 (0)	West Exterior
Integrated Natural Resources Management Plan for Camp Guernsey	Army National Guard	WY	78,900 (49,700)	North Exterior
Camp Murray	Army National Guard	WA	250 (0)	West Exterior
Defense Distribution Center Susquehanna	U.S. Army	PA	850 (<1)	North Exterior
Edwards Air Force Base	Department of Air Force	CA	308,500 (2,400)	North Core
Facilities in IL, IN, IA, MI, MN, MO, OH, and WI (USFWS Region 3)	U.S. Army Reserve	*	1,800 (1,400)	*
Fort Chaffee Maneuver Training Center	Army National Guard	AR	65,150 (9,700)	South Core
Homestead Air Reserve Base	Department of Air Force Reserve	FL	1,300 (40)	Southern Florida
Marine Corps Base Quantico	U.S. Marine Corps	VA	59,050 (500)	South Exterior
Marine Corps Logistics Base Albany	U.S. Marine Corps	GA	3,350 (100)	South Exterior
Naval Air Station Key West	U.S. Navy	FL	5,600 (60)	Southern Florida
Naval Air Station Patuxent River Complex's, Naval Air Station Patuxent River, Webster Field Annex, and Minor Properties in Maryland	U.S. Navy	MD	13,150 (250)	South Exterior
Naval Base Ventura County Point Mugu and Special Areas	U.S. Navy	CA	14,100 (1,300)	Overwintering
Naval Base Ventura County San Nicolas Island	U.S. Navy	CA	17,500 (1,050)	West Core
Research Laboratory Installations Washington, D.C., Chesapeake Bay Detachment, and Pomonkey	U.S. Navy	MD	200 (10)	South Exterior
Naval Weapons Station Seal Beach	U.S. Navy	CA	4,850 (100)	Overwintering
Naval Weapons Station Seal Beach Detachment Fallbrook	U.S. Navy	CA	9,000 (3,800)	West Core
Integrated Navy Operational Support Center Sacramento	U.S. Navy Reserve	CA	20 (0)	Central Valley
Presidio of Monterey	U.S. Army	CA	400 (2)	Overwintering
Sites in CO, KS, MT, NE, ND, SD, UT, and WY (USFWS Regions 5/7)	U.S. Army Reserve	*	1,650 (20)	*

INRMP Name	Branch of Service	State	~Acres	MCU
Sites in WA, ID, and OR (USFWS Region 9)	U.S. Army Reserve	*	200 (<1)	*
Camp Butner Training Site	Army National Guard	NC	5,000 (60)	South Exterior
The Camp Dodge Johnston Joint Maneuver Training Center	Army National Guard	IA	33,100 (3,000)	North Core
Maine Army National Guard Caswell-Loring Training Facility	Army National Guard	ME	1,100 (10)	North Exterior
Marine Corps Air Station Beaufort	U.S. Marine Corps	SC	7,400 (6,000)	South Exterior
Military Ocean Terminal, Sunny Point, North Carolina	U.S. Army	NC	11,550 (700)	South Exterior
Missouri Army National Guard	Army National Guard	MO	10,700 (200)	South Core
New Hampshire Army National Guard Training Site	Army National Guard	NH	400 (20)	North Exterior
Wyoming Military Department Local Training Areas in Lander, Lovell, and Sheridan	Army National Guard	WY	8,900 (3,000)	West Exterior
Fort Moore (formally Fort Benning)	U.S. Army	GA	181,900 (13,100)	South Exterior
Fort Liberty (formally Fort Bragg) and Camp Mackall	U.S. Army	NC	162,900 (24,500)	South Exterior
Fort Harrison Training Area and Limestone Hills Training Area	Army National Guard	MT	27,900 (700)	West Exterior
Fort Huachuca	U.S. Army	AZ	81,000 (18,000)	West Core
Fort McClellan Army National Guard Training Center	Army National Guard	AL	22,750 (500)	South Exterior
Fort Riley	U.S. Army	KS	101,800 (61,700)	South Core
Fort Smith Department of Air Force Base	Department of Air Force	AR	150 (<1)	South Core
Fort Stewart and Hunter Army Airfield	U.S. Army	GA	285,000 (12,200)	South Exterior
Great Pond Outdoor Adventure Center	U.S. Navy	ME	450 (15)	North Exterior
Hancock Field Department of Air Force Base and the Eastern Air Defense Sector Site	Department of Air Force	NY	400 (5)	North Exterior
Harvey Point Defense Testing Activity	U.S. Navy	NC	-	South Exterior
Hawthorne Army Depot	U.S. Army	NV	146,100 (705)	West Core
Jefferson Range Department of Air Force	U.S. Army	IN	52,800 (3,400)	North Core
Joint Base Langley Eustis - Langley	Department of Air Force	VA	4,000 (30)	South Exterior

INRMP Name	Branch of Service	State	~Acres	MCU
Joint Expeditionary Base Little Creek - Fort Story	U.S. Navy	VA	2,200 (100)	South Exterior
Joint Readiness Training Center and Fort Johson (formally Fort Polk)	U.S. Army	LA	240,300 (13,205)	South Exterior
Kingsley Department of Air Force Base	Department of Air Force	OR	350 (3)	West Core
Letterkenny Army Depot	U.S. Army	PA	18,000 (150)	North Exterior
Maine Army National Guard Hollis Training Site	Army National Guard	ME	450 (40)	North Exterior
Maine Army National Guard Training Facility Auburn	Army National Guard	ME	200 (5)	North Exterior
Marine Air Ground Task Force Training Command Marine Corps Air Ground Combat Center Twentynine Palms	U.S. Marine Corps	CA	761,600 (1,000)	West Core
Marine Corps Base Camp Lejeune	U.S. Marine Corps	NC	127,700 (6,400)	South Exterior
Marine Corps Mountain Warfare Training Center Bridgeport, California	U.S. Marine Corps	CA	61,900 (4,300)	West Core
Marine Corps Recruit Depot Parris Island	U.S. Marine Corps	SC	10,250 (200)	South Exterior
Maryland Department of Air Force Base Martin State Airport	Department of Air Force	MD	200 (<1)	South Exterior
McAlester Army Ammunition Plant	U.S. Army	OK	45,000 (10,200)	South Core
McEntire Joint National Guard Base	Department of Air Force	SC	2,400 (200)	South Exterior
Mississippi Army National Guard Camp McCain	Army National Guard	MS	13,000 (200)	South Exterior
Mississippi Army National Guard Camp Shelby Joint Forces Training Center	Army National Guard	MS	138,450 (5,000)	South Exterior
Moffett Department of Air Force Base	Department of Air Force	CA	150 (0)	West Core
Naval Air Facility El Centro	U.S. Navy	CA	60,500 (10)	West Core
Naval Air Station Corpus Christi	U.S. Navy	TX	6,000 (450)	South Exterior
Naval Air Station Fallon	U.S. Navy	NV	243,200 (6,200)	West Core
Naval Air Station Kingsville	U.S. Navy	TX	15,250 (1,000)	South Exterior
Naval Air Station Oceana and Naval Auxiliary Landing Field Fentress	U.S. Navy	VA	8,300 (50)	South Exterior
Naval Air Station Oceana Dam Neck Annex	U.S. Navy	VA	2,000 (155)	South Exterior

INRMP Name	Branch of Service	State	~Acres	MCU
Naval Air Station Pensacola Complex	U.S. Navy	FL	8,350 (300)	South Exterior
Naval Air Station Whidbey Island	U.S. Navy	WA	9,150 (55)	West Exterior
Naval Air Station Whiting Field Complex	U.S. Navy	FL	11,850 (800)	South Exterior
Naval Air Weapons Station China Lake	U.S. Navy	CA	1,141,200 (13,900)	West Core
Naval Auxiliary Landing Field San Clemente Island	U.S. Navy	CA	36,100 (1,300)	West Core
Naval Base Coronado	U.S. Navy	CA	13,500 (20)	Overwintering
Naval Base Kitsap	U.S. Navy	WA	10,150 (20)	West Exterior
Naval Base Point Loma	U.S. Navy	CA	1,850 (2)	Overwintering
Naval Base San Diego	U.S. Navy	CA	2,650 (15)	West Core
Naval Radio Transmitter Facility Dixon	U.S. Navy	CA	1,250 (100)	Central Valley
Naval Radio Transmitter Facility Lamoure	U.S. Navy	ND	850 (<1)	North Exterior
Naval Recreation Center Solomons	U.S. Navy	MD	325 (5)	South Exterior
Naval Research Laboratory Midway Research Center	U.S. Navy	VA	175 (<1)	South Exterior
Naval Research Laboratory Washington DC	U.S. Navy	DC	150 (0)	South Exterior
Naval Station Great Lakes	U.S. Navy	IL	1,900 (6)	North Core
Naval Station Mayport	U.S. Navy	FL	4,000 (100)	South Exterior
Naval Station Newport and Outlying Parcels	U.S. Navy	RI	1,850 (50)	North Exterior
Naval Submarine Base New London	U.S. Navy	CT	1,400 (5)	North Exterior
Naval Support Activity Annapolis	U.S. Navy	MD	2,000 (60)	South Exterior
Naval Support Activity Bethesda	U.S. Navy	MD	250 (0)	South Exterior
Naval Support Activity Crane	U.S. Navy	IN	62,500 (1,050)	North Core
Naval Support Activity Cutler	U.S. Navy	ME	3,100 (1,000)	North Exterior
Naval Support Activity Hampton Roads Lafayette River Annex, Northwest Annex, and Portsmouth Annex	U.S. Navy	VA	4,700 (20)	North Exterior
Naval Support Activity Mid-South	U.S. Navy	TN	1,500 (20)	South Exterior

INRMP Name	Branch of Service	State	~Acres	MCU
Naval Support Activity Monterey	U.S. Navy	CA	1,000 (10)	Overwintering
Naval Support Activity Panama City	U.S. Navy	FL	700 (20)	South Exterior
Naval Support Facility Carderock	U.S. Navy	MD	200 (<1)	South Exterior
Naval Support Facility Dahlgren	U.S. Navy	VA	4,300 (200)	South Exterior
Naval Support Facility Indian Head	U.S. Navy	MD	3,200 (100)	South Exterior
Naval Surface Warfare Center Acoustic Research Detachment Bayview Idaho	U.S. Navy	ID	50 (<1)	West Exterior
Naval Weapons Station Earle	U.S. Navy	NJ	11,900 (200)	North Exterior
Naval Weapons Station Seal Beach Detachment Norco	U.S. Navy	CA	250 (50)	West Core
Naval Weapons Station Yorktown	U.S. Navy	VA	13,150 (200)	South Exterior
Naval Weapons Systems Training Facility Boardman	U.S. Navy	OR	63,850 (22,000)	West Core
Navy Information Operations Command Sugar Grove	U.S. Navy	WV	500 (3)	South Exterior
Nebraska National Guard	Army National Guard	NE	5,950 (3,000)	North Core
New Jersey Army National Guard Sea Girt National Guard Training Center	Army National Guard	NJ	200 (20)	North Exterior
New York Army National Guard Camp Smith Training Site	Army National Guard	NY	1,600 (15)	North Exterior
New York Army National Guard Youngstown Local Training Area	Army National Guard	NY	900 (10)	North Exterior
Armed Forces Experimental Training Activity Camp Peary	U.S. Navy	VA	-	North Exterior
Orchard Combat Training Center	Army National Guard	ID	143,450 (86,600)	West Core
Picatinny Arsenal	U.S. Army	NJ	6,600 (50)	North Exterior
Port Hueneme	U.S. Navy	CA	1,650 (0)	Overwintering
Pueblo Chemical Depot	U.S. Army	CO	22,825 (18,700)	West Exterior
Red River Army Depot	U.S. Army	TX	15,000 (1,000)	South Exterior
Robinson Maneuver Training Center	Army National Guard	AR	33,150 (305)	South Core
Selfridge Department of Air Force Base	Department of Air Force	MI	3,100 (150)	North Core

INRMP Name	Branch of Service	State	~Acres	MCU
Snake Creek Weekend Training Site	Army National Guard	FL	350 (50)	Southern Florida
South Dakota Army National Guard	Army National Guard	SD	1,150 (400)	North Core
State Military Reserve City of Virginia Beach	Army National Guard	VA	350 (5)	North Exterior
Stone's Ranch Military Reservation and East Haven Rifle Range	Army National Guard	CT	2,000 (30)	North Exterior
Tooele Army Depot	U.S. Army	UT	42,400 (4,700)	West Core
U.S. Army Dugway Proving Ground	U.S. Army	UT	800,500 (32,700)	West Core
U.S. Army Garrison Aberdeen Proving Ground - Adelphi Laboratory Center and Blossom Point Research Facility	U.S. Army	MD	1,800 (100)	South Exterior
U.S. Army Garrison Fort Drum	U.S. Army	NY	108,900 (10,200)	North Exterior
U.S. Army Garrison Fort Eisenhower (formally Fort Gordon)	U.S. Army	GA	56,800 (7,020)	South Exterior
U.S. Army Garrison Fort Hunter Liggett	U.S. Army Reserve	CA	160,750 (25,700)	West Core
U.S. Army Garrison Fort Jackson	U.S. Army	SC	51,400 (3,600)	South Exterior
U.S. Army Garrison Fort Knox	U.S. Army	KY	109,100 (4,500)	North Core
U.S. Army Garrison Fort Gregg-Adams (formally Fort Lee)	U.S. Army	VA	5,700 (150)	South Exterior
U.S. Army Garrison George G. Meade	U.S. Army	MD	5,125 (50)	South Exterior
U.S. Army Maneuver Support Center of Excellence Fort Leonard Wood	U.S. Army	MO	62,025 (2,000)	South Core
U.S. Army Garrison - Redstone	U.S. Army	AL	38,200 (205)	South Exterior
U.S. Army Garrison West Point	U.S. Army	NY	15,900 (250)	North Exterior
Vermont Army National Guard Ethan Allen Firing Range	Army National Guard	VT	11,100 (100)	North Exterior
Volunteer Training Site - Catoosa	Army National Guard	GA	1,650 (5)	South Exterior
Volunteer Training Site - Milan	Army National Guard	TN	2,500 (115)	South Exterior
Volunteer Training Site - Smyrna	Army National Guard	TN	900 (10)	South Exterior
White Sands Missile Range	U.S. Army	NM	2,271,100 (71,310)	West Exterior
Chocolate Mountain Aerial Gunnery Range	U.S. Marine Corps	CA	458,350 (40)	West Core
Kansas Training Center	Army National Guard	KS	3,600 (0)	South Core

INRMP Name	Branch of Service	State	~Acres	MCU
Naval Submarine Base Kings Bay	U.S. Navy	GA	45,000 (1,650)	South Exterior
Townsend Bombing Range	U.S. Marine Corps	SC	79,100 (10,200)	South Exterior
U.S. Army Aberdeen Proving Ground - Aberdeen Area and Edgewood Area	U.S. Army	MD	72,625 (2,600)	South Exterior
Wendell H. Ford Regional Training Center	Army National Guard	KY	11,250 (1,250)	North Core
Fort Barfoot (formally Fort Pickett)	Army National Guard	VA	41,100 (1,100)	South Exterior
Naval Station Norfolk and Craney Island Fuel Terminal	U.S. Navy	VA	5,425 (50)	South Exterior
Naval Air Station Lemoore	U.S. Navy	CA	18,800 (1,600)	Central Valley
Naval Air Station Meridian	U.S. Navy	MS	13,800 (1,200)	South Exterior
Naval Air Station Jacksonville Complex	U.S. Navy	FL	11,400 (300)	South Exterior
Joint Base Langley-Eustis Fort Eustis	Department of Air Force	VA	7,900 (150)	South Exterior
Joint Base Lewis-McChord	U.S. Army	WA	91,400 (9,800)	West Exterior
Marine Corps Base and Marine Corps Air Station Camp Pendleton	U.S. Army Reserve	CA	126,000 (0)	Overwintering
Laughlin Air Force Base	Department of Air Force	TX	4,600 (55)	South Core
Little Rock Air Force Base	Department of Air Force	AR	6,500 (25)	South Core
Luke Air Force Base	Department of Air Force	AZ	4,200 (100)	West Exterior
Manchester Fuel Department	U.S. Navy	WA	350 (<1)	West Exterior
Marine Corps Air Station Cherry Point	U.S. Marine Corps	NC	25,900 (700)	South Exterior
Marine Corps Air Station Miramar	U.S. Marine Corps	CA	23,100 (700)	West Core
Marine Corps Air Station Yuma Installation Overview	U.S. Marine Corps	AZ	-	West Core
Marine Corps Logistics Base Barstow	U.S. Marine Corps	CA	5,500 (<1)	West Core
Marseilles Training Area	Army National Guard	IL	2,900 (400)	North Core
McCrady Training Center	Army National Guard	SC	-	South Exterior
Naval Air Station Joint Reserve Base New Orleans	U.S. Navy	LA	5,000 (75)	South Exterior

INRMP Name	Branch of Service	State	~Acres	MCU
Naval Construction Battalion Center (NCBC) Gulfport Stennis Western Maneuver Area Stennis Space Center	U.S. Navy	MS	5,300 (150)	South Exterior
Naval District Washington	U.S. Navy	DC	225 (<1)	South Exterior
Naval Magazine Indian Island	U.S. Navy	WA	3,050 (20)	West Exterior
Naval Radio Station (Transmitter) Jim Creek	U.S. Navy	WA	2,000 (30)	West Exterior
Naval Station Everett	U.S. Navy	WA	650 (0)	West Exterior
Naval Support Activity Orlando, LEFAC/BUGG Spring Facility	U.S. Navy	FL	100 (0)	Southern Florida
North Dakota Army National Guard Camp Grafton North	Army National Guard	ND	11,300** (2,600)	North Exterior
North Dakota Army National Guard Camp Grafton South	Army National Guard	ND	11,300** 2,600)	North Exterior
North Dakota Army National Guard Douglas Creek Local Training Area	Army National Guard	ND	700 (500)	North Exterior
Pacific Beach Annex Naval Station Everett	U.S. Navy	WA	150 (0)	West Exterior
St. George Armory	Army National Guard	UT	75 (0)	West Core
Department of Air Force Joint Base McGuire-Dix-Lakehurst	Department of Air Force	NJ	42,200 (2,500)	North Exterior
Department of Air Force Nellis Air Force Base, Creech Air Force Base and Nevada Testing and Training Range	Department of Air Force	NV	3,056,325 (11,600)	West Core
Department of Air Force Fairchild Air Force Base	Department of Air Force	WA	4,500 (200)	West Core
Department of Air Force Hurlburt Field	Department of Air Force	FL	6,400 (105)	South Exterior
Department of Air Force Altus Air Force Base	Department of Air Force	OK	8,025 (1,100)	South Core
Department of Air Force Avon Park Air Force Range	Department of Air Force	FL	108,200 (15,000)	Southern Florida
Department of Air Force Barksdale Air Force Base	Department of Air Force	LA	22,000 (500)	South Exterior
Department of Air Force Beale Air Force Base and Lincoln Receiver Site	Department of Air Force	CA	33,800 (14,500)	Central Valley
Department of Air Force Buckley Space Force Base	Department of Air Force	CO	3,325 (1,000)	South Exterior
Department of Air Force Dare County Range	Department of Air Force	NC	46,650 (20)	South Exterior
Department of Air Force Dobbins Air Reserve Base	U.S. Army Reserve	GA	1,800 (10)	South Exterior
Department of Air Force Dyess Air Force Base	Department of Air Force	TX	5,400 (160)	South Core

INRMP Name	Branch of Service	State	~Acres	MCU
Department of Air Force Eglin Air Force Base	Department of Air Force	FL	459,400 (49,100)	South Exterior
Department of Air Force Ellsworth Air Force Base	Department of Air Force	SD	5,250 (2,100)	North Exterior
Department of Air Force Goodfellow Air Force Base	Department of Air Force	TX	1,400 (10)	South Core
Department of Air Force Grand Forks Air Force Base	Department of Air Force	ND	5,600 (60)	North Core
Department of Air Force Holloman Air Force Base	Department of Air Force	NM	186,000 (1,800)	West Exterior
Department of Air Force Joint Base Anacostia Bolling	Department of Air Force	DC	1,000 (<1)	South Exterior
Department of Air Force Plan Joint Base Andrews	Department of Air Force	MD	7,000 (150)	South Exterior
Department of Air Force Plan Joint Base Charleston	Department of Air Force	SC	22,550 (600)	South Exterior
Department of Air Force Plan Joint Base San Antonio	Department of Air Force	TX	46,150 (2,600)	South Core
Department of Air Force Keesler Air Force Base	Department of Air Force	MS	1,700 (2)	South Exterior
Department of Air Force Kirtland Air Force Base	Department of Air Force	NM	50,225 (10,200)	West Exterior
Department of Air Force Malmstrom Air Force Base	Department of Air Force	MT	3,300 (1,000)	North Exterior
Department of Air Force March Air Reserve Base	U.S. Army Reserve	CA	2,800 (1,650)	West Core
Department of Air Force Maxwell Air Force Base	Department of Air Force	AL	2,900 (15)	South Exterior
Department of Air Force McConnell Air Force Base	Department of Air Force	KS	13,800 (3,000)	South Core
Department of Air Force Minot Air Force Base	Department of Air Force	ND	5,000 (1,000)	North Exterior
Department of Air Force Moody Air Force Base	Department of Air Force	GA	11,600 (350)	South Exterior
Department of Air Force Mountain Home Air Force Base, Saylor Creek Air Force Range, and Other Mountain Home Range Complexes	Department of Air Force	ID	133,100 (49,250)	West Core
Department of Air Force New Boston Air Force Station	Department of Air Force	NH	2,900 (30)	North Exterior
Department of Air Force Offutt Air Force Base	Department of Air Force	NE	3,300 (120)	North Core
Department of Air Force Peterson Air Force Base	Department of Air Force	CO	1,650 (500)	West Exterior
Department of Air Force Pillar Point Air Force Station	Department of Air Force	CA	75 (5)	Overwintering
Department of Air Force Robins Air Force Base	Department of Air Force	GA	6,700 (75)	South Exterior

INRMP Name	Branch of Service	State	~Acres	MCU
Department of Air Force Schriever Air Force Base	Department of Air Force	CO	5,425 (4,800)	West Exterior
Department of Air Force Shaw Air Force Base	Department of Air Force	SC	16,050 (420)	South Exterior
Department of Air Force Tinker Air Force Base	Department of Air Force	OK	5,800 (525)	South Core
Department of Air Force Travis Air Force Base	Department of Air Force	CA	6,600 (1,500)	Central Valley
Department of Air Force Tyndall Air Force Base	Department of Air Force	FL	29,100 (2,520)	South Exterior
Department of Air Force Westover Air Reserve Base	Department of Air Force Reserve	MA	2,400 (100)	North Exterior
Department of Air Force Wright-Patterson Air Force Base	Department of Air Force	OH	7,650 (25)	North Core
Department of Air Force Cheyenne Mountain Space Force Station	Department of Air Force	CO	550 (50)	West Exterior
Department of Air Force Vandenberg Space Force Base	Department of Air Force	CA	99,450 (17,200)	Overwintering
Vance Air Force Base	Department of Air Force	OK	3,400 (700)	South Core
Yakima Training Center Cultural and Natural Resources Management Plan	U.S. Army	WA	327,125 (70,520)	West Core
Army Reserve 63rd Readiness Division – Sgt. James Witkowski	U.S. Army Reserve	CA	75 (0)	West Core
Badlands Air Force Range	Department of Air Force	SD	2,500 (2,300)	North Exterior
Blue Grass Army Depot	U.S. Army	KY	14,600 (400)	North Core
Camp Navajo	Army National Guard	AZ	28,350 (2,000)	West Exterior
Camp Rapid	Army National Guard	SD	100 (0)	North Exterior
Carlisle Barracks	U.S. Army	PA	450 (0)	North Exterior
Florence Military Reservation	Army National Guard	AZ	19,200 (100)	West Core
Fort Bliss	U.S. Army	TX	1,116,925 (65,000)	South Exterior
Holston Army Ammunition Plant	U.S. Army	TN	6,200 (5)	South Exterior
National Training Center and Fort Irwin	U.S. Army	CA	869,400 (4,700)	West Core
U.S. Army Garrison Miami	U.S. Army	FL	150 (0)	Southern Florida
Iowa Army Ammunition Plant	U.S. Army	IA	21,525 (800)	North Core

INRMP Name	Branch of Service	State	~Acres	MCU
Milan Army Ammunition Plant	U.S. Army	TN	22,400 (1,000)	South Exterior
Military Ocean Terminal Concord	U.S. Army	CA	5,800 (1,200)	Central Valley
Parks Reserve Forces Training Area	U.S. Army Reserve	CA	2,300 (1,600)	West Core
Pine Bluff Arsenal	U.S. Army	AR	13,025 (225)	South Exterior
Radford Army Ammunition Plant	U.S. Army	VA	4,050 (165)	South Exterior
San Diego Air Force Space Surveillance Station	Department of Air Force	CA	5 (0)	West Core
Sierra Army Depot	U.S. Army	CA	26,000 (350)	West Core
Seymour Johnson Air Force Base	Department of Air Force	NC	3,250 (50)	South Exterior
Yuma Proving Ground	U.S. Army	AZ	837,120 (400)	West Core
Whiteman Air Force Base	Department of Air Force	MO	5,300 (50)	South Core
Vermont Army National Guard Camp Johnson	Army National Guard	VT	720 (2)	North Exterior
Sites Not Covered by INRMP	***	Lower 48	2,731,110 (50,000)	All

- Sites were missing from Defense Installation Spatial Data Infrastructure (DISDI) FY2021 DOD_Site_Locations_Boundaries_Shapefile.

*INRMP covers installations in multiple states. States where sites are located are included in the INRMP Name for these entries.

**Camp Grafton North and South have two separate INRMPs, however the installation boundaries for these features are combined in the DISDI FY2021 DOD_Site_Locations_Boundaries shapefile. Installation acreage and grassland acre estimates within this table are for Camp Grafton North and South combined.

***Sites not covered by INRMPs include U.S. Army, U.S. Army Reserve, Army National Guard, Department of Air Force, Department of Air Force Reserve, Department of Air Force, U.S. Marine Corps, U.S. Marine Corps Reserve, U.S. Navy, U.S. Navy Reserve, and White House Services.