U. S. AIR FORCE

Draft

INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

Nellis Air Force Base

Nevada Test and Training Range

(See INRMP signature pages for plan approval date)

ABOUT THIS PLAN

This installation-specific Environmental Management Plan (EMP) utilizes the United States Air Force's (USAF's) standardized Integrated Natural Resources Management Plan (INRMP) template. This INRMP has been developed in cooperation with applicable stakeholders, which may include Sikes Act cooperating agencies and/or local equivalents, to document how natural resources will be managed. Non-United States territories will comply with applicable Final Governing Standards. Where applicable, external resources, including Air Force Instructions (AFIs); USAF Playbooks; federal, state, local, Final Governing Standards; executive orders; biological opinions (BOs); and permit requirements, are referenced.

Certain sections of this INRMP begin with standardized, USAF-wide "common text" language to address USAF and Department of Defense (DoD) policy and federal requirements. This common text language is restricted from editing to ensure that it remains standard throughout all plans. Immediately following the USAF-wide common text sections are installation sections. The installation sections contain installation-specific content to address local and/or installation-specific requirements. Installation sections are unrestricted and are maintained and updated by USAF environmental Installation Support Teams, and/or installation personnel.

NOTE: The terms "Natural Resources Manager," (NRM) and "NRM/Point of Contact" are used throughout this document to refer to the installation person responsible for the natural resources program, regardless of whether this person meets the qualifications within the definition of a natural resources management professional in DoDI 4715.03.

TABLE OF CONTENTS

LIST OF TABLES

198 **LIST OF FIGURES**
199

DOCUMENT CONTROL

Standardized INRMP Template

In accordance with (IAW) the Air Force Civil Engineer Center (AFCEC) Environmental Directorate (CZ) Business Rule (BR) 08, *EMP Review, Update, and Maintenance*, the standard content in this INRMP template is reviewed periodically, updated as appropriate, and approved by the Natural Resources Subject Matter Expert (SME).

This version of the template is current as of 26 June 2020 and supersedes the 2018 version.

NOTE: Installations are not required to update their INRMPs every time this template is updated. When it is time for installations to update their INRMPs, they should refer to the eDASH EMP Repository to ensure they have the most current version.

Installation INRMP

Record of Review—The INRMP is updated no less than annually, or as changes to natural resource management and conservation practices occur, including those driven by changes in applicable regulations. IAW the Sikes Act and Air Force Manual (AFMAN) 32-7003, *Environmental Conservation*, the INRMP is required to be reviewed for operation and effect no less than every five years. An INRMP is considered compliant with the Sikes Act if it has been approved in writing by the appropriate representative from each cooperating agency within the past five years. Approval of a new or revised INRMP is documented by signature on a signature page signed by the Installation Commander (or designee), and a designated representative of the United States Fish and Wildlife Service (USFWS), state fish and wildlife agency, and National Oceanic and Atmospheric Administration (NOAA) Fisheries, when applicable (AFMAN 32-7003).

Annual reviews and updates are accomplished by the installation Natural Resources Manager (NRM), and/or a Section Natural Resources Media Manager. The installation shall establish and maintain regular communications with the appropriate federal and state agencies. At a minimum, the installation NRM (with assistance as appropriate from the Section Natural Resources Media Manager) conducts an annual review of the INRMP in coordination with internal stakeholders and local representatives of USFWS, state fish and wildlife agency, and NOAA Fisheries, where applicable, and accomplishes pertinent updates. Installations will document the findings of the annual review in an Annual INRMP Review Summary. By signing the Annual INRMP Review Summary, the collaborating agency representative asserts concurrence with the findings. Any agreed updates are then made to the document, at a minimum updating the work plans.

INRMP APPROVAL/SIGNATURE PAGES

Add signature pages.

EXECUTIVE SUMMARY

This INRMP has been updated to reflect current and future natural resources management and protection at Nellis Air Force Base (NAFB) and the Nevada Test and Training Range (NTTR), and to provide for continued mission capability. The INRMP summarizes natural resources, mission resource needs, and provides a framework to manage natural resources accordingly. Natural resources are valuable assets of the USAF, and sound management of natural resources increases the effectiveness of USAF adaptability in all environments. The Sikes Act (16 United State Code [U.S.C.] 670a-670o, as amended) is the legal driver for the INRMP.

The Military Mission on Nellis Air Force Base and the Nevada Test and Training Range

The primary objective of USAF natural resources programs is to sustain, restore, and modernize natural infrastructure to ensure operational capability and no net loss in the capability of USAF lands to support the military mission. The primary responsibility of the USAF is to project American airpower to enhance the defensive capabilities of the U.S. The mission of the USAF Warfare Center on NAFB is to develop Airmen and advance warfighter capabilities through testing, training, and tactics development to dominate the multi-domain fight. The mission of the NTTR is to create, operate, and maintain live and synthetic environments and integrate partners to optimize warfighter capabilities.

The NTTR is the largest contiguous air and ground space available for peacetime military operations in the free world. The range occupies approximately 2.9 million acres of land, 5,000 square miles of airspace that is restricted from civilian air traffic over-flight, and another 7,000 square miles of Military Operating Area, which is shared with civilian aircraft. The 12,000-square nautical mile range provides a realistic arena for operational testing and training aircrews to improve combat readiness. A wide variety of live munitions can be employed on targets on the range. As such, NAFB and the NTTR support a variety of military testing and training operations. The ability to conduct realistic training and weapons testing in conditions similar to combat situations is crucial to the mission success of the USAF. The terrain, topography, and environmental conditions found on NAFB and the NTTR are similar to conditions found on modern battlefields. The most important natural resource required by the military mission is the remoteness and the general physical and biotic character of NAFB and the NTTR. Maintaining ecosystem integrity while sustaining the mission environment is of primary importance to the USAF when considering new projects, either internally or for other wings or directorates.

Natural Resources and the Military Mission

The Natural Resources Program supports the military's combat readiness mission by ensuring continued access to the 2.9 million acres of NAFB and the NTTR's land, air, and water resources needed to accomplish vital testing, training, and operational activities. The Natural Resources Program invests significant resources to implement long-term conservation programs, which, in turn, help sustain our nation's priceless natural heritage. Current key priorities include preventing new species listings, facilitating species de-listings, and encouraging off-base conservation to enhance on-base mission flexibility. NAFB and the NTTR landscapes are unique and increasingly rare. Healthy natural landscapes are critical to DoD's mission success, as DoD requires high quality lands, free of legal and environmental encumbrances, to conduct readiness activities. The Natural Resources Program strives to maintain the long-term sustainability of DoD's lands and resources to enable realistic, mission-essential testing, training, and operations. Protecting species and managing natural resources supports the military mission by strengthening imperiled species' populations and maintaining habitat and landscape resilience. By properly managing imperiled species, invasive species, fire, and other key natural resource issues on base, DoD can avoid or minimize mission impacts that could otherwise result in natural resources related restrictions or delays.

Approximately 5% of the land area of the NTTR is directly affected by mission activities (USAF 2017). Human disturbance (other than from the military) is minimized on the NTTR because of the high level of security which allows little to no public access. These management activities have resulted in 2.9 million acres remaining largely undisturbed by human activity. Consequently, the ecological communities occurring on the NTTR are less affected by anthropogenic activities (offroad vehicle impacts, introduction of exotic species, vandalism, littering, etc.) than similar communities occurring outside the range area. Continued proper management of natural resources at the NTTR will ensure that these healthy plant and animal communities will be conserved.

Due largely to its size and topography, NAFB and the NTTR encompass a remarkable assemblage of Great Basin and Mojave Deserts biodiversity. It is home to the Mojave desert tortoise (*Gopherus agassizii*), which is listed as threatened under the Endangered Species Act (ESA), and is also protected by the state of Nevada. In addition, 39 species of animals with some form of formal protection, either from the state of Nevada or the federal government, have been documented on NAFB and the NTTR. Appendix E provides a list of animal species that have either federal or state protected status and occur or have potential to occur on NAFB and the NTTR. This INRMP reflects cumulative survey data through 2020; the installation performs annual updates with recent data as reports become finalized.

The INRMP has been developed to support the military mission while facilitating effective ecosystem and natural resource management for NAFB and the NTTR. The INRMP is designed to minimize the effects of military operations on natural resources and develop an appropriate framework for ecosystem-wide natural resources management. The INRMP provides guidance for minimizing impacts to natural resources from new construction or expansion projects. It ensures that landscaping at new construction areas and some existing facilities will plant climate-resilient species, especially where development interfaces with natural habitats. The INRMP also ensures that sensitive habitats that support species like the Mojave desert tortoise are also considered during planning, site selection, and decision-making processes.

General natural resources management goals for NAFB and the NTTR are listed below.

- Ensure long-term wildlife and ecosystem viability on NAFB and the NTTR in support of the military mission by conducting targeted surveys and monitoring for threatened, endangered, and sensitive species.
- Sustain and protect sensitive plant and animal species and natural habitats to support the military mission and preserve biodiversity in a changing climate.
- Maintain compliance with federal, state, local, and military regulations.
- Protect life, property, and resources from wildfire at costs commensurate with values at risk.
- Update the natural resources management database and geographic information system (GIS) to comply with Spatial Data Standards for Facilities, Infrastructure, and Environment (SDSFIE) standards and provide the foundation for management.

Regulatory Authority

The authority to establish natural resources management programs at DoD installations is provided by 16 U.S.C. 670, also known as the Sikes Act (Conservation Programs on Military Installations). The INRMP is prepared under the guidance of AFMAN 32-7003 20 April 2020 (Environmental Conservation) as implemented by Air Force Policy Directive 32-70 (Environmental Considerations in Air Force Programs and Activities) and DoD Instruction 4715.03 (Natural Resources Conservation Program). Additional governing laws include the Endangered Species Act (ESA), Clean Water Act, the Migratory Bird Treaty

Act, Bald and Golden Eagle Protection Act, and the House of Representatives 639-25 National Defense Authorization Act of 2021 Title XXVII Subtitle E Section 2843.

Conclusion

It is the intent and purpose of the INRMP to support the military mission while conserving the natural resources found on NAFB and the NTTR. The INRMP will provide guidance to ensure mission sustainability in accordance with the Sikes Act and Public Law 10665, will support the military mission through compliance with Sec. 670a of the ESA, and will ensure no net loss in the capability of NAFB and the NTTR lands to support the military mission.

1.0 OVERVIEW AND SCOPE

This Integrated Natural Resources Management Plan (INRMP) was developed to provide for effective management and protection of natural resources. It summarizes the natural resources present on the installation and outlines strategies to adequately manage those resources. Natural resources are valuable assets of the United States Air Force (USAF). They provide the natural infrastructure needed for testing weapons and technology, as well as for training military personnel for deployment. Sound management of natural resources increases the effectiveness of USAF adaptability in all environments. The USAF has stewardship responsibility for the physical lands on which installations are located to ensure all natural resources are properly conserved, protected, and used in sustainable ways. The primary objective of the USAF natural resources program is to sustain, restore, and modernize natural infrastructure to ensure operational capability and no net loss in the capability of USAF lands to support the military mission of the installation. The plan outlines and assigns responsibilities for the management of natural resources, discusses related concerns, and provides program management elements that will help to maintain or improve the natural resources within the context of the installation's mission. The INRMP is intended for use by all installation personnel. The Sikes Act is the legal driver for the INRMP.

1.1 Purpose and Scope

The INRMP provides practical guidelines for the management of natural resources on Nellis Air Force Base (NAFB) and the Nevada Test and Training Range (NTTR). The plan provides informational context for the natural resources; assigns roles and responsibilities of management; defines management goals, objectives, and projects; and ensures compatibility of the mission and natural resources management. The INRMP provides guidance to ensure environmental law compliance while sustainably managing natural resources for future mission use. An additional purpose of the INRMP is to ensure integration with other installation plans, avoid conflicts, and promote mission execution.

A key priority of this INRMP is the continued sustainable management of natural resources. The INRMP will provide for the protection and management of known sensitive resources while supporting well-informed mission uses elsewhere. Data collection projects planned in the INRMP are critical not only to protect sensitive resources, but also to fill data gaps about installation natural resources and responsibly inform mission planning efforts. The INRMP will serve as a guide to prioritize and fill data gaps through its goals, objectives, and projects.

The INRMP provides the framework for a geographic information system (GIS) database and its use for natural resource management and planning. Natural resources data acquisition and GIS provide critical tools for mission planning. The GIS database is used by resource managers to identify sensitive areas on NAFB and the NTTR; thus, new facilities and targets can be sited to meet mission requirements while minimizing environmental impacts. This database is also useful for developing environmental assessments (EAs), environmental impact statements (EISs), and other planning documents.

1.2 Management Philosophy

The INRMP serves as a key component of the Installation Development Plan (IDP), which provides background and rationale for the policies and programming decisions related to land use, resource conservation, facilities and infrastructure development, and operations and maintenance to ensure that they meet current requirements and provide for future growth. The INRMP fosters environmental stewardship by identifying the natural resources on the installation and developing management goals for these resources. The management objectives are then integrated into mission operations and support requirements and regulatory compliance to minimize natural resource constraints.

This INRMP is organized into the following principal sections:

- An overview of current and potential future conditions of installation natural resources (Sections 2.2, 2.3);
- Identification of potential impacts to or from natural resources (Section 2.4);
- Management roles and responsibilities (Section 4.0);
- Key natural resource management areas addressed (Sections 7.1, 7.4);
- Management recommendations that incorporate the installation's goals and objectives for natural resource management areas (Section 8.0); and
- Specific work plans for effective implementation of the INRMP (Section 10.0).

The INRMP was developed using an interdisciplinary approach and is based on existing information about the physical and biotic environments, mission activities, and environmental management practices at NAFB and the NTTR. Information was obtained from a variety of documents, interviews with installation personnel, on-site observations, and communications with both internal and external stakeholders. Coordination and correspondence with these agencies are documented in accordance with 32 Code of Federal Regulations (CFR) 989, *Environmental Impact Analysis Process* (EIAP).

The goal in managing ecosystems on NAFB and the NTTR is to support the military mission through conservation and enhancement of ecosystem integrity. USAF activities on NAFB and the NTTR comply with said laws and avoid issues that could slow or halt mission activities. Furthermore, through a proactive conservation strategy, the USAF can align the interests of the military mission with those of regulatory agencies. The INRMP uses the principles of ecosystem-based management (Air Force Manual [AFMAN] 32-7003, Department of Defense Instruction [DoDI] 4715.03). Ecosystem-based management focuses on maintaining the health of ecosystems and ecosystem processes, including hydrological processes and disturbance processes such as wildfire, rather than on managing specific species. This approach maintains and improves the sustainability and biological diversity of ecosystems while supporting sustainable economies, human use, and the environments required for realistic military training operation (DoDI 4715.03). NAFB also implements adaptive management. Adaptive management is a systematic process for continually improving natural resources management policy and practices by continually monitoring current operations and applying lessons learned to modify these programs as warranted (AFMAN 32-7003 3.41.3.3). Adaptive management will help ensure proper management of natural resources, given the highly variable nature of the ecosystems on NAFB and the NTTR.

Climate change adaptation strategies described in this plan are in alignment with ecosystem management and adaptive management approaches. Most depictions of the adaptive management cycle for climate change include phases for planning, acting, and evaluating. Managers should explicitly address vulnerabilities to changing climate at several stages of the adaptive management cycle. For guidance on the adaptive management process, a comprehensive guide has been developed to assist Department of Defense (DoD) installations (Stein et al. 2019).

Most of the NTTR is undisturbed and ecologically intact, but disturbed areas require special attention. Military operations directly impact approximately 5% of the NTTR; however, a legacy of disturbance from ranching and mining activities on portions of the North Range of the NTTR must be accounted for in management and remediation planning. The slow recovery of disturbed desert ecosystems necessitates patient and far-sighted approaches to natural resources management. Many disturbed sites will not return to their pre-disturbance structure and function for decades. If such areas are to benefit from environmental restoration, remediation activities should begin at the earliest practical opportunity. Long-term monitoring

is also essential, given the variability of weather, disturbances, growing seasons, and slow recovery rates of disturbed desert ecosystems.

1.3 Authority

The Sikes Act, 16 United States Code (USC) § 670a, requires an INRMP be written and implemented for all DoD installations with significant natural resources. This plan has been developed cooperatively between the installation, U.S. Fish and Wildlife Service (USFWS), Bureau of Land Management (BLM), and the Nevada Department of Wildlife (NDOW). The USAF natural resources program ensures continued access to land, air, and water resources to conduct realistic military training and testing, as well as to sustain the long-term ecological integrity of the resource base.

This INRMP is developed under, and proposes actions in accordance with (IAW), applicable DoD and USAF policies, directives, and instructions. AFMAN 32-7003 provides the necessary direction and instructions for preparing an INRMP. Issues are addressed in this plan using guidance provided under legislation, Executive Orders (EOs), Directives, and Instructions including DoDI 4715.03; Air Force Policy Directive (AFPD) 32-70, Environmental Quality; and AFMAN 32-7003. DoDI 4715.03 provides direction for DoD installations to establish procedures for an integrated program for multiple-use management of natural resources. AFPD 32-70 discusses general environmental quality issues, including proper cleanup of polluted sites, compliance with applicable regulations, conservation of natural resources, and pollution prevention. AFMAN 32-7003 provides guidance on the preservation of cultural resources at USAF installations. Appendix A, the "Annotated Summary of Key Legislation Related to Design and Implementation of the INRMP" Table, summarizes key legislation and guidance used to create and implement this INRMP.

This plan summarizes potential future changes in climate at the installation and discusses the implications of these changes for natural resources and the mission. By incorporating climate change considerations into relevant sections of this plan, the installation addresses DoD climate change guidance, including guidance from DoD Directive 4715.21, Department of Defense Manual 4715.03, and AFMAN 32-7003, which are further described in the Colorado State University Center for Environmental Management of Military Lands (CSU CEMML; hereafter "CEMML") Climate Assessment (CEMML 2019). Wildlife-specific laws, such as the Endangered Species Act (ESA) and the Migratory Bird Treaty Act (MBTA) are discussed in Section 2.3.4. Installation-specific policies, including state and local laws and regulations, are summarized below.

Installation-specific Policies, Laws, and Guidance

Public Land Order 4079, dated 31 August 1966, as amended by Public Law (PL) 106–65 (Sec. 3011[b][3]), established the Desert National Wildlife Refuge (DNWR) for the protection, enhancement, and maintenance of wildlife resources, including bighorn sheep. Under PL 106-65, the USAF was given primary jurisdiction over 112,000 acres of DNWR. Public law 106-65 directs the USAF and the Department of the Interior (DoI) to collaboratively manage the Joint Use Area of the DNWR, the terms for which are described by a Memorandum of Understanding (MOU) between USFWS and USAF. However, areas outside the impact zones but still within the DNWR must be managed in accordance with the purposes of the DNWR. Management of these areas is guided by the DNWR Comprehensive Conservation Plan, the primary natural resource management plan for the Refuge. The withdrawn lands have been extended to 2046 by House Resolution (H. R.) 639-25 National Defense Authorization Act of 2021 Title XXVII Subtitle E Section 2843.

PL 106-65 also defines the BLM's management responsibilities on withdrawn lands to include the protection of wildlife and wildlife habitat, control of predatory and other animals, and the prevention and

595 appropriate suppression of brush and range fires resulting from non-military activities. If a wildfire occurs
596 on the NTTR, fire suppression will be requested from BLM in accordance with the Military Lands
597 Withdrawal Act of 1999 and the MOU between NAFB and BLM.

598 Installation-specific policies, including state and local laws and regulations, are summarized in below in
599 Table 1-1.

Table 1-1. Installation specific policies.

Installation-Specific Policies (including State and/or Local Laws and Regulations)	
Federal Laws	
Title	**Description**
Desert National Wildlife Refuge Comprehensive Conservation Plan (USFWS 2009b)	Goals include maintaining and restoring, when necessary, healthy populations of wildlife in general and bighorn sheep in particular on DNWR lands.
Executive Order 7373 Establishing the Desert Game Range, Nevada, dated 20 May 1936	Established the Desert Game Range in Nevada.
Public Land Order 4079, dated 31 August 1966, as amended by Public Law 106–65 (Sec. 3011[b][3])	Established the DNWR for the protection, enhancement, and maintenance of wildlife resources, including bighorn sheep.
H. R. 639-25 National Defense Authorization Act of 2021 Title XXVII Subtitle E Section 2843.	Extended the land withdrawal until 2046.
1962 Cooperative Agreement between NAFB Commander and BLM Nevada State Director	Established the Nevada Wild Horse Range for the management of wild horses.
State Laws	
Nevada Administrative Code (NAC) 503, Hunting, Fishing and Trapping; Miscellaneous Protective Measures	Nevada regulations that define protected species of mammals, birds, fish, amphibians, and reptiles, and proper permitting processes.
NAC 527- Protection and Preservation of Timbered Lands, Trees and Flora	Nevada regulations that define protected flora, and proper permitting processes.
Nevada Revised Statute (NRS) 503.595, Prevention or alleviation of damage caused by wildlife	After the owner or tenant of any land or property has made a report to the Department indicating that such land or property is being damaged or destroyed, or is in danger of being damaged or destroyed, by wildlife, the Department may, after thorough investigation and pursuant to such regulations as the Commission may promulgate, cause such action to be taken as it may deem necessary, desirable and practical to prevent or alleviate such damage or threatened damage to such land or property.
NRS 503.597, Introduction or removal of aquatic life or wildlife: Approval required; investigation; regulations; penalties.	Regulates the introduction or removal of aquatic life or wildlife within bodies of water within Nevada.

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1.4 Integration with Other Plans

NAFB and the NTTR have many installation-specific plans other than the INRMP. Integration and support of these plans within the INRMP is essential to avoid conflicts and mission impacts. These plans often work in tandem; however, personnel must be aware of and mitigate any conflicting priorities or activities. Nellis Natural Resources Program (NNRP) personnel are responsible for collaboration with other NAFB and the NTTR offices to ensure mutual support and effectiveness of installation plans. As such, clear internal communication at NAFB and the NTTR is essential.

The INRMP is "integrated" because

- It brings together USAF mission requirements and natural resource management goals within a single document;
- It communicates federal, state, and local regulations, requirements, and USAF Policy;
- It is mutually supportive and not in conflict with other installation plans;
- It is derived from multiple scientific disciplines;
- It describes an ecosystem approach to environmental management, considering information from the environment; and
- It provides guidelines to sustain and conserve native vegetation on the NTTR and to maintain realistic training areas.

The INRMP supports many other installation-specific processes and plans. These plans include the EIAP, Air Installation Compatible Use Zone (AICUZ) program, the Bird Aircraft Strike Hazard (BASH) plan, Golf Course Environmental Management plan (GEM), Installation Cultural Resources Management Plan (ICRMP), IDP, the NAFB Installation Pest Management Plan (NAFB IPMP), Stormwater Pollution Prevention Plan (SWPPP), Urban Forest and Landscape Plan, and the Wildland Fire Management Plan (WFMP). The EIAP, BASH, ICRMP, NAFB IPMP, Urban Forest and Landscape Plan, and the WFMP are further discussed in Section 7.0.

Other installation plans considered by the INRMP are listed below in Table 1-2

Table 1-2. Nellis Air Force Base and the Nevada Test and Training Range plans and programs.

Plans and Programs	
Air Installation Compatible Use Zone (AICUZ) Program	The program achieves compatibility between air installations and neighboring communities. Given that land use is a large component of the AICUZ program, the INRMP delineates how future development is to be overseen from an environmental perspective. It also indicates which pertinent laws, regulations, and collaborations must be addressed regarding changes in land use and construction.
Bird/Wildlife Aircraft Strike Hazard (BASH) Plan	Bird and wildlife aircraft strike hazard avoidance and mitigation actions. To avoid potential aircraft collisions with birds and wildlife, USAF installations must develop a BASH plan. BASH plans and INRMPs are mutually supportive in that both plans aim to reduce the number of birds and wildlife that are struck by planes while also ensuring any activities conducted to reduce these collisions promote the USAF mission.
Golf Course Environmental Management (GEM) Plan	Provides guidance on natural resource management for the NAFB golf course.
Installation Cultural Resources Management Plan (ICRMP)	Provides guidance on cultural resources management for NAFB and the NTTR.
Installation Development Plan (IDP)	Master plan describing all future development and mission focus on base. The INRMP supports the IDP by providing critical background information essential for installation planning decisions. The INRMP also provides for management to balance natural resources management with mission-essential development.
NAFB Installation Pest Management Plan (NAFB IPMP)	Pest management standard operating procedures and a workplan for pest management. The INRMP supports the NAFB IPMP by planning and implementing invasive species control efforts; the NAFB IPMP supports the INRMP by providing the legal, logistical, and procedural foundations for managing invasive species.
Stormwater Pollution Prevention Plan (SWPPP)	Provides guidance to prevent installation-produced pollution from entering local waterways.
Urban Forest and Landscape Plan	Provides guidance for urban forest and landscaping practices across the installation.
Wildland Fire Management Plan (WFMP)	Describes management focus, strategy, standard operating procedures, and workplan for wildland fire management on base. The INRMP supports the WFMP by driving the need for fire management. Whereas the WFMP provides guidance, responsibilities, and procedures for the prevention and suppression of wildfires on all NAFB and the NTTR lands and to implement ecosystem management and fuels reduction goals using mechanical fuel treatments and prescribed fire in support of the INRMP.

626

2.0 INSTALLATION PROFILE

Table 2-1 below provides a key overview of notable installation characteristics and points of contact (POC).

Table 2-1. Installation profile.

Installation Profile Table	
Feature	**Description**
Office of Primary Responsibility (OPR)	99 CES/CEIEA has overall responsibility for implementing the natural resources management program and is the lead organization for monitoring compliance with applicable federal, state, and local regulations.
Natural Resources Manager/Point of Contact (POC)	**Name**: Anna Johnson Phone: (702) 652-4354 Email: anna.johnson.18@us.af.mil **Name**: Olivia Curtis Phone: (702) 652-7606 Email: olivia.curtis@us.af.mil
State and/or local regulatory POCs	USFWS: Southern Nevada Fish and Wildlife Office NDOW BLM
Total acreage managed by installation	2,980,531
Total acreage of wetlands	44
Total acreage of forested land	189,600
Does installation have any Biological Opinions?	Programmatic Biological Opinion for Activities and Expansion of the NTTR. Number 08ENVS00-2018-F-0028, 16 August 2018. Programmatic Biological Opinion for Implementation of Action Proposed on Nellis Air Force Base and the Small Arms Range. Number _____, _____.
Natural Resources Program Applicability	☒ Fish and Wildlife Management ☒ Outdoor Recreation and Access to Natural Resources ☐ Conservation Law Enforcement ☒ Management of Threatened, Endangered, and Host Nation-Protected Species ☒ Water Resource Protection ☒ Wetland Protection ☒ Grounds Maintenance ☒ Forest Management ☒ Wildland Fire Management ☐ Agricultural Outleasing ☒ Integrated Pest Management Program ☒ Bird/Wildlife Aircraft Strike Hazard (BASH) ☐ Coastal Zone and Marine Resources Management ☒ Cultural Resources Protection ☒ Public Outreach ☒ Geographic Information Systems (GIS)

2.1 Installation Overview

2.1.1 Location and Area

NAFB and the NTTR are located in southern Nevada, within the Las Vegas Valley. NAFB is located to the northeast of Las Vegas, within the city of North Las Vegas (Figure 2-1). The NTTR is located generally to the north of Las Vegas, and encompasses a significant portion of the southern Nevadan desert (Figure 2-2).

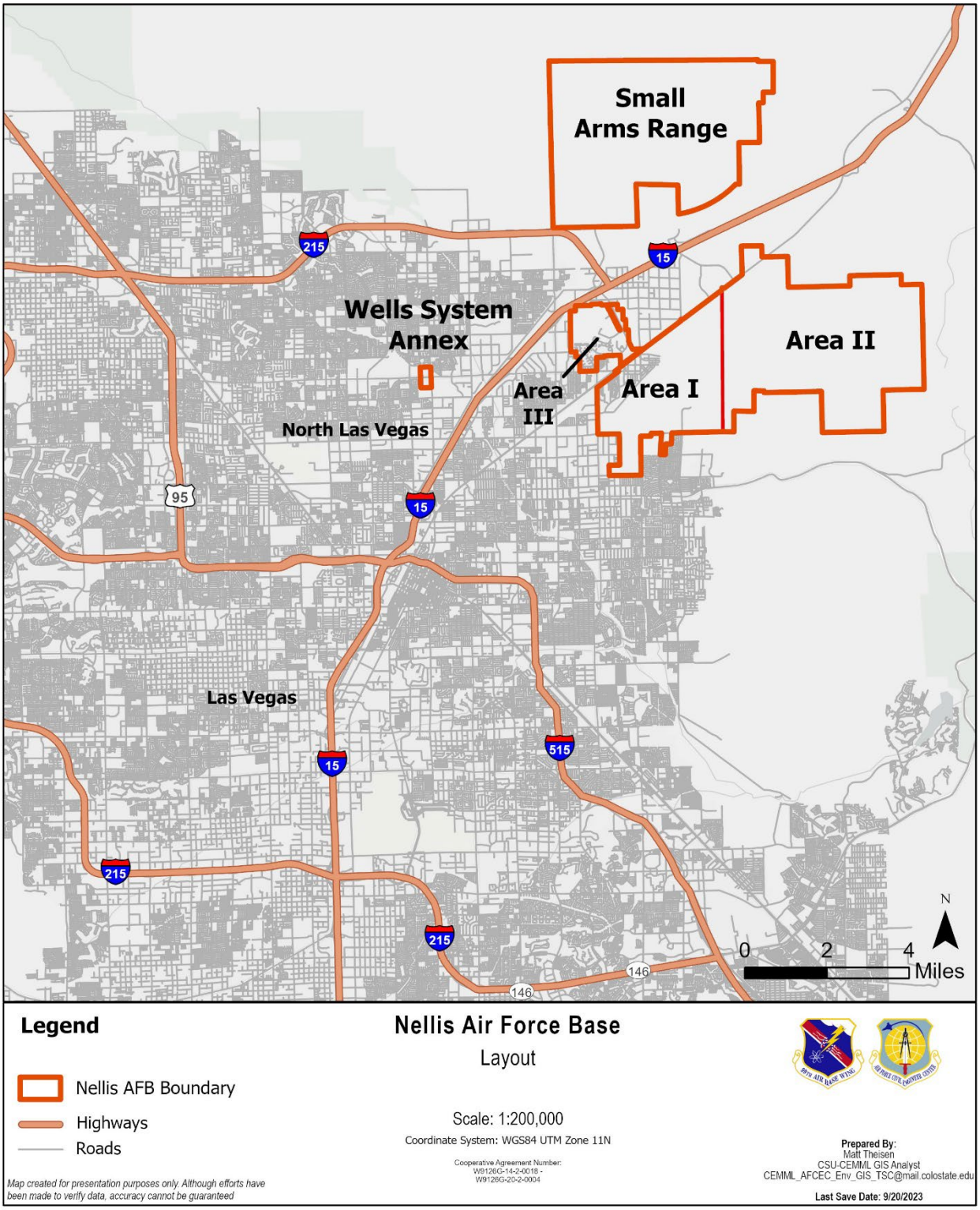


Figure 2-1. Layout of Nellis Air Force Base and the Small Arms Range.

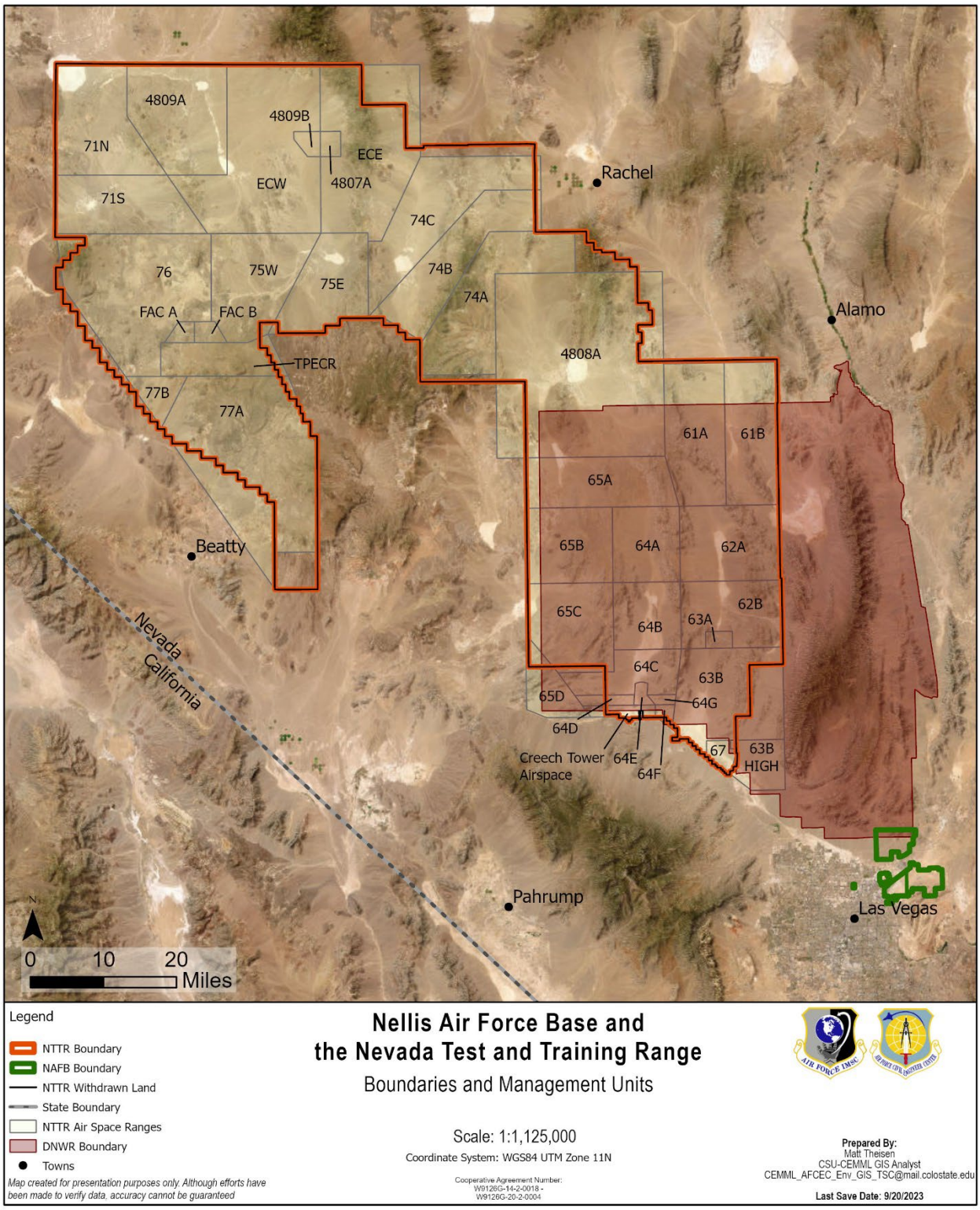


Figure 2-2. Nellis Air Force Base and the Nevada Test and Training Range boundaries and management units.

A description of the installation's main base and Geographically Separate Units (GSUs) is given in Table 2-2.

Table 2-2. Installation/Geographically Separated Unit location and area descriptions.

Installation/ GSU	Main Use/ Mission	Acreage	Addressed in INRMP?	Natural Resource Implications
Nellis Air Force Base	Administrative, Training	16,439.12	Yes, throughout	DT; RP; SOC
Nevada Test and Training Range	Training, Testing	2,949,603	Yes, throughout	DT; RP; SOC; WH; RH
Small Arms Range	Training, Testing	11,489.45	Yes, throughout	DT; SOC; RP
Nellis Water Annex System (North)		32.51	No	
Nellis Water Annex System (South)		38.65	No	

Abbreviations: DT (Desert tortoise); SOC (Species of Concern); RP (Rare Plant); WH (Wild Horses); RH (Riparian Habitat)

2.1.1.1 Nellis Air Force Base

NAFB is located approximately eight miles northeast of the City of North Las Vegas in Clark County, Nevada (Figure 2-1). It occupies approximately 16,510 acres and its average elevation is approximately 1,900 feet above mean sea level (MSL). NAFB is divided into three areas. Area I includes base facilities southeast of Las Vegas Boulevard. Aircraft facilities, administrative buildings, residential housing, recreation facilities, and personnel services are located here. Area II is directly adjacent to Area I on the east. Area II houses the 820th Rapid Engineer Deployable Heavy Operational Repair Squadron Engineers (REDHORSE) Squadron, 896th Munitions Squadron, and the nation's largest above-ground weapons storage complex. Area III, located northwest of Las Vegas Boulevard and Areas I and II, includes the Mike O'Callaghan Federal Hospital, administrative areas, an Air Force Reserve center, a solar energy development, industrial facilities, and the Conservation Area.

The Nellis Water System Annex, a small lot (85 acres) of disturbed desert one mile west of the NAFB main gate on Craig Road, is also managed by NAFB. The Small Arms Range (SAR) is the final piece of NAFB. The SAR comprises 11,489 acres. It lies three miles north of NAFB and Interstate 15, east of County Highway 215, west of U.S. Highway 93, and south of the DNWR. Except for a few buildings and access roads to support a small-arms firing range, the SAR is undeveloped desert scrub. Its elevation ranges from 2,100 to 3,600 feet MSL.

2.1.1.2 Nevada Test and Training Range

The NTTR covers approximately 2.9 million acres of federally owned lands that were withdrawn from DoI management for military use under PL 106-65. The NTTR is located northwest of NAFB, and its closest border is approximately 20 miles from NAFB. The NTTR is a unique range area because it has excellent flying weather year-round. The physical and environmental conditions on the NTTR provide a realistic arena for operational testing and training aircrews to improve combat readiness. Restricted public access combined with the remoteness of the NTTR allows the use of a wide variety of live munitions.

The NTTR, often collectively referred to as the "Range," is divided into two parts. The South Range occupies approximately one-third of the total NTTR lands. The North Range accounts for the remaining two-thirds. The NTTR accounts for almost one-third of the nine million acres of USAF lands in the U.S. It

lies in portions of Clark, Lincoln, and Nye Counties, northwest of the city of Las Vegas. The North Range includes the 1,330,540-acre Nevada Wild Horse Range (NWHR), established in 1962. The boundaries and management units that make up the North and South Ranges are shown in Figure 2-2.

2.1.2 Installation History

2.1.2.1 Nellis Air Force Base

Between 1929 and 1941, NAFB property was used for private flight operations. The base at that time consisted of dirt runways, a few buildings, and some utility service. The City of Las Vegas purchased the property in 1941, and later offered it to the Army Air Corps (Paher 1971). The Army Air Corps Gunnery School used the site for training in 1941 and 1942. The USAF took command in 1949, and in 1950 renamed it Nellis Air Force Base. The Tactical Air Command assumed command of NAFB in 1958, and the Tactical Fighter Weapons Center was established there in 1966. The 554th Operations Support Wing was activated in 1979. Command responsibility for NAFB was transferred to the Air Combat Command (ACC) on 1 June 1992.

2.1.2.2 Nevada Test and Training Range

The lands of the NTTR were the domain of Native American tribes, including the Mojave, Shoshone, and Paiute peoples, before Euro-American settlement. Settlement of these areas by Euro-Americans began in the late 19th century. Cattle ranching brought small numbers of people to the area (Thompson and West 1881, Zanjani 1988, McMullen et al. 1995), but thousands came during the mining booms, particularly to areas around the towns of Tonopah and Goldfield in the early 1900s (Shearer 1905, Elliott 1966). The Mellan and Clarkdale mining districts were established in the 1930s. As the 20th century progressed, demand for vehicle access to the mines increased, which brought more roads into areas that would eventually become the NTTR (Shearer 1905, Carpenter et al. 1953, Zanjani 1988).

The NTTR was established in 1940, when approximately 846,000 acres of the Desert Game Range (now The DNWR) were reserved for use by the War Department as a weapons and gunnery range. Airfields and military lands added over time developed into the Nellis Range Complex. A December 1949 MOU (updated in 1997, 2013, and 2014) between USAF and USFWS permits the military to use the part of the DNWR that extends northwest from Las Vegas, over the Las Vegas, Sheep, and East Desert Mountain Ranges (USAF and USFWS 1997, 2013, 2014). Dry lakebeds in this area subsequently have been used by the military for air-to-ground and air-to-air bombing practice.

On the North Range, the Tonopah Test Range was among the areas designated by President Franklin D. Roosevelt to be included in the Las Vegas Bombing and Gunnery Range. This effectively superseded civilian titles in areas near Tonopah (NAFB 1993a), and in August of 1941, about 2,500 acres were transferred to NAFB jurisdiction. More than 82,500 acres were added to military uses in 1963. Originally developed as a training center for Army pilots, the adjacent Tonopah Army Air Field served over 6,000 personnel in 1940. The Tonopah Test Range was developed by the Atomic Energy Commission in 1957, and the four Roller Coaster events (atomic weapons tests) were carried out in 1963 and resulted in plutonium contamination of four areas totaling about 193 acres (Science Applications International Corporation, Inc., and Desert Research Institute [SAIC and DRI], 1999). Several divisions of the NTTR are used for electronic warfare, which began in 1975. The Stealth F-117A program was developed at the Tonopah Test Range (as acknowledged in 1988), and its 37th Fighter Wing was inactivated in 1992. Today, the NTTR covers about 2.9 million acres and is used for training, testing, and weapons evaluation by the USAF, U.S. Army, U.S. Marine Corps, U.S. Navy, Air National Guard, Department of Energy (DoE), reserve forces, and other federal agencies. Foreign military allies of the U.S. also train here.

2.1.3 Military Missions

2.1.3.1 Nellis Air Force Base

NAFB is a major focal point for advanced combat aviation training. Its mission is accomplished through an array of aircraft, including fighters, bombers, refueling aircraft; as well as aircraft used for transport, close-air support, command and control, and combat search and rescue. The NAFB workforce of about 9,500 military and civilians makes it one of the largest single employers in southern Nevada. The total military population numbers more than 40,000, including family members and military retirees in the area.

United States Air Force Warfare Center

The U.S. Air Force Warfare Center (AFWC) is located at NAFB and reports directly to the ACC Center. It was founded on 1 September 1966 as the U.S. Air Force Tactical Fighter Weapons Center, and later renamed AFWC.

The AFWC exists to ensure that deployed forces are well trained and well equipped to conduct integrated combat operations. From testing and tactics development programs to training schools and venues, AFWC provides airmen with proven and tested technology, the most current tactics, superb academic training, and a unique opportunity to practice integrated force employment. The AFWC vision, mission, and priorities are central to supporting the ACC's mission to provide dominant combat airpower for America with Warrior Airmen committed to excellence, trained to fly, fight, and win… airpower anytime, anywhere.

The mission of the AFWC is to develop innovative leaders and full-spectrum capabilities through responsive, realistic, and relevant testing, tactics development, and advanced training across the full spectrum of warfare. The AFWC's vision is a team of proud, professional, and highly skilled airmen who, through innovation, influence and support the USAF and Joint partners with responsive, realistic, and relevant testing, tactics development, and training across air, space, and cyberspace domains.

99th Air Base Wing

Activated in October 1995, 99 Air Base Wing (99 ABW) is the host wing for NAFB. The wing provides installation support for more than 10,000 personnel assigned to NAFB and the NTTR. Three groups are assigned to the wing: 99th Mission Support Group, 99th Medical Group, and the 799th Air Base Group.

99th Civil Engineering Squadron

The mission of the 99th Civil Engineering Squadron (99 CES) is to provide work and services in the management and custody of fixed real property. The Squadron plans, programs, justifies, acquires, designs, and constructs new facilities. They operate, maintain, repair, improve, and dispose of existing facilities and utility systems. The 99 CES establishes and trains Prime Base Engineers Emergency Force (BEEF) teams. The Squadron establishes and trains a civilian Continental United States (CONUS) Sustaining Force (SF) as required by the War Mobilization. Lastly, the 99 CES provides fire protection, crash rescue, environmental management, and sanitation services.

505th Command & Control Wing

The 505th Command and Control Wing, represented by the 505th Test and Evaluation Group at NAFB, oversees the operations of the 505th Test Squadron. The 505th Test Squadron's mission is to integrate air, space, and cyber capabilities by conducting operational test and evaluation, developing advanced tactics, techniques, and procedures supporting data exchange and architectures to ensure all source information is available to the warfighter. In addition, the 505th Test Squadron supports Combined Air and Space

Operations Center training to produce fully trained joint and multinational warfighters at the operational level of war.

Air Force Joint Test Program Office

The mission of the Air Force Joint Test Program Office is to generate, develop, and support Joint Test activities that enhance USAF capabilities and mission effectiveness in joint operations. The Office of the DoD Secretary is working on a project meant to help the services solve inter-service operational problems in a joint environment and alleviate test and evaluation difficulties through work on testing methodologies. The Air Force Joint Test Program Office provides continuous, proactive management of USAF participation in the Office of the Secretary of Defense Joint Test & Evaluation Program.

57th Wing

The 57th Wing provides advanced aerospace training to world-wide combat air forces and showcases aerospace power to the world while overseeing the dynamic and challenging flying operations at NAFB. It manages all flying operations at NAFB and conducts advanced aircrew, space, logistics, and command and control training through the USAF Weapons School, and DoD level exercises such as RED FLAG, GREEN FLAG, and NEPTUNE series. Important components of the training include adversary tactics replication (provided by the wing's aggressor squadrons) and graduate-level instruction and tactics development (accomplished through each of its schools). The wing also supports the AFWC's test and evaluation activities and showcases U.S. air power through the USAF Air Demonstration Squadron, the Thunderbirds.

57th Wing Safety

The 57th Wing Safety (57 WG SE) serves as the focal point to ensure safe flying operations for the largest Flying Hour Program in ACC. 57 WG SE ensures safety policies have been established by leadership to provide clear expectations and accountability for the safety and health of all Airmen, and supports leaders at all levels in integrating risk management into mission planning, daily operations, and off-duty activities to ensure their subordinates make responsible and informed decisions. 57 WG SE office's overall goal is to maintain a positive safety culture that prevents future losses of personnel and equipment by effectively mitigating the risks of both on and off-duty mishaps. To do this, 57 WG SE fosters an environment that empowers personnel at all levels to seek answers when they do not understand something, identify hazards, speak up when safety is a concern, and properly assess risk. On NAFB and the NTTR, the 57 WG SE office supports every Mission Design Series aircraft in the Air Force inventory and various Marine and Navy aircraft during training events and exercises throughout the year. These training events and exercises require a robust BASH program that 57 WG SE oversees and manages to ensure the safety of flight operations.Nevada Test and Training Range

The NTTR, formerly the 98th Range Wing, provides the warfighter a flexible, realistic and multidimensional battlespace to test tactics development and perform advanced training in support of U.S. national interests (Figure 2-2). The NTTR mission is to create, operate, and maintain live and synthetic environments and integrate partners to optimize warfighter capabilities.

The NTTR supports DoD advanced composite force training, tactics development, and electronic combat testing, as well as DoD and DoE testing, research, and development. The NTTR hosts numerous RED FLAG and USAF Weapons School exercises each year, as well as various test and tactics development missions. The NTTR also provides instrumentation and target maintenance support for GREEN FLAG–West at the National Training Center and Leach Lake Tactics Range.

The NTTR coordinates operational and support matters with major commands (MAJCOMs); other services; DoE and DoI; and other federal, state, and local government agencies. The NTTR acts as the single point of contact (POC) for Range customers.

The NTTR is a unique national military asset. The range provides the opportunity for weapons system testing combined with the highest level of training available for USAF personnel. The NTTR provides an aerial battlespace that includes a robust threat environment, varied target arrays, operational airspace, topographic complexity, security, and public safety buffers. The NTTR is the only location in the U.S. where both individual and large multi-force training can be conducted in a natural environment that simulates full-scale battlefield scenarios. The advanced level of training and testing that the NTTR offers is crucial to the survival of U.S. and allied military personnel and the success of the USAF mission to defend the U.S. and to secure and enhance U.S. interests and policies worldwide.

2.1.4 Natural Resources Needed to Support the Military Mission

The primarily air-based military mission at NAFB and the NTTR requires large expanses of land that are remote and undeveloped or uninhabited by non-military personnel. Much of the area is used for target and warfare maneuvers practice. A large buffer between the public and target or practice areas is required for security and safety.

Topographic and vegetative features of the area mimic land features in other parts of the world where the military may be involved. These areas can be used as the setting for practicing military maneuvers that may be used in those places. Thus, the most important natural resource used by the military mission is the remoteness and the general physical and biotic character of the area.

Healthy vegetation and stable soils also benefit the mission by providing a resilient environment for the military mission. Healthy native vegetation and wildlife also provide for compliance with numerous regulatory drivers and helps avoid compliance-driven mission restrictions. Maintaining native vegetation also provides resistance to wildfire, which could damage mission infrastructure, and impact or delay training.

2.1.5 Surrounding Communities

NAFB is in Clark County, which has a population of 2.32 million (Census Bureau 2023). Areas to the north and east of NAFB are undeveloped and mostly owned and managed by the BLM. To the west of NAFB is the city of North Las Vegas, with a population of just over 280,000 (Census Bureau 2023). Most of its land area is devoted to commercial and industrial development. South of NAFB is a commercial/industrial area, with some residential areas to the southeast. Because of the high growth rate of Las Vegas, continued development of land to the west, south, and northeast of NAFB is likely. However, close encroachment of development around NAFB is doubtful because of NAFB's lands acquisition and BLM ownership of land to the east.

The NTTR, in contrast, is more rural, with only a few small towns, including Tonopah, Goldfield, Beatty, Indian Springs, Alamo, and Rachel, all located on the periphery near the boundaries. Encroachment of development by these towns on the NTTR is unlikely.

2.1.6 Local and Regional Natural Areas

Several protected natural areas are in the vicinity of NAFB and the NTTR. The most prominent is the DNWR, which is owned and managed by the USFWS. Over 826,000 acres of the 1.5-million-acre refuge are within the boundaries of the South Range (Figure 2-2). That portion of the DNWR encompassing the

Spotted Range, the Pintwater Range, and most of the Desert Range, is managed as a proposed wilderness area. Public access to the DNWR is provided by two roads originating at the USFWS Corn Creek Field Station, approximately 23 miles north of downtown Las Vegas and east of US-95.

The DNWR is part of USFWS's Desert National Wildlife Refuge Complex. Management of the Complex includes three additional refuges: the 5,380-acre Pahranagat National Wildlife Refuge (NWR), the 116-acre Moapa Valley NWR east of the NTTR in Lincoln and Clark Counties, and the 23,528-acre Ash Meadows NWR in Nye County to the west. Together, the four refuges protect a broad range of native plants, invertebrates, and vertebrate species, some of which are rare or endemic to southern Nevada. In addition, the permanent lakes and marshes of the Pahranagat NWR are an important link in the Pacific Flyway for birds migrating between their summer and winter habitats. The three smaller units of the DNWR Complex provide unique aquatic and wetland habitats for plants and animals that are rare or nonexistent on NAFB and the NTTR.

Northwest of the DNWR are several Wilderness Study Areas (WSA) owned and managed by the BLM. These are located within the airspace boundaries of the NTTR, and include the 54,320-acre Kawich Mountain WSA, 106,200-acre South Reveille WSA, 99,550-acre Palisade Mesa WSA, and 38,000-acre The Wall WSA (USAF 2017). These areas are set aside to protect the wilderness characteristics of these lands until they are officially designated as wilderness areas or the BLM is directed to manage them for other multiple uses.

To the west of the NTTR and US-95 is the Spring Mountains National Recreational Area, administered primarily by the Humboldt-Toiyabe National Forest. The area covers approximately 316,000 acres in Clark and Nye counties and is managed for multiple use. It is adjacent to the Red Rock Canyon National Conservation Area, managed by the BLM, which covers approximately the same acreage. Adjacent to and southeast of NAFB lies the 1,500,000-acre Lake Mead National Recreation Area (LMNRA), administered by the National Park Service. The nation's first designated recreation area, it is shared by Nevada and Arizona and contains two reservoirs on the Colorado River: 100-mile-long Lake Mead and 68-mile-long Lake Mohave. Recreational opportunities include swimming, diving, boating, fishing, camping, picnicking, wildlife viewing, and hunting. LMNRA is a prominent stopover in the Pacific Flyway for migrating birds, and it provides a significant wintering area for the bald eagle (*Haliaeetus leucocephalus*) which is protected as a BLM Sensitive species and by; the Bald and Golden Eagle Protection Act (BGEPA); MBTA; Nevada Endangered Species Act, and is listed as a Nevada Species of Greatest Conservation Need (SGCN).

Three National Monuments (NM) are located near NAFB and the NTTR. Basin and Range NM covers 704,000 acres of near-roadless desert west of US-93 and north of Crystal Springs and Alamo, Nevada. Tule Springs Fossil Beds NM encompasses 22,650 acres between US-95 and DNWR south of the NTTR. Gold Butte NM spans 296,937 acres northeast of LMNRA and was created in 2016.

2.2 Physical Environment

This section of the INRMP describes the physical environment of NAFB and the NTTR. Data to inform this section's descriptions and figures is summarized from surveys conducted through 2020.

2.2.1 Climate

The NAFB and the NTTR are within the Arid-desert-hot (BWh), Arid-desert-cold (BWk), and Arid-steppe-cold (BSk) Kottek climate regions further described below.

Common characteristics of these climate zones include minimal precipitation and high evaporative potential. The BWk zone has average annual temperatures below 65 Fahrenheit (°F), and is typically warm

to hot in the summer, with cold, dry winters. BSk regions have slightly more precipitation than BWh and BWk climates, an average annual temperature of no more than 65 °F, and average temperature of one month of the winter below 32 °F.

Nellis Air Force Base

NAFB is located within the Mojave Desert, which is a BWh climate zone. The Mojave Desert's climate is characterized by mild winters and hot summers. It receives several nights of frost each year.

The climate summary below was extrapolated from recorded values at Harry Reid International Airport Table 2-3. This summary is generally representative of NAFB. In general, the most extreme high daily temperatures have occurred at Harry Reid International Airport from the mid-1970s to the present. Temperatures over 100 °F have occurred from the months of May through October. The highest temperature recorded was 117 °F, in June of 2017 and again in July of 2021. The most extreme minimum daily temperatures tended to occur pre-1995, with the lowest daily value of 8 °F occurring in January of 1963. These temperature trends of higher daily high extremes and fewer record low daily temperatures in more recent times are consistent with projections of warming temperatures under a changing climate. The highest daily maximum precipitation values are generally close to or over one inch per day, with the largest daily values occurring in January of 2018, with 1.33 inches, and August 1957, with 2.58 inches. Average annual total precipitation over the period of record was 4.04 inches, with a high of 9.89 inches in 1992 and a low of 0.57 inches in 1953. Notable drought occurred in Nevada during both the 1950s and early 2000s.

Table 2-3. Temperature and precipitation data recorded at Harry Reid International Airport, Nevada, 1949–2021.

Month	Mean Monthly Temperature (°F)		Mean Monthly Precipitation (inches)
	Max.	Min.	
January	57.2	35.9	0.54
February	69.8	45.9	0.4
March	68.2	48.6	0.4
April	78.4	53.0	0.2
May	88.1	62.1	0.15
June	99.1	71.7	0.07
July	104.4	78.3	0.42
August	102.3	76.4	0.42
September	94.6	68.2	0.29
October	81.2	55.7	0.25
November	66.8	43.7	0.37
December	57.0	35.9	0.39

Source: National Oceanographic and Atmospheric Administration, National Center for Environmental information https://www.ncei.noaa.gov/cdo-web/

902 Nevada Test and Training Range

903 The NTTR spans three climate zones, BWh, BWk, and BSk. BWh spans the southernmost third of the
904 NTTR, and BWk spans the northern half of the NTTR. BSk encompasses a small sliver on the northern
905 boundary of the NTTR. The elevation and latitude differences between the South and North Ranges result
906 in notable temperature and precipitation differences (El-Ghonemy et al. 1980).

907 The climate summary given below was extrapolated from recorded values at the DNWR weather station at
908 Corn Creek Field Station Table 2-4. This summary is generally representative of the South Range valleys.
909 Daily extreme temperatures for the months of May through October during 1940–2022 exceeded 100 °F.
910 The most extreme high temperature was recorded in July of 2003 at 117 °F. Most of the extreme daily low
911 temperatures for each month occurred pre-1985, although -8 °F was recorded in January 2003 and -12 °F
912 in December 2002. Daily extreme precipitation was over one inch for all months, with the largest daily total
913 rainfall of 2.05 inches recorded in December 1951. More recently, extreme daily precipitation amounts for
914 January and February of 1.15 inches and 1.90 inches were recorded in 2005. Annual precipitation varied,
915 with the greatest annual total precipitation recorded 14.77 inches in 2005, and the lowest of 0.69 inches in
916 2002, with an average total of 4.35 inches.

917

918

Table 2-4. Temperature and precipitation data recorded at the U.S. Fish and Wildlife Service's Corn Creek Field Station, Clark County, Desert Game Range, Nevada, 1941–2021.

Month	Mean Monthly Temperature (°F)		Mean Monthly Precipitation (inches)
	Max.	Min.	
January	57.4	30.0	0.44
February	61.9	33.2	0.51
March	68.1	38.0	0.51
April	76.6	44.5	0.32
May	85.9	52.7	0.18
June	96.2	60.7	0.1
July	101.8	67.5	0.38
August	99.6	65.9	0.41
September	92.5	58.1	0.35
October	80.0	47.1	0.34
November	66.2	36.5	0.34
December	57.1	30.2	0.51

Source: National Oceanographic and Atmospheric Administration, National Center for Environmental information https://www.ncei.noaa.gov/cdo-web/

919

920

921 The climate summary given below was extrapolated from recorded values at the Goldfield Nevada Table
922 2-5. Data were available only until 2010. This summary is generally representative of the North Range.

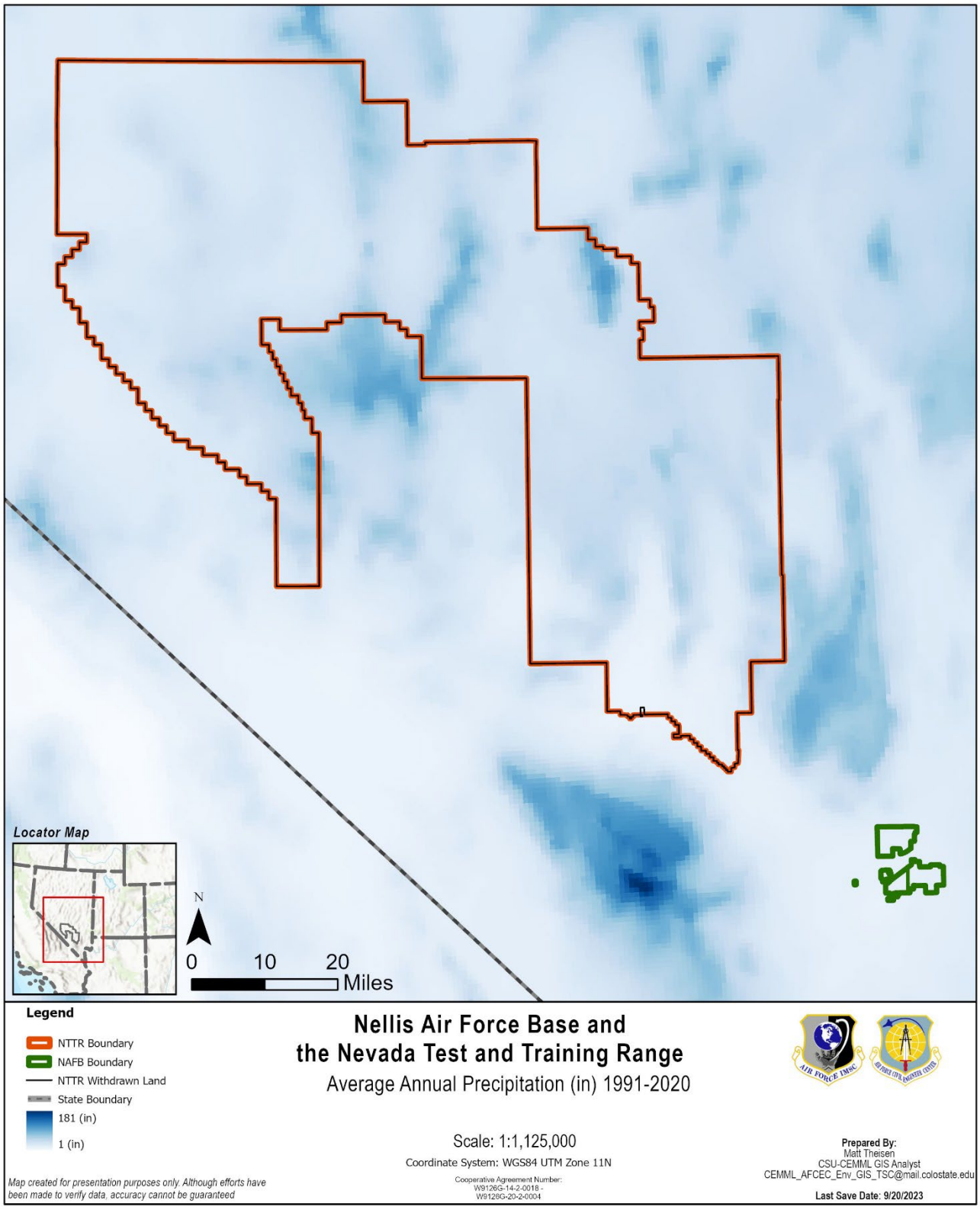
The North Range of the NTTR has a mean low temperature of 20.3 ºF in January. The mean high temperature occurs in July at 89.6 ºF, as extrapolated from data collected at the Goldfield weather station near Range 71. The NTTR experiences below-freezing temperatures during January (20.3 ºF), February (24.3 ºF), March (29.0 ºF), November (28.3 ºF), and December (21.5 ºF). Data collected on the South Range has never included a daily mean temperature below freezing in January. Precipitation is limited throughout the NTTR's North Range. The highest mean precipitation levels were recorded in February at 0.77 inches. December is documented experiencing the lowest average precipitation levels at 0.39 inches. January and March documented the same precipitation levels of 0.63 inches. Nearby Goldfield has a mean annual precipitation of 6.5 inches, whereas near the South Range, the mean annual precipitation is 4.3 inches (Ashby 1996).

Table 2-5. Temperature and precipitation data recorded at Goldfield, Nevada, 1906–2010.

Month	Mean Monthly Temperature (°F)		Average Total Precipitation (inches)
	Max.	Min.	
January	42.2	20.3	0.63
February	47.1	24.3	0.77
March	54.2	29.0	0.63
April	62.5	35.2	0.54
May	71.3	42.9	0.50
June	81.4	50.9	0.37
July	89.6	58.7	0.45
August	87.4	56.9	0.52
September	79.0	48.9	0.44
October	66.5	38.8	0.44
November	52.9	28.3	0.38
December	43.3	21.5	0.39

Source: Western Regional Climate Center, http://www.wrcc.dri.edu, Ashby 1996.

More rainfall occurs in the North Range than the South Range, due to its greater abundance of mountaintops that receive significantly more precipitation than valley floors. Nonetheless, the entire area lies within some of the most arid terrain in North America. Consistently strong winds, combined with low relative humidity, yield an annual evaporation rate exceeding precipitation by as much as 10 times. This limited rainfall coupled with vast undeveloped acreage contributes to making the NTTR ideal for military ground and air exercises and training. Average annual precipitation and average daily low and high temperatures are shown in Figure 2-3, Figure 2-4, and Figure 2-5 and are based on the 30-year historical baseline widely used in climate studies and models.



945

946 Figure 2-3. Average annual precipitation for Nellis Air Force Base and the Nevada Test and Training Range,
947 1991–2020.

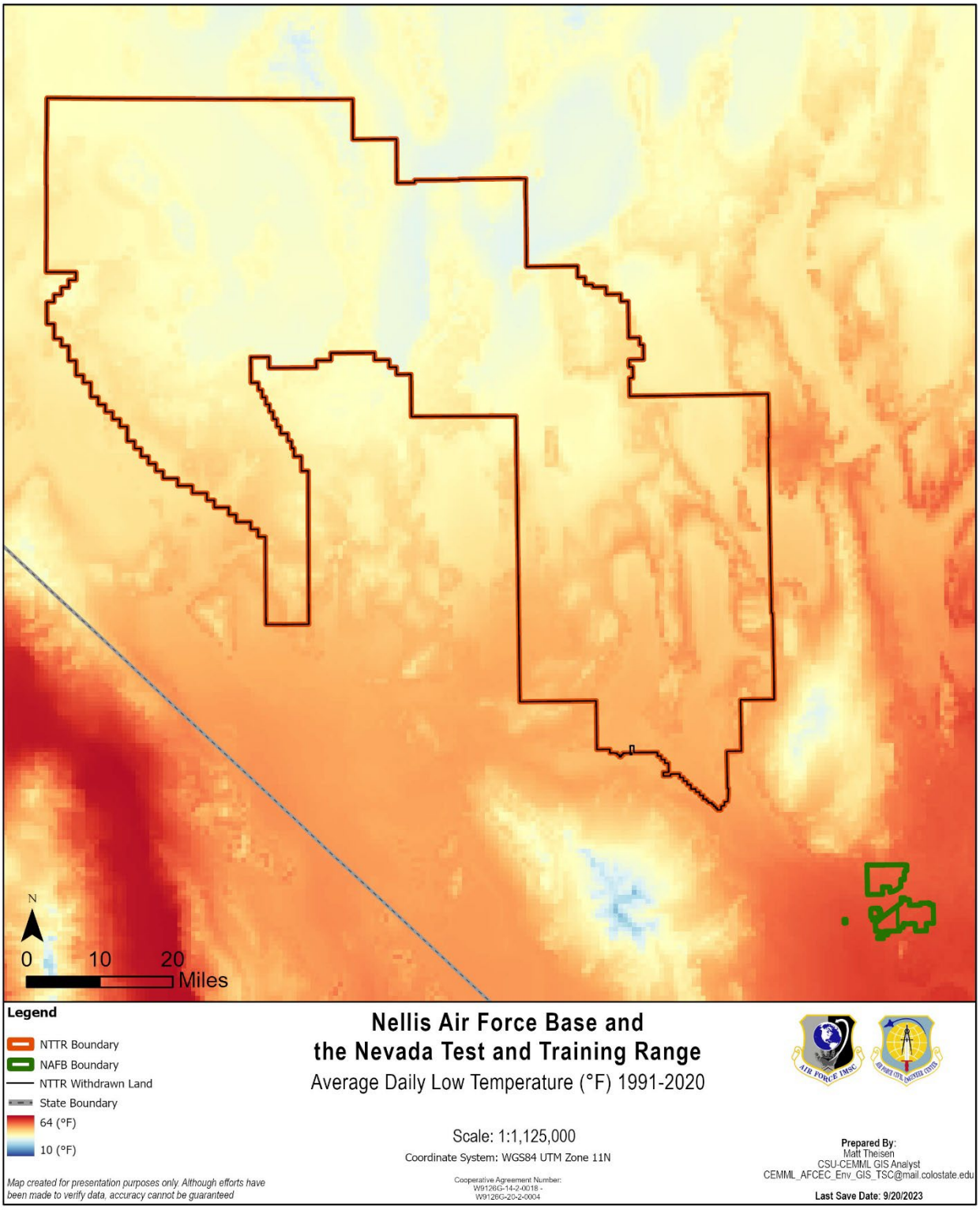


Figure 2-4. Average daily low temperature across Nellis Air Force Base and the Nevada Test and Training Range, 1991–2020.

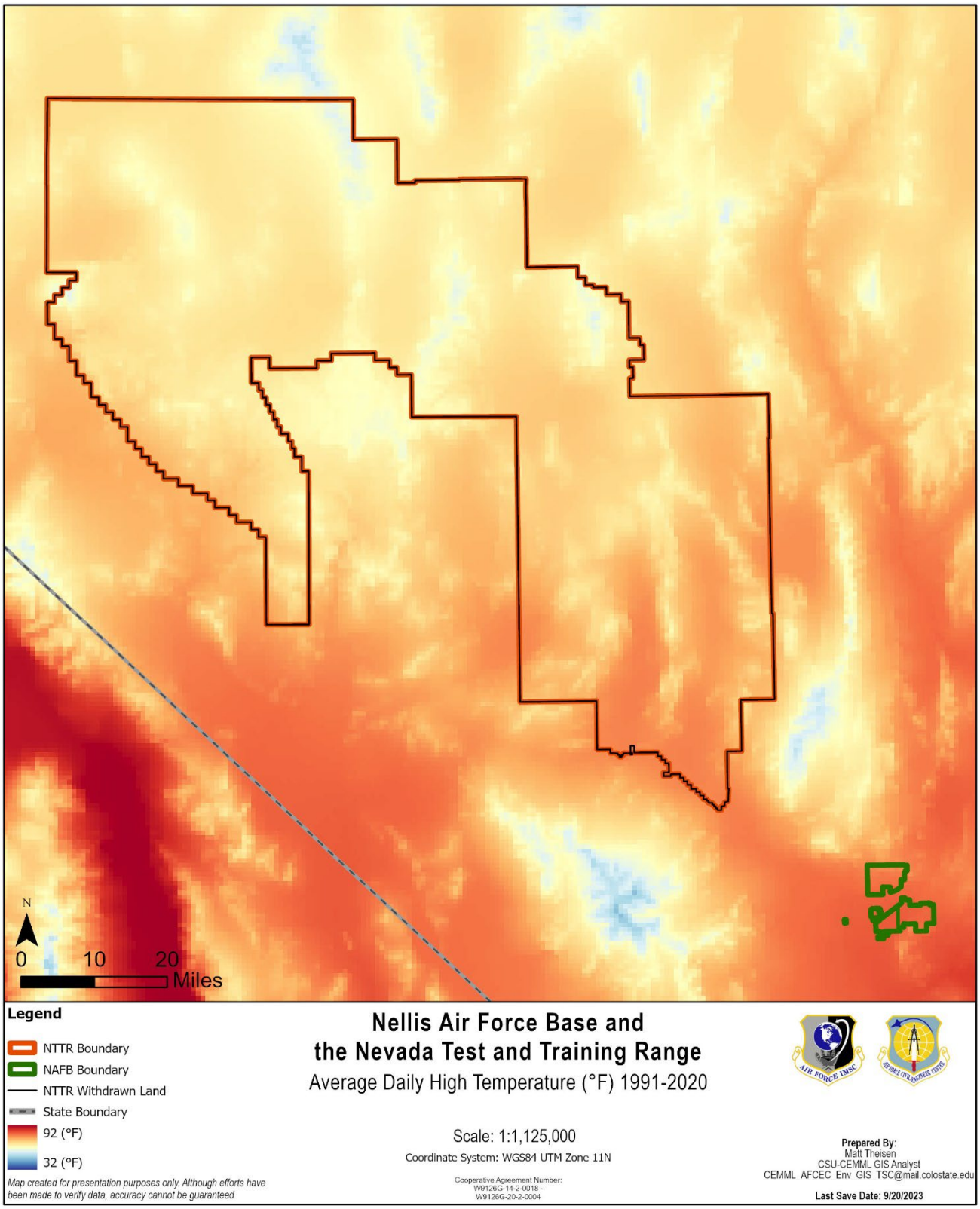


Figure 2-5. Average daily high temperature across Nellis Air Force Base and the Nevada Test and Training Range, 1991–2020.

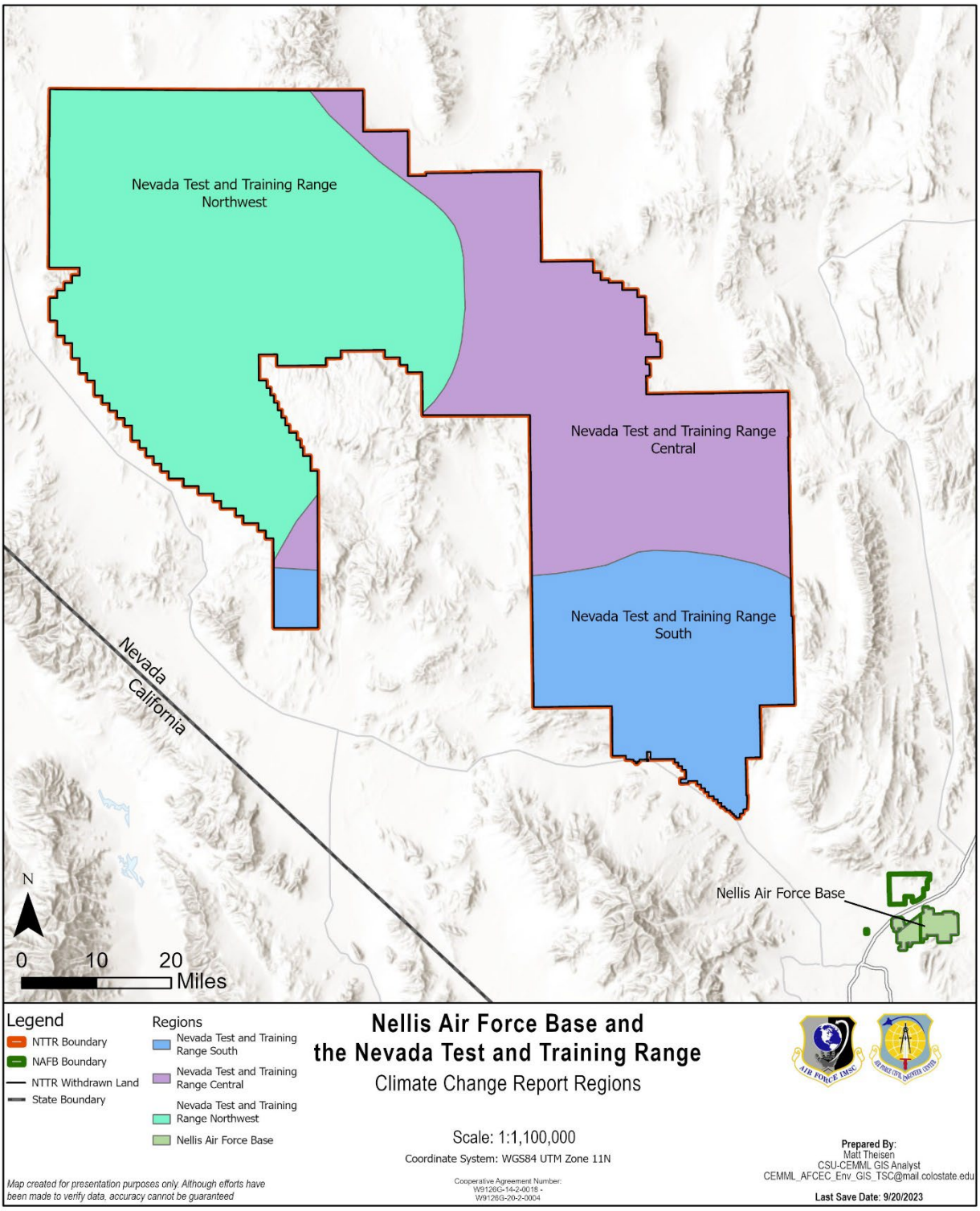
2.2.1.1 Climate Change Projections

CEMML developed site-level climate projections for NAFB and the NTTR. CEMML used the U.S. National Center for Atmospheric Research Community Climate System Model (CCSM4) simulations prepared for the Intergovernmental Panel on Climate Change (IPCC) 5th Assessment Report (Gent et al. 2011; Hurrell et al. 2013; Moss et al. 2007, 2010) to generate simulations for two Representative Concentration Pathway (RCP) scenarios: a moderate emissions scenario (RCP 4.5) and a higher emissions scenario (RCP 8.5). These scenarios were used to produce a time series of daily climate values for the decades centered around 2030 (2026–2035) and 2050 (2046–2055). Data from the CCSM4 model that had been downscaled to $1/16^{th}$ of a degree using the localized constructed analogs (LOCA) downscaling methodology was used to develop projections for the four future climate scenarios (Pierce et al. 2014). Which were then compared to the results to a 30-year historical baseline created from Daily Surface Weather and Climatological Summaries (DAYMET) (1980–2009).

NAFB and the NTTR are so expansive that climate projections were developed separately for four geographic regions: NAFB, NTTR South, NTTR Central, and NTTR Northwest (Figure 2-6). These region-specific projections are detailed within the subsections below. For more information about climate projections, reference the CEMML Climate Assessment (CEMML 2019).

In contrast to familiar and more linear physical processes, climate models such as CCSM4 may produce somewhat counterintuitive projections. The climate system is complex and driven by competing feedbacks and interactions among systems. Gaps in data about the influence of phenomena such as changes in globally significant ice sheets add to uncertainty in climate projections (IPCC 2014). Additionally, climate projections for the near future may not be consistent with climate projections for the distant future. The CEMML projections are the reflection of a single climate model.

The projections provided here demonstrate the range of conditions to which Natural Resources Managers (NRM) may have to adapt. The 2030 and 2050 timeframes were chosen for practicality and feasibility of climate adaptation planning. NAFB and the NTTR-specific projections have significant inter-season variations and are quite nuanced. For example, all scenarios project changes in temperature and precipitation, but these do not happen uniformly throughout the year in any scenario. Hence, simply describing the future climate for NAFB as “hotter and drier”, or “wetter”, is not appropriate or effective for use by the NRM. For further explanation of climate modeling, projections, and use, please reference the CEMML Climate Assessment (2019).



984 Figure 2-6. Climate change projection regions for Nellis Air Force Base and the Nevada Test and Training
985 Range.

986

Nellis Air Force Base

Climate projections for NAFB are given in Table 2-6. The current climate that observes long, very hot summers; warm transitional seasons; and short, mild to chilly winters will continue with warmer winters and hotter summers. For the decade centered around 2030, both scenarios project an increase in annual average temperature at NAFB of 3.0 °F to 3.1 °F. Both emission scenarios project greater warming by 2050, with RCP 4.5 projecting a warming of 3.3 °F and RCP 8.5 projecting a warming of 5.1 °F. Under all scenarios, the number of days per year over 90 °F is projected to increase significantly.

Annual average precipitation at NAFB varies between emission scenarios and over time due to larger interconnected ocean-atmosphere dynamics associated with the CCSM4 model. For 2030, the RCP 4.5 scenario projects a 12% increase in average annual precipitation, whereas RCP 8.5 shows a 12.0% decrease. For 2050, RCP 4.5 projects a 26% decrease, whereas RCP 8.5 projects a 9% decrease. Although most scenarios project reduced annual precipitation, these changes are not projected to be consistent throughout the year. Models project that under each scenario, some months will have increased precipitation and others will have reduced precipitation. Additionally, increases in more intense storms will increase erosion and decrease water infiltration rates, leading to an increased risk of drought.

Table 2-6. Summary of climate data for Nellis Air Force Base.

Variable	Historical	RCP 4.5		RCP 8.5	
		2030	2050	2030	2050
PRECIP (inches)	4.3	4.8	3.2	3.8	3.9
TMIN (°F)	50.2	54.1	52.7	53.3	54.9
TMAX (°F)	82.8	85.0	86.9	85.9	88.2
TAVE (°F)	66.5	69.5	69.8	69.6	71.6
GDD (°F)	6,127	6,673	6,755	6,694	7,054
HOTDAYS	148	161	175	168	178
WETDAYS	0	0	0	0	0

Notes: TAVE °F = annual average temperature; TMAX °F = annual average maximum temperature; TMIN °F = annual average minimum temperatures; PRECIP (inches) = average annual precipitation; GDD °F = Average annual accumulated growing degree days with a base temperature of 50 °F; HOTDAYS (average # of days per year) = average number of days exceeding 90 °F; WETDAYS (average # of days per year) = annual number of days with precipitation exceeding two inches in a day.

Nevada Test and Training Range South (Mojave Desert Section)

Climate projections for the NTTR South are given in Table 2-7. For the decade centered around 2030, models project an increase in average annual temperature at the NTTR South of 3.0 °F for both RCP 4.5 and RCP 8.5. The two emission scenarios project higher warming by 2050, with RCP 4.5 projecting a warming of 3.5 °F and RCP 8.5 projecting a warming of 4.9 °F. Days over 90°F are projected to increase substantially across all scenarios.

For 2030, the RCP 4.5 scenario is associated with a 12% increase in average annual precipitation, whereas RCP 8.5 is associated with a 20% decrease. For 2050, RCP 4.5 is associated with a 23% decrease, whereas RCP 8.5 is associated with a 12% decrease. Changes in precipitation are not projected to be consistent

throughout the year. Like the projections for the main base, models project that under each scenario at the NTTR South, some months will have increased precipitation and others will have reduced precipitation.

Table 2-7. Summary of climate data for Nevada Test and Training Range South.

Variable	Historical	RCP 4.5		RCP 8.5	
		2030	2050	2030	2050
PRECIP (inches)	6.5	7.3	5.0	5.2	5.7
TMIN (°F)	43.2	46.7	46.0	46.1	47.7
TMAX (°F)	74.9	77.4	79.2	78.2	80.3
TAVE (°F)	59.1	62.1	62.6	62.1	64.0
GDD (°F)	4,737	5,247	5,402	5,280	5,606
HOTDAYS	97	116	126	116	126
WETDAYS	0	0	0	0.0	0

Notes: TAVE °F = annual average temperature; TMAX °F = annual average maximum temperature; TMIN °F = annual average minimum temperatures; PRECIP (inches) = average annual precipitation; GDD °F = Average annual accumulated growing degree days with a base temperature of 50 °F; HOTDAYS (average # of days per year) = average number of days exceeding 90 °F; WETDAYS (average # of days per year) = annual number of days with precipitation exceeding two inches in a day.

Nevada Test and Training Range Central (Southeastern Great Basin Section)

Climate projections for the central portion of the NTTR are given in Table 2-8. For the decade centered around 2030, both scenarios project a similar increase in average annual temperature at the central portion of the NTTR of 2.9 °F and 3.0 °F. Both projections show more warming by 2050, with RCP 4.5 projecting a warming of 3.7 °F and RCP 8.5 projecting a warming of 5.0 °F. Days over 90 °F are projected to increase significantly across all scenarios.

For 2030, the RCP 4.5 scenario is associated with a 16% increase in average annual precipitation, while RCP 8.5 is associated with an 18% decrease. For 2050, RCP 4.5 is associated with a 21% decrease, while RCP 8.5 is associated with a 6% decrease. Although most scenarios project reduced precipitation annually, these changes are not projected to be consistent throughout the year. At the NTTR, the RCP 4.5 2030 scenario projects increases in precipitation peaks during summer and late fall. The predicted late-summer and fall precipitation spike at the NTTR under this scenario may have especially important impacts for wildfire management and erosion rates (see Section 7.9).

Table 2-8. Summary of climate data for Nevada Test and Training Range Central.

Variable	Historical	RCP 4.5		RCP 8.5	
		2030	2050	2030	2050
PRECIP (inches)	9.5	11.0	7.5	7.8	8.9
TMIN (°F)	38.0	41.0	40.9	40.6	42.4
TMAX (°F)	69.3	72.0	73.7	72.7	74.8
TAVE (°F)	53.6	56.5	57.3	56.6	58.6
GDD (°F)	3,802	4,235	4,442	4,287	4,595
HOTDAYS	58	77	89	82	92
WETDAYS	0	0	0	0	0

Notes: TAVE °F = annual average temperature; TMAX °F = annual average maximum temperature; TMIN °F = annual average minimum temperatures; PRECIP (inches) = average annual precipitation; GDD °F = Average annual accumulated growing degree days with a base temperature of 50 °F; HOTDAYS (average # of days per year) = average number of days exceeding 90 °F; WETDAYS (average # of days per year) = annual number of days with precipitation exceeding two inches in a day.

Nevada Test and Training Range Northwest

Climate projections for the northwestern portion of the NTTR are given in Table 2-9. For the decade centered around 2030, both scenarios project an average annual temperature increase in the northwestern portion of the NTTR. The RCP 4.5 scenario projects a 2.9 °F increase, and the RCP 8.5 scenario projects a 3.1 °F increase. Both projections show more warming by 2050, with RCP 4.5 projecting a warming of 3.8 °F and RCP 8.5 projecting a warming of 5.2 °F. Days over 90 °F are projected to increase substantially.

For 2030, the RCP 4.5 scenario is associated with a 15% increase in average annual precipitation, while RCP 8.5 is associated with a 23% decrease. For 2050, RCP 4.5 is associated with a 21% decrease, while RCP 8.5 is associated with a 3% decrease. Although most scenarios project reduced precipitation annually, these changes are not projected to be consistent throughout the year. At the NTTR, the RCP 4.5 2030 scenario projects increases in precipitation from August through November. The predicted late-summer and fall precipitation spike at the NTTR under this scenario may have especially important impacts for wildfire management and erosion rates (see Section 7.9).

Table 2-9. Summary of climate data for Nevada Test and Training Range Northwest.

Variable	Historical	RCP 4.5		RCP 8.5	
		2030	2050	2030	2050
PRECIP (inches)	8.0	9.2	6.3	6.2	7.8
TMIN (°F)	37.4	40.4	40.6	40.1	42.2
TMAX (°F)	67.1	70.1	71.7	70.7	72.7
TAVE (°F)	52.3	55.2	56.1	55.4	57.5
GDD (°F)	3,528	3,978	4,185	4,051	4,345
HOTDAYS	44	64	77	71	79
WETDAYS	0	0	0	0	0

Notes: TAVE °F = annual average temperature; TMAX °F = annual average maximum temperature; TMIN °F = annual average minimum temperatures; PRECIP (inches) = average annual precipitation; GDD °F = Average annual accumulated growing degree days with a base temperature of 50 °F; HOTDAYS (average # of days per year) = average number of days exceeding 90 °F; WETDAYS (average # of days per year) = annual number of days with precipitation exceeding two inches in a day.

2.2.2 Landforms

NAFB and the NTTR lie in the Basin and Range physiographic region, characterized by a series of north-south trending mountain ranges and intervening basins that extend from southeast Oregon into Mexico (Fenneman 1931). Individual mountain ranges rise out of the Mojave and Great Basin Deserts, and their alignment along similar axes provides connectivity between the two deserts. These basins and mountains lead to significant topographic and habitat variability. The basins between the mountains increase in elevation and latitude from south to north, causing declines in thermal regimes and vegetation profiles.

2.2.2.1 Nellis Air Force Base

NAFB lies in the northeastern portion of the broad Las Vegas Valley at an elevation of about 1,900 feet. Alluvial fans extending south from the Las Vegas Range and northwest from Sunrise Mountain reach the edges of NAFB. Between these lies a broad, gently sloping valley floor underlain mostly by fine-grained alluvial silts. The SAR consists largely of alluvial fans extending from the Las Vegas Range and the Apex Hills. The SAR is bisected by a large levee to divert and channel floodwaters that occasionally flow off the Las Vegas Range. Landforms in the vicinity of NAFB include sand dunes (within the Nellis Dunes Off Highway Recreational Vehicle Area [OHRVA] and north side of Area II) and alluvial fans below the Las Vegas Range and Sunrise Mountain (east of NAFB), and Sunrise Mountain, Frenchman Mountain, and the Dry Lake Range.

2.2.2.2 Nevada Test and Training Range

The topography over most of the NTTR is undisturbed; however, some areas have been locally modified by cantonment facilities, sand and gravel pits, underground mining, drainage improvements, airstrips, landfills, fuel staging and storage areas, bombing targets, roads, and cratering from aerial bombing. Due to its vast area, the elevation throughout the NTTR varies from about 1,900 feet to over 8,500 feet MSL. The valley floors of the South Range vary from 2,900 to 3,600 feet MSL, while the valley floors of the North Range vary from 3,900 to 5,200 feet MSL. This is consistent with the marked south-to-north rise in the basal elevations of Mojave/Great Basin valleys, from approximately the latitude of Lake Mead to the latitude of Tonopah. The maximum elevation of the surrounding mountains also generally increases from south to north. The mountain ranges reach elevations almost 6,000 feet in the South Range and almost 8,500 feet in the North Range. In the latter, block-faulted mountains, composed of massive Paleozoic carbonate rocks, rise abruptly from their flanking alluvial fans or bajadas. The bajadas themselves are prominent physiographic features in this area, and in the South Range they can attain relatively steep grades. The lower portions of the alluvial fans commonly have grades of 5% or less and end at playas that occupy the floors of closed valleys.

Although the North Range also lies in the Basin and Range physiographic province, the contrast between "basin" and "range" is not as pronounced in this area. The topography that provides the bold contrast between the valleys and mountains of the South Range is buried under great accumulations of Tertiary volcanic rocks in the North Range. Volcanic ash forms the surface of western Pahute Mesa, and volcanic rocks compose the mountains of this area (e.g., Timber, Stonewall, and Black Mountains; the Cactus and Kawich Ranges; Cornwall 1972). The massive outflow deposits of volcanic ash are more broken by faulting in the northern portions of the North Range (Ranges 71, 74, 75, 76, Electronic Combat West [ECW], and Electronic Combat East [ECE]). Here, the valleys are broader than in the South Range and many of these valleys include playas (e.g., Mud Lake, Stonewall, and Cactus Flats).

2.2.3 Geology and Soils

2.2.3.1 Description of Current Conditions

The geologic formations on NAFB and the NTTR can be divided into a southeastern area that is mostly Paleozoic sedimentary rocks, and a northwestern area that is dominated by volcanic rocks of the Cenozoic age (Nevada Bureau of Mines and Geology [NBMG] 1997).

2.2.3.2 Nellis Air Force Base

NAFB lies in the Las Vegas Valley, which is predominantly made up of sedimentary formations and alluvial deposits. The sedimentary formations consist of limestone mixed with sandstone, shale, dolomite, gypsum, and interbedded quartzite. The alluvial fans found to the east and north of NAFB are composed of many coalescing fans dissected by numerous drainage channels. In the upper reaches, these alluvial fans are comprised of poorly sorted gravelly, cobbly, and stony sand deposits that grade to finer-textured material toward the valley floors. Those bajadas that lie downwind of valley bottom playas often support a sand sheet composed of sediments originating from the playas. Since the prevailing wind in this region is from the west, sand ramps overlay the bajadas of the west side of the Desert and Pintwater Ranges where they extend into the Three Lakes and Indian Springs Valleys.

Basin floors are depositional areas of late-laid silt and clay and younger alluvial deposits. Most of these alluvial deposits have been transported by water and deposited on the sloping basin floors of the floodplains. The deposition of alluvium is a continuing process which may accelerate as precipitation becomes more variable with occasional intense storm events.

2.2.3.3 Nevada Test and Training Range

In the NTTR, the mountain ranges in the South Range are dominated by Paleozoic carbonate rocks mixed with smaller amounts of quartzite, sandstone, and shale. Valleys in this area contain thick deposits of alluvium from erosion of adjacent mountain ranges. Sedimentary rocks from lakes and rivers have been deposited in shallow basins and outcrops in several areas within the NTTR, particularly in the southern Spotted Range, the Pintwater Range, and the Desert Range. Older Tertiary valley-fill sediments that were uplifted with the underlying Paleozoic bedrock are exposed on the flanks of the mountains (Longwell et al. 1965, NBMG 1997).

Volcanic rocks dominate the geology of the North Range of the NTTR. The Timber Mountain caldera is one of several sources of volcanic activity in the North Range. Other sources include the Black Mountain, Cactus Range, Silent Canyon calderas, and Mount Helen dome. Volcanic tuff (hardened clay) originating from the volcanic sources extends throughout the North Range, including the extensive tableland of western Pahute Mesa, the southern Cactus and Kawich Ranges, and Stonewall Mountain (Cornwall 1972, NBMG 1997).

The tectonic history of the region is very complex. Most faults are a result of regional thrust, folds, and wrench faults developed during compressional deformation associated with mountain building. A detailed discussion of faults in southern Nevada can be found in Armstrong (1968) and Caskey and Schweickerty (1992). The western one-third of the NTTR is located within Seismic Zone 3, whereas all of NAFB and the eastern two-thirds of the NTTR are located in Seismic Zone 2B. Seismic Zone 3 is considered an area with major damage potential, whereas Seismic Zone 2B is considered an area of moderate damage potential. The Yucca fault, located in the south-central portion of the NTTR, is the only fault that is considered active based on displacement of surface alluvium. Several inactive or potentially active faults are also present at

the NTTR. These faults include the Carpetbag fault located west of the Yucca fault and the Pahranagat fault system located in the South Range. Most faults on NAFB and the NTTR are considered inactive.

Maps providing accurate locations of geologic outcrops (a visible exposure of bedrock or ancient superficial deposits) at the NTTR are not available. In addition, accurate information on faults and other evidence of tectonic activity is somewhat lacking. Procurement of these maps would be useful for multiple reasons. Accurate knowledge of geologic outcrops and soil types allows biologists to model potential habitat for various plant and animal species of concern. For example, the Las Vegas bearpoppy (*Arctomecon californica*, BLM Sensitive, Nevada Critically Endangered), and the Las Vegas buckwheat (*Eriogonum corymbosum* var. *nilesii*, BLM Sensitive, Nevada Imperiled rank) are both adapted to gypsum outcrops commonly found in alluvial fans and basins in and around NAFB. Additionally, specific geologic strata are more conducive to use by the desert tortoise (*Gopherus agassizii*, Federally Threatened, Nevada Threatened and SGCN). Often mission activities require specific environments to mimic those encountered by troops in combat. These specific areas may require certain types of geology, such as areas supporting caves, steep slopes, crevices, cliffs, and canyons. An accurate geologic map could assist in finding locations for mission activities and streamline the siting process.

In summary, improved, accurate mapping of geologic formation outcrops and soil mapping is critical to proper management of natural resources within NAFB and the NTTR. Presently, these are lacking. This information should be collected and incorporated into the natural resources database.

2.2.4 Hydrology

2.2.4.1 Nellis Air Force Base

NAFB is in the northern part of the Las Vegas Valley. The Valley runs northwest to southeast and is drained by the Las Vegas Wash, which eventually drains into Lake Mead. No natural perennial or intermittent streams, lakes, or springs are found on NAFB, due to the low precipitation and high evaporation rates (USACE 2001). All wetlands are artificial impoundments and located on the golf course. Water erosion is rare in the basin but can be somewhat prominent along alluvial fans. This is especially evident in Area II along the base of Sunrise Mountain. The site contains several ephemeral streams or washes that eventually flow into the Las Vegas Wash.

Area I of NAFB is an urban environment that contains aircraft facilities, including runways, residences, offices, and recreational facilities. Ponds have been established on the NAFB golf course, but are not considered jurisdictional waters. Stormwater in all areas of NAFB generally flows into Clark County Regional Flood Control District channels and eventually into the Las Vegas Wash. Municipal sewage from NAFB is treated by the Clark County Sanitation District and then released into Las Vegas Wash southeast of the Las Vegas Valley. Las Vegas Wash was historically connected directly to the Colorado River; however, in 2003, it was rerouted to Lake Mead via a channel below Lake Las Vegas.

Area II of NAFB is largely undeveloped, but it houses the RED HORSE Squadron, Explosive Ordnance Disposal (EOD) Range, and a munitions storage area. These facilities are connected to the municipal sewage system. Runoff from the undeveloped desert areas north and east of NAFB during infrequent storm events drains into the Las Vegas Wash to the southeast, which eventually drains into Lake Mead, which is part of the Colorado River.

Area III of NAFB, including the residential area, hospital, and gasoline storage tanks, is connected to the municipal sewage system. The SAR also contains many ephemeral streams, alluvial fans, and draws, all of

which could be affected by silt, sedimentation, and debris, potentially impacting the Colorado River as well as the storm water system.

2.2.4.2 Nevada Test and Training Range

The NTTR is located in an arid region with few surface water resources and deep groundwater. Over 300 springs and seeps were historically identified at the NTTR, and some have hydrophytic (water-dependent) vegetation but rarely exposed surface water. Those with high water tables and surface waters are essential for terrestrial wildlife populations, and often support micro ecosystems with a variety of plants and animals uniquely adapted to isolated surface waters in desert regions. Other water-related features on the NTTR include alluvial fans, valley connectors, and playas (USAF 1997). However, hydrological knowledge about the more remote areas of the NTTR is lacking.

Average annual rainfall ranges from about 4 inches on the lower elevations of the desert floor to about 16 inches in higher-elevation areas. Some thunderstorms are sufficiently intense to produce flash flooding, but most precipitation in the summer is lost to evaporation shortly after reaching the soil. Precipitation in the winter forms snowpack in the high elevations. Snowpack stores moisture during the winter and spring, releasing it slowly through the warmer months as runoff, which can mitigate high rates of evaporation and transpiration in the warm summer months. Snowmelt provides water for springs, drainages, and riparian corridors in the early spring. Precipitation regimes on the NTTR are further detailed in Section 2.2.1 of this report.

Most of the North and South Ranges are internally drained. Of the six watersheds overlapping with the NTTR, four of those drainage basins are contained, and do not connect to navigable Waters of the U.S (WOTUS). Figure 2-7 shows the watersheds found in the NTTR. Most of the surface water drains internally into numerous playas, which are scattered throughout both Ranges. In the playas, water collects and then eventually evaporates, leaving behind high concentrations of salts and other materials that often cause playas to be devoid of vegetation. Ranges 77a, 77b, and 63 are all exceptions to this and drain off-range. Ranges 77a and 77b mostly drain into the Upper Amargosa drainage system, and Range 63 drains into the Las Vegas Valley and eventually into Las Vegas Wash drainage system.

Surface waters and streams at the NTTR are intermittent because their water source is runoff, not groundwater. Except for some manmade ponds, dugouts, and guzzlers, the only perennial surface waters result from springs, which form pools or flow for short stretches across the ground (Figure 2-8). Dugouts are usually located in areas that were excavated in the past to accumulate surface water for livestock. Historically Breen Creek had perennial surface water, but due to drier conditions in modern times, surface water tables are generally below the surface of that riparian corridor. Monitoring efforts are underway using remote monitors in Breen Creek to collect data on water flow and hydrology.

Under the Navigable Waters Protection Rule, playas and their associated drainage basins are not protected because they are isolated and not connected to WOTUS. Therefore, consultation with the U.S. Army Corps of Engineers (USACE) under Section 404 is not required if the actions place fill material in isolated WOTUS, such as playas. For further definition of WOTUS, refer to Section 2.3.5.

Alluvial fan systems and dry lakebeds are present on the NTTR. A description of each as they occur on the NTTR is given below.

Alluvial fans are found at the base of mountains where flooding is characterized by high-velocity flows, active processes of erosion, sediment transport and deposition, and unpredictable flow paths. Alluvial fans differ from normal stream channels in that flooding in the upper portion of the alluvial fan is confined to a

single channel that disperses into multiple channels as it flows downhill. Conventional stream channels tend to coalesce into larger channels as they move down slopes. Farther downslope from the mountain front, the alluvial fans join and coalesce. When the slope flattens out, shallow flooding may occur.

At the bottom of alluvial fan systems, a single channel often forms. This channel is termed a "valley collector." The valley collector collects and transmits flow from several systems of alluvial fans to a topographic outlet connected to other WOTUS or to a playa when no outlet is present. Valley collectors are important features within the NTTR ecosystem. Even though these features are dry for a significant portion of the year, they tend to support a high density of vegetation along and near their banks. This vegetation is supported by high moisture levels that last long after precipitation and provides critical food and cover for various wildlife species.

Dry lakebeds, or playas, are typically located at the lowest elevation compared to the surrounding watersheds. During or immediately after storm events, these dry lakebeds fill with water, either directly from precipitation falling on the lakebed or from valley channels that drain surrounding upland areas. Dry lakebeds will hold water for short periods. The water flowing into the lakebeds contains sediments and dissolved solids. Sediments spread evenly over the lake's surface, creating the flat topography commonly associated with these lakebeds. As water evaporates, dissolved solids are deposited on top of the sediments. This results in barren terrestrial surfaces that do not support significant vegetation but are important to migratory birds after significant rainfall or after snow has occurred. They provide food resources, such as brine shrimp, insects, and other invertebrates.

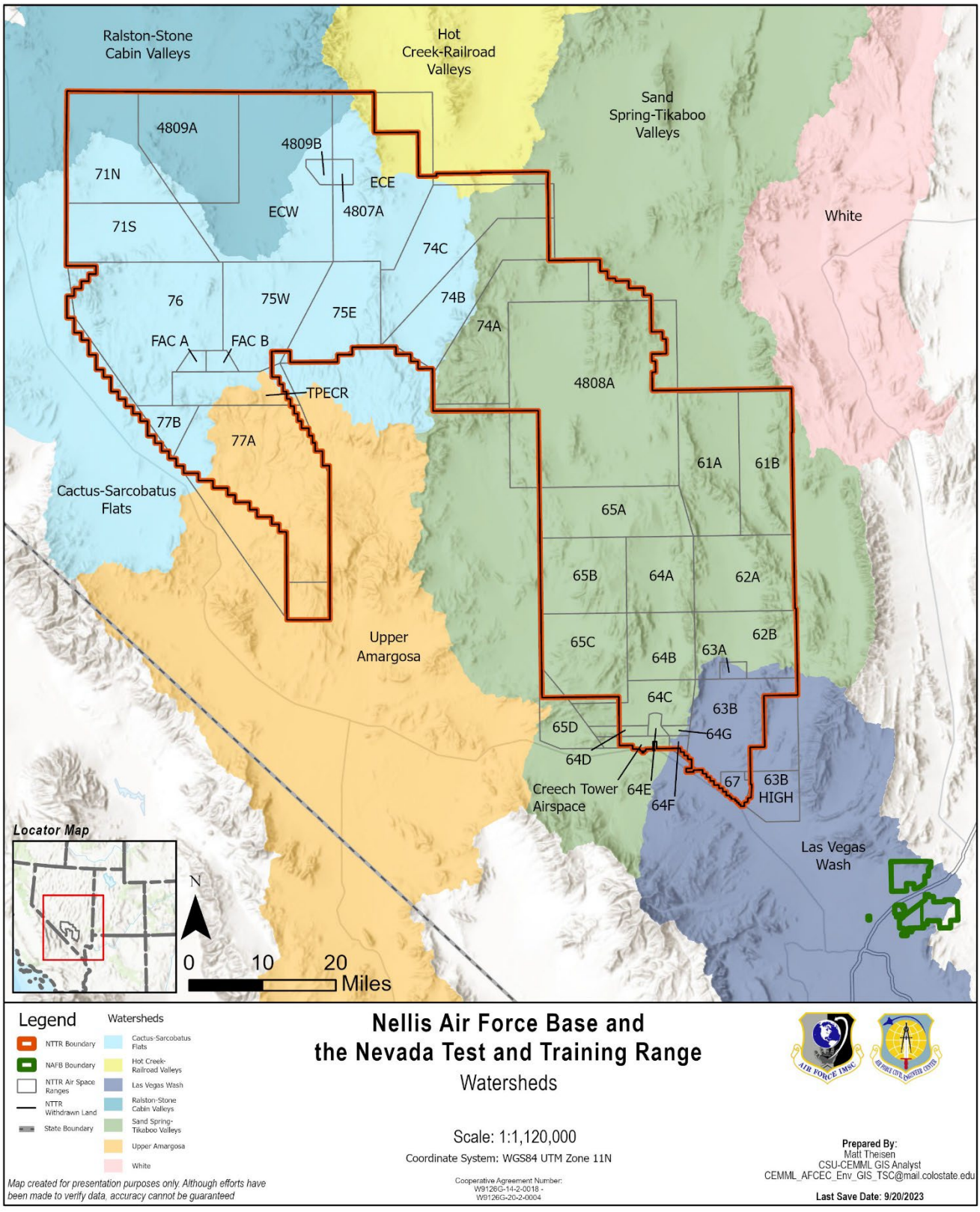


Figure 2-7. Watersheds on the Nevada Test and Training Range.

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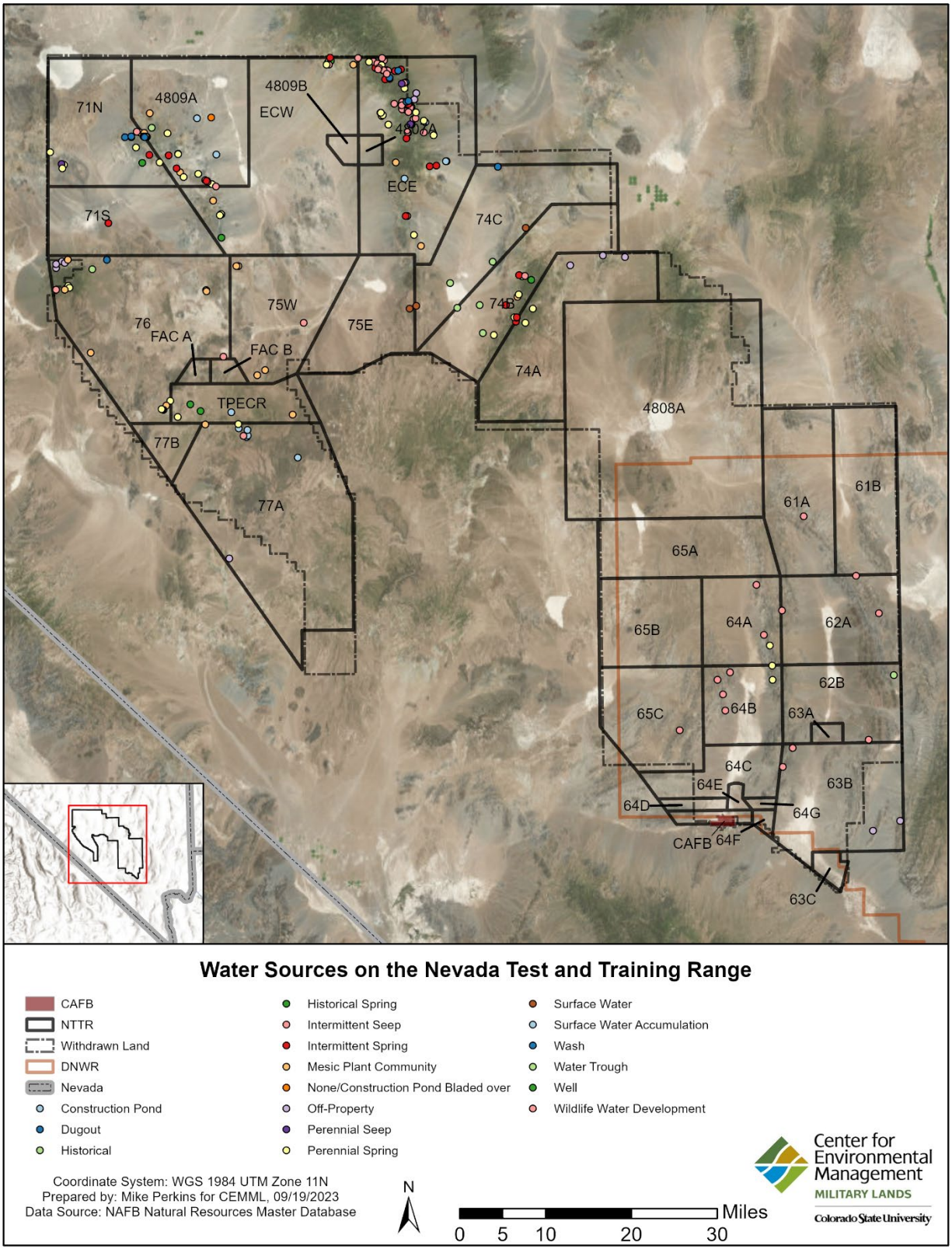

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1246 Figure 2-8. Water sources on the Nevada Test and Training Range.

2.2.4.3 Groundwater

Nellis Air Force Base

NAFB is located on the eastern side of Las Vegas Valley, an intermountain basin. Groundwater flows from west to east within Las Vegas Valley. The valley fill sediments of the Las Vegas basin are host to a large groundwater reservoir. Groundwater provides about 15% of the water supply for NAFB. The deeper aquifers at NAFB are not known to have been affected by contaminants identified in shallow groundwater, which include volatile organic compounds, nitrates, and arsenic. Laboratory analyses of samples from six NAFB production wells did not detect volatile organic compounds or nitrates; however, three production wells with water exceeding the maximum allowable levels for arsenic are used only to irrigate the golf course.

Nevada Test and Training Range

The NTTR is in the carbonate rock province of the Great Basin (Prudic et al. 1993). This province extends across much of eastern and southern Nevada and western Utah. Due to the permeability of carbonate rocks, the area supports an extensive regional groundwater flow system. Groundwater in the carbonate rock province is stored in two interconnected aquifer systems, a regional system that is largely in deeply buried carbonate bedrock, and shallow alluvial aquifer systems residing in individual basins or watersheds. Winter precipitation recharges these systems. Groundwater discharge occurs primarily through evapotranspiration from the valley floors and from discharge at large springs.

Groundwater flow within the carbonate rock is relatively shallow and is confined to individual mountain-valley watersheds. The direction of flow in these shallow aquifer systems does not necessarily coincide with flow in the deeper, regional groundwater system, which crosses individual mountain ranges. In general, deep groundwater at the NTTR is believed to flow in a southwest direction; however, only a few wells can be used to confirm groundwater levels or gradients. Flows in the local aquifer systems may follow surface drainages in most cases. Groundwater is expected to move from the surrounding highlands toward the topographic low point within an individual valley or basin.

Several regional groundwater flow systems have been identified in the Great Basin (Harrill et al. 1988). Many of the target complex sites on the NTTR are located within the Death Valley regional flow system. The Death Valley flow system is composed of fractured carbonate and volcanic rock and is characterized by inter-basin flow toward the west and southwest, where discharge occurs at several large regional springs. The Death Valley playa in California is considered the terminus of this regional flow system. The Death Valley flow system is divided into smaller hydrographic basins, which possess distinct recharge areas (Harrill et al. 1988). These areas contain valley fill groundwater reservoirs recharged primarily by snowmelt from adjacent mountains. Precipitation that falls on the valley floors is largely lost to evaporation and evapotranspiration; hence, it provides little recharge to the groundwater systems.

The amount of groundwater recharge in mountains in and adjacent to the NTTR depends on precipitation, evapotranspiration, permeability of the surface soils, and the types and abundance of vegetation. The greatest opportunity for groundwater recharge is in areas of permeable surface materials during periods when the amount of precipitation exceeds the rate of evapotranspiration. Evaporation at the NTTR, however; usually exceeds precipitation at rates ranging from 50 to 65 inches annually (Hazardous Waste Remedial Action Program 1992); therefore, the amount of recharge from valley floors to the groundwater is generally limited.

Water-quality information is largely limited to regional data on dissolved solids concentrations and the dominant chemical types (Thompson and Chappell 1984). Generally, the groundwater within the North Range has dissolved solids concentrations that do not exceed 500 milligrams per liter. This groundwater is rich in sodium bicarbonate. Groundwater in the South Range has dissolved solids concentrations that typically vary from 500–1,000 milligrams per liter and is rich in calcium/magnesium bicarbonate.

Well records from the Nevada Division of Water Resources show five permitted water-supply wells on the NTTR (Roe 1996). Other wells on the NTTR are used for testing and hydrogeological research projects associated with the adjacent Nevada National Security Site (formerly the Nevada Test Site [NTS]). The only known wells within active bombing targets are on Range 75 in southern Gold Flat and on Range 63.

See Section 2.3.5 for information on wetlands and floodplains.

2.3 Ecosystems and the Biotic Environment

2.3.1 Ecosystem Classification

Ecoregions are a useful unit used to characterize "patterns and composition of biotic and abiotic phenomena that affect or reflect differences in ecosystem quality and integrity" (U.S. Environmental Protection Agency 2023). Two major ecoregion-defining frameworks are Bailey's ecoregions (Bailey 2014), and Omernik (1987) which is used by the Environmental Protection Agency (EPA). These two frameworks define ecoregions differently, yet both have relevance when being used to describe ecoregions on the immense scale of NAFB and the NTTR.

According to Bailey's ecoregion classifications, NAFB and the NTTR are located within the Dry Domain. The NAFB and southern portion of the NTTR are located within the Mojave Desert Section. The northeast corner of the NTTR is in the Southeastern Great Basin Section, and the northwest corner of the NTTR is located in the Lahontan Basin Section. A very small portion of the northern NTTR is located within the Great Basin Mountains Section (Bailey 2014).

The EPA ecoregions place the NAFB and the South Range of the NTTR within the Mojave Desert, and the North Range of the NTTR within the Great Basin Desert. However, the exact boundary between the Great Basin and Mojave deserts is inexact and defined differently by different sources, and much of the unique and valuable character of the NTTR's natural resources is related to the fact that it encompasses parts of both regions and the intergrade between them. Both Bailey's and the EPA's ecoregions are shown in Figure 2-9.

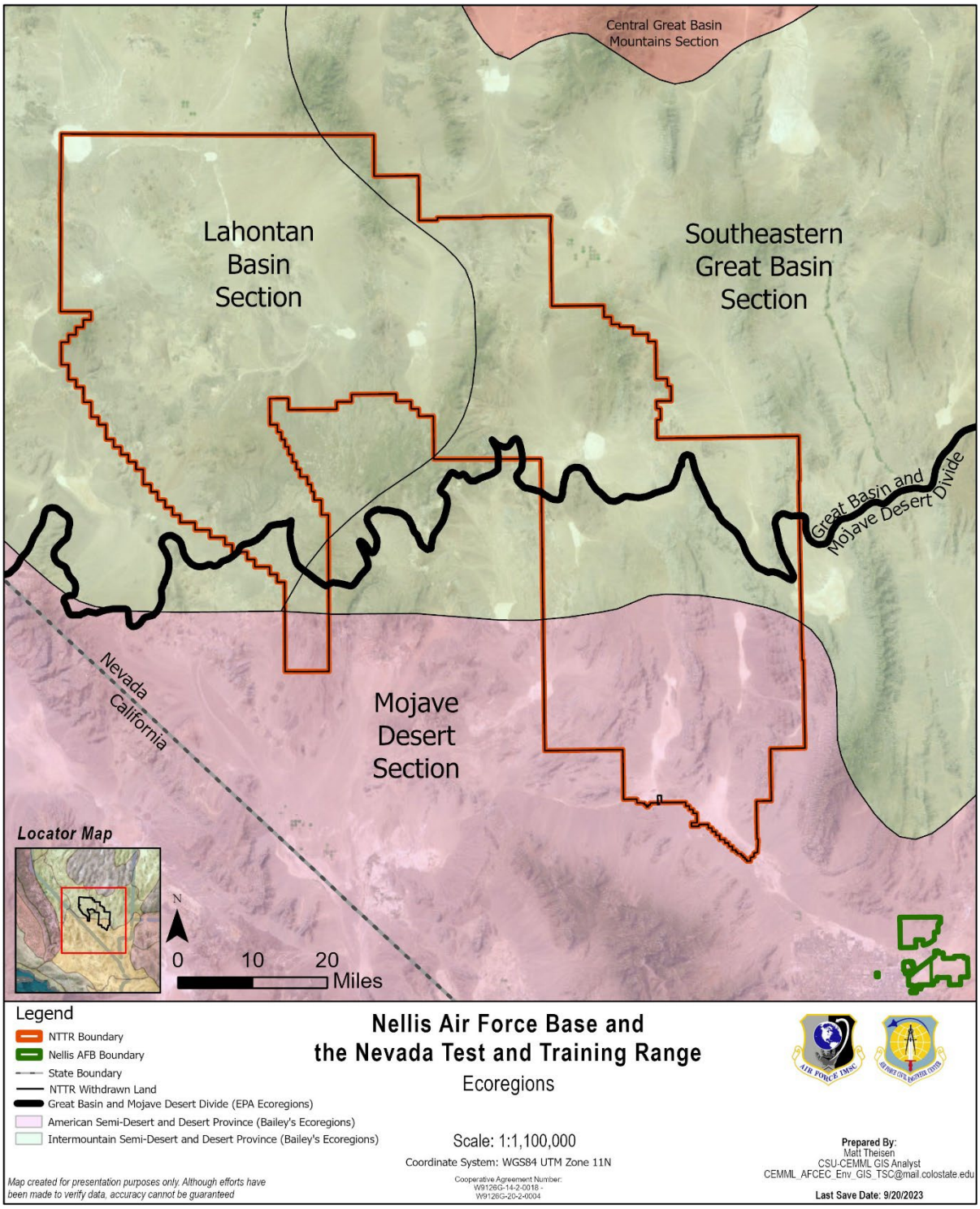


Figure 2-9. Location of Nellis Air Force Base and the Nevada Test and Training Range with respect to the Great Basin and Mojave Desert ecoregions.

2.3.2 Vegetation

The classification of vegetative communities provides valuable information to the NNRP. It presents a framework of ecosystem structure and services that informs management and supports environmental managers' efforts to balance ecosystem health and the mission.

2.3.2.1 Historical Vegetation Cover

The Las Vegas Valley, which includes NAFB, was widely settled for a long period. In contrast, the NTTR is a remote area, which historically supported only isolated, small settlements. As such, more historical vegetation information is available for NAFB. On the NTTR, the historical composition and structure of the vegetation was essentially unknown as of the 1970s (Beatley 1976). Much of the NTTR has remained undisturbed for years, and some remote areas may have experienced few or no direct impacts by Euro-Americans. Figure 2-10 shows grizzlybear pricklypear (*Opuntia polyacantha var. erinacea*), and Figure 2-11 shows ball cactus (*Coryphantha vivipara*), two attractive cactus species found on the NTTR.

Historically, the Las Vegas Valley contained many natural artesian springs, including the perennial Las Vegas Big Spring, which released recharge water from the Spring, Sheep, and Las Vegas mountain ranges. The available surface and near-surface water supported oases in the surrounding arid landscape and suggested the place name (Las Vegas is Spanish for "the meadows") to early Spanish-speaking cartographers (Jones and Cahlan 1975). The springs and outflow channels initially supported distinct riparian habitats, typified by cottonwood trees (*Populus fremontii*), willows (*Salix* spp.), cattail (*Typha latifolia*), and other plants that thrive in mesic environments (NAFB 2010). Although European explorers, trappers, and missionaries passed through the valley between the 17th and 19th centuries, it was not until the late 19th century that continuous European settlement began in the area. Settlers extracted increasing amounts of groundwater for human consumption, livestock watering, crop production, and, by 1905, operating steam locomotives. Withdrawals continued, and eventually the demand exceeded the recharge rate (NAFB 2010). Riparian habitats were gradually reduced and replaced by development. Substantial valley subsidence (decreasing elevation) has resulted from aquifer withdrawal. Some remnants of historical riparian plant communities are still present in the valley, most notably at the Las Vegas Valley Water District well field. The well field is closed to the public.

Figure 2-10. *Opuntia polyacantha* var. *erinacea* blooming on the North Range, 2019. Nellis Air Force Base Photo Library.

Most early Euro-Americans traveling through the NTTR area did not find the area hospitable for settlement, with the prominent exception of those who stayed briefly to extract mineral resources. It is likely that historical vegetation impacts occurred near mining settlements, town sites, and homesteads. The domestic livestock grazing, reduction of native herbivores (e.g., unregulated hunting and varmint control, livestock-wildlife competition for forage and water, livestock-borne diseases), and wood harvesting for fuel and structural materials likely degraded vegetation in the North Range (Noss and Cooperrider 1994). In the absence of historical records, the degree of impact on and subsequent recovery of native vegetation cannot be evaluated accurately. Lower elevations and bajadas on the South Range may have been historically dominated by vegetation typically found in the creosote bush/burrobrush (*Larrea tridentata*/ *Ambrosia dumosa*) and saltbush communities, and on the North Range by the blackbrush (*Coleogyne ramosissima*) and Great Basin Desert scrub communities (NAFB 2010).

Figure 2-11. *Coryphantha vivipara* var. *vivipara* blooming, 2019. Nellis Air Force Base Photo Library.

During the military's tenure, vegetation types on NAFB and the NTTR have been characterized and described according to the plant community classification system used regionally by Beatley (1976). In this system, a plant community is named after the dominant and co-dominant plant species. Other vegetation classification systems used include a vegetation map of Nevada prepared by Utah State University as part of the nationwide Gap Analysis Program with coverage including NAFB and the NTTR. Additional historical vegetation classification systems used for NAFB and the NTTR are listed below.

- 1997 National Vegetation Classification Standard
- Terrestrial Vegetation of the United States (Grossman et.al. 1998)
- International Vegetation Classification Alliances and Associations Occurring in Nevada with Proposed Additions (Peterson 2008)
- NDOW's Nevada Wildlife Action Plan Team (WAPT): Key Habitats (WAPT 2012)

2.3.2.2 Current Vegetation Cover

Environmental and physical characteristics of an area, such as climate, soils, and hydrology, play a key role in determining the types of plant communities that establish in any given location. In turn, plant composition and state influence which species of wildlife can inhabit an area, thus acting as a strong indicator of the overall health of an ecosystem. Plant composition can be used to determine the carrying capacity of an ecosystem and provide a warning sign if that capacity has been or soon will be exceeded. Those species sensitive to ecosystem disturbance can also play a role indicating the level to which an area may have been affected by stressors, providing ecologists with a better understanding of how to address them (NAFB 2010).

Through the understanding of plant communities and, subsequently, their successional stages, restoration and recovery efforts for areas impacted by natural or anthropogenic factors can be more effectively applied to preserve the integrity of native vegetation diversity and structure so essential to the nature of the NTTR

training environment. Understanding the variety of vegetation communities and their function informs sustainable land management and compliance with National Environmental Policy Act (NEPA), ESA, Clean Water Act (CWA), and other federal regulations.

Figure 2-12. Typical creosote bush habitat around Nellis Air Force Base, 2023. Nellis Air Force Base Photo Library.

Since 2007, NAFB vegetation information has been accumulated in a standardized geodatabase documenting plant species and vegetation communities on the installation. NAFB and the NTTR use the International Vegetation Classification (IVC) system and its derivative, the U.S. National Vegetation Classification (USNVC) system, to classify natural communities (NatureServe 2017). These systems create a hierarchy of vegetative classification levels from broad-based Formation Classes containing globally recognized dominant growth forms, to finer-resolution alliance- and association-level descriptions on local to regional scales (USNVC 2023). The most current vegetation classification standard for the U.S. is the USNVC Natural Vegetation of the Conterminous U.S., derived from the IVC. These systems provide a standardized, detailed approach for the management of natural communities and habitats and will be used throughout the near future (NatureServe 2017). Formal vegetation community classifications using the USNVC system are compatible with NDOW Key Habitats classifications. Figure 2-12 shows typical creosote bush habitat around NAFB and Figure 2-13 shows western juniper/ mountain big sagebrush woodland on the North Range of the NTTR.

Remote sensing is used to derive USNVC classifications because of the NTTR's large size. Ground-truthing is necessary to confirm results. The rarity rankings, distribution, and extent of natural communities derived from ongoing survey efforts will support the mission and natural resource management on the installation. Information within this section regarding the hierarchal structure of vegetative communities and individual community descriptions was sources on the NatureServe website (www.natureserve.org) or the USNVC website (www.usnvc.org).

Figure 2-13. Sagebrush habitat on the North Range, 2020. Nellis Air Force Base Photo Library.

In addition to the IVC system, past classification efforts have used NDOW Key Habitats to classify habitats across the installation. This descriptive system is a product of the Nevada Wildlife Action Plan (NWAP) developed by NDOW in 2012 and defines "Key Habitats" as "biophysical groups that approximate major habitat types" (WAPT 2012). Current delineations of the Key Habitats of the NTTR are given in the most recent vegetation mapping reports (NAFB 2022*h*, 2022*k*).

Recent vegetation classification work from 2017–2021 is described in Table 2-10 below. Vegetation survey locations and mapping progress are shown in Figure 2-14 and Figure 2-15.

Table 2-10. Recent vegetation classification work.

Vegetation Report	Range(s) Surveyed	Vegetation Classification System	Vegetation Classification Level	Delineation Software or Method Used
2021				
NAFB Natural Resources Team 2021*b*	74B and 4809A	IVC/USNVC	Alliance	N/A
NAFB Natural Resources Team 2021*c*	64A	IVC/USNVC	Alliance	N/A
2020				
NAFB Natural Resources Team 2021*a*	TPECR	IVC/USNVC	Alliance	N/A
NAFB Natural Resources Team 2021*b*	63B	IVC/USNVC	Alliance	N/A
2019				
NAFB Natural Resources Team 2020*a*	TPECR	IVC/USNVC	Alliance	N/A
NAFB Natural Resources Team 2020*b*	63B	IVC/USNVC	Alliance	N/A
2018				
NAFB Natural Resources Team 2019*a*	75E	IVC/USNVC	Alliance	N/A
NAFB Natural Resources Team 2019*b*	62A	IVC/USNVC	Alliance	N/A
2017				
NAFB Natural Resources Team 2018*a*	ECE, ECW, 4809A, 71S	IVC/USNVC	Alliance	N/A
NAFB Natural Resources Team 2018*b*	61B, 62A, 63B, 65C	IVC/USNVC	Alliance	N/A

Currently, 875 plant species have been documented on NAFB and the NTTR (Appendix C). Of those species, 46 have been documented by the Nevada Department of Natural Heritage (NDNH) as Sensitive in Nevada (Appendix E). Rare species, including the Las Vegas bearpoppy and Las Vegas buckwheat, have been documented on the installation. They are further discussed in Section 2.3.4.6. Las Vegas bearpoppy and buckwheat are shown in Figure 2-16 and Figure 2-17, respectively.

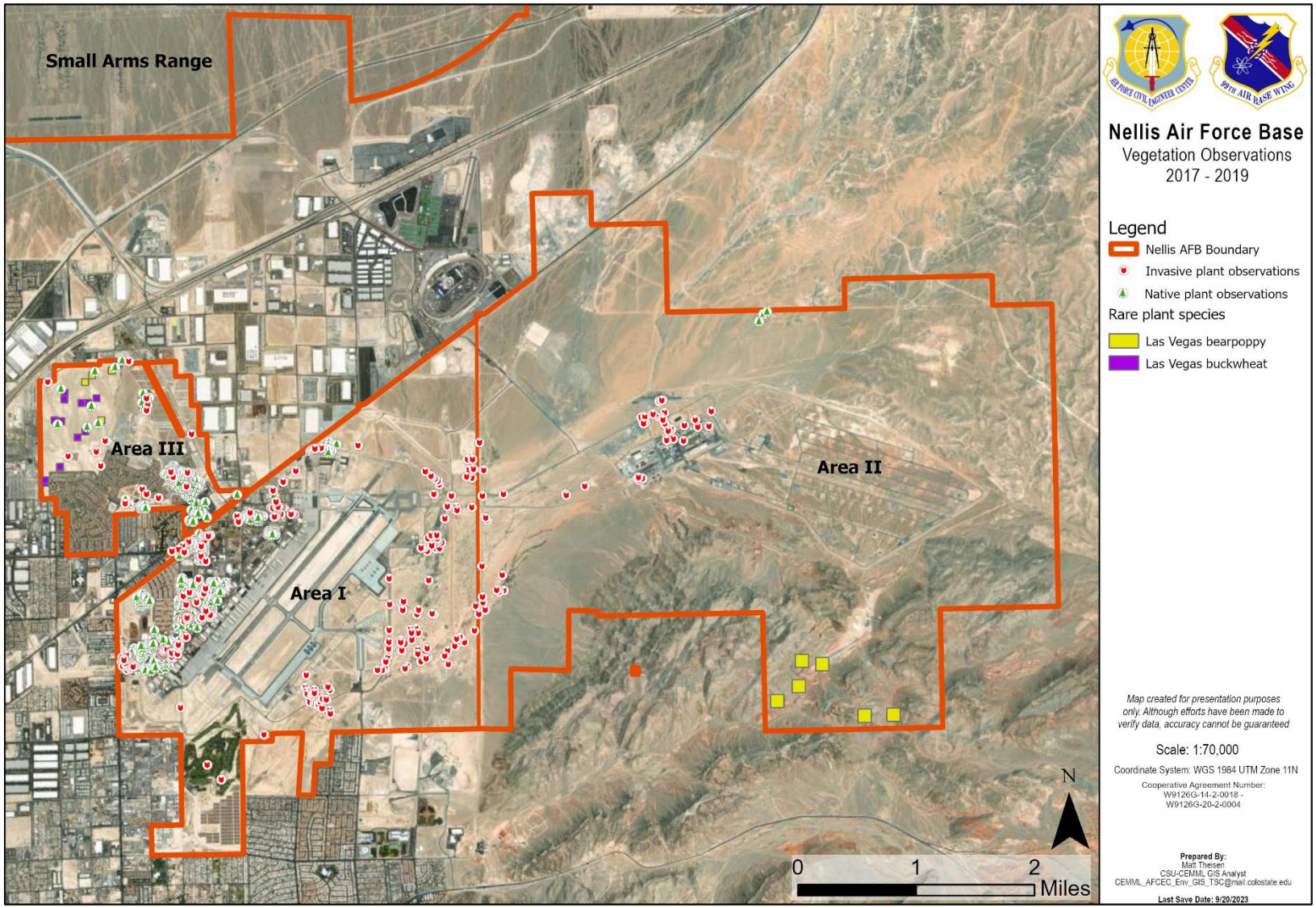


Figure 2-14. Nellis Air Force Base vegetation survey locations, 2017–2019.

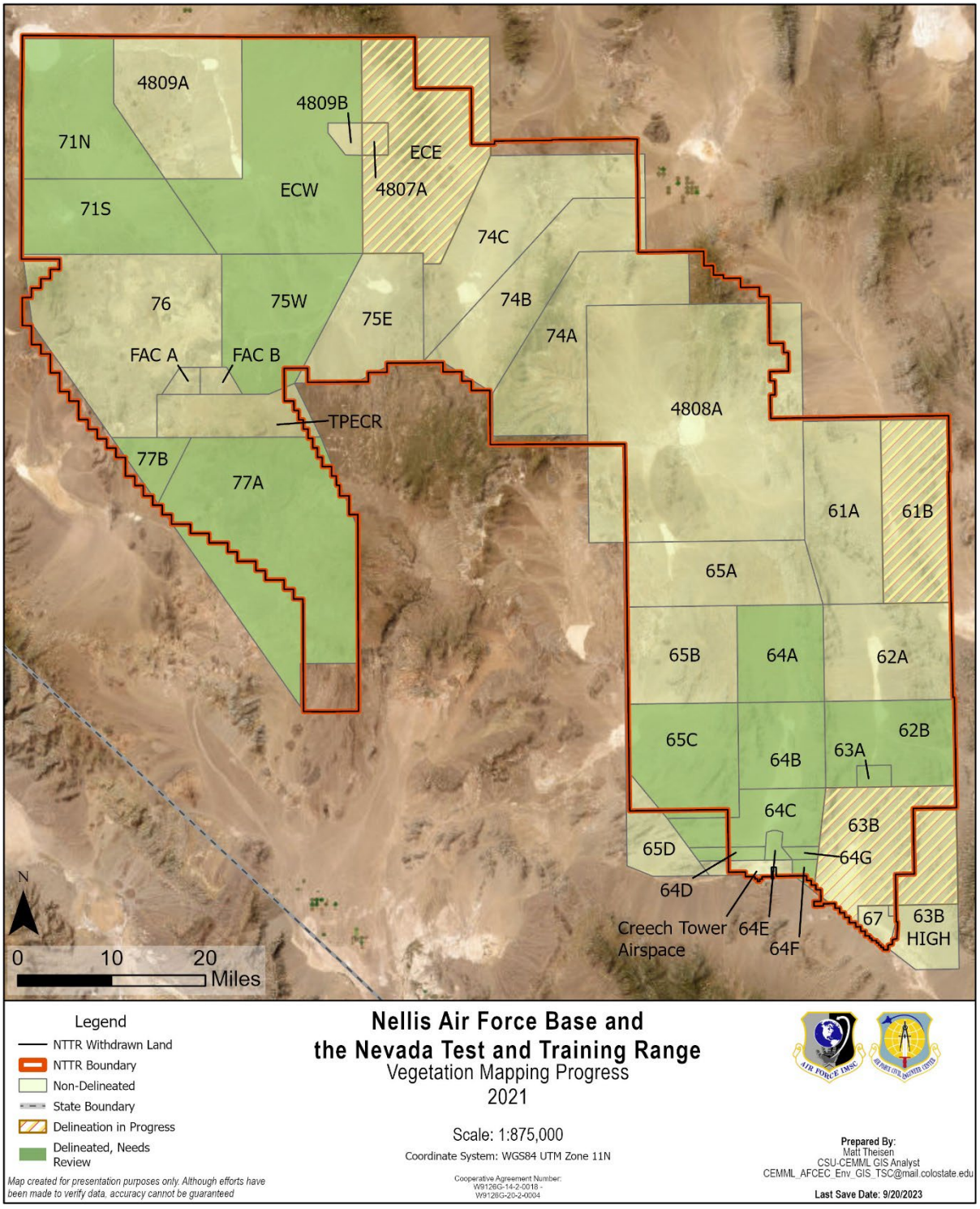


Figure 2-15. Current state of vegetation mapping progress on the Nevada Test and Training Range, 2021.

Further efforts to delineate vegetation will be necessary to fully describe the vegetation communities across the installation and to support environmental management and military mission training activities. Vegetation community classification has not been conducted for NAFB. Existing surveys for NAFB include rare plant surveys, invasive plant surveys, and general floral species inventory surveys, none of which have mapped vegetation communities.

Figure 2-16. Las Vegas buckwheat (*Eriogonum corymbosum* var. *nilesii*). Nellis Air Force Base Photo Library.

Future efforts include assessing the feasibility of employing automated software programs to annually delineate vegetation classifications for the NTTR, to assess shifts caused by changing precipitation and temperature patterns, assessing the feasibility of incorporating the BLM Assessment, Inventory, and Monitoring Strategy monitoring protocols in existing surveys, and pairing weather monitoring stations with vegetation data to understand climate-change-driven shifts in vegetation. Vegetation surveys will also be linked with other existing studies such as small mammal and wild horse (*Equus ferus*) studies, to determine relationships between native and non-native fauna and vegetation. Additionally, the NNRP will coordinate with BLM's Seeds of Success program or other native seed collecting groups to collect representative seed samples of NTTR plant species to stabilize, rehabilitate, and restore degraded land. The NTTR is a particularly valuable source of seed because of its large stock of native vegetation that can be harvested to help restore other areas. Working with BLM and other organizations to expand opportunities for seed collection for restoration and seed banking efforts could provide critical resources as species' ranges shift in response to changing climate conditions.

Nellis Air Force Base Vegetation Communities

Vegetation classification mapping on NAFB has not been completed. Figure 2-15 shows vegetation surveys conducted on NAFB to date. Biologists conducted three types of vegetation surveys on NAFB from 2002 to 2021, including vegetation community, invasive plant, and rare plant surveys. At each survey point, species identification and other ecological parameters were recorded within the area. A list of observed species can be found within the comprehensive vegetation species list for NAFB provided in Appendix C.

Figure 2-17. Las Vegas bearpoppy (*Arctomecon californica*) in bloom on Nellis Air Force Base, 2021. Nellis Air Force Base Photo Library.

In general, large expanses of the Mojave Desert valley floors that encompass NAFB primarily support creosote bush/white bursage vegetation communities (Vasek and Barbour 2007). Creosote bush/white bursage communities are characteristic of much of the Mojave Desert at elevations ranging from below sea level to approximately 3,940 feet, and

they can be observed in less-developed areas of NAFB, such as in the eastern portion of Area II and the SAR.

Nevada Test and Training Range

The North and South Ranges of the NTTR lie in the Great Basin and Mojave ecoregion sections, respectively. The South Range generally encompasses an area that supports vegetation and habitat types that are characteristic of the Mojave Desert section; the North Range generally encompasses an area that supports vegetation and habitat types characteristic of the Great Basin section.

Figure 2-18. Plant community near Stealth Seep on North Range, 2021. Nellis Air Force Base Photo Library.

A recent vegetation classification effort of the NTTR by CEMML began in 2017 and is currently in progress. Classifications within the North and South Range focus on sampling one or more training ranges within the overall NTTR. Thus far, in the North Range of the NTTR Ranges 4809A, 71S, 74B, 75E, 76, ECE, ECW, and TPECR have been sampled either partially or completely. In the South Range of the NTTR, Ranges 61B, 62A, 63B, 65B, and 65C are classified. Vegetation classifications on the NTTR have primarily focused on USNVC alliance level classifications. The alliance level of the USNVC features descriptions of diagnostic species within the dominant growth form of the community and accounts for regional climactic, hydrologic, and disturbance factors. In some instances where an appropriate USNVC alliance does not accurately describe the vegetation community, a provisional alliance is used for classification.

Previous descriptions of the vegetative communities of the NTTR are complete and classify vegetation base-wide. However, various methodologies in sampling and surveying as well as classification systems were used to complete these surveys. Various authorities were also cited to classify vegetation for each of those ranges over the years; a comparison of previous classifications to the USNVC descriptions will ultimately be necessary to understand vegetation more completely on the range (NAFB 2022*h*, 2022*k*). The current surveying and classification effort will provide a complete and standardized picture of the vegetative communities of the NTTR.

North Range Vegetation

The Great Basin Desert floristic region was defined by Shreve (1942) as a region typified by sagebrush and saltbush vegetation north of Beatty, Nevada. In this area, winter temperatures are too low to support plants typical of the warmer deserts of the Southwest, such as creosote bush, and sparse vegetation over rocky outcrops is common (Figure 2-19). Therefore, while both the North and South Ranges of the NTTR lie within the hydrographic region of the Great Basin, only the North Range lies within the floristically defined Great Basin Desert, and most of the South Range lies within the Mojave Desert.

Figure 2-19. Rock outcrop plant community with lichen at Thirsty Canyon on the North Range, 2022. Nellis Air Force Base Photo Library.

The broad-scale region encompassing the North Range of the NTTR is typified by broad desert valleys bounded by relatively high mountain ranges (NAFB 2018*a*). Vegetation in this area consists predominantly of cold desert scrub vegetation communities, 60% of which are saltbush alliances (NAFB 2022*h*). This alliance type is common in the Great Basin and generally forms in areas where the availability of water for plants is affected by the soil's water retention rate, or they occur with variation in areas that are alkaline or saline (NAFB 2017*a*). Areas with lower water retention or higher alkalinity and salinity tend to support saltbush vegetation, while areas with less harsh soils may support species such as sagebrush (*Artemisia* spp.). Currently, range maps with vegetation polygon delineations are available for Ranges 71N, 71S, 75W, 77A, 77B, and ECW, composing 722,000 acres of the North Range (NAFB 2022*h*).

The NAFB North Range vegetation classification reports (2017–2021) documented 25 alliance level vegetative communities and 16 provisional alliances (NAFB 2018*a*, 2019*a*, 2020*a*, 2021*b*). According to the reports, shrub-dominated communities were the most observed and were typical of vegetation found in Great Basin and Mojave Desert environments. Classification reports for the North Range also characterized alliances within Nevada Key Habitat types, which describe vegetation community and structure on a coarse scale. Classification reports noted seven Nevada Key Habitat types that are reflective of classified areas within the North Range NTTR. These include Barren landscapes, Desert Playas and Ephemeral Pools, Grasslands and Meadows, Intermountain Cold Desert Scrub, Lower Montane Woodlands and Chaparral, Mojave Warm Desert and Mixed Desert Scrub, and Sagebrush.

Of the alliances identified through ongoing classification efforts for the North Range, several are especially significant within specific habitat types. Bajadas, basin floors, and foothills of the North Range are commonly comprised of *Artemisia nova* (black sagebrush) Steppe and Shrubland Alliance, *Atriplex canescens* (fourwing saltbush) Scrub Alliance, and *Artemisia tridentata* – Mixed Shrub Dry Steppe & Shrubland Alliance communities. The USNVC describes these communities generally as having a sparse to moderately dense shrub layer dominated by black sagebrush, fourwing saltbush, and big basin sagebrush (*Artemisia tridentata* ssp. *Tridentata)* respectively, with sagebrush species, rabbitbrush species (*Ericameria* spp.), jointfir species (*Ephedra* spp.) and winterfat (*Krascheninnikovia lanata*), shrubs as associates. Perennial grasses are common in the understory, with stands occurring on well-draining soils.

Dry lake beds in the North Range were classified as *Sarcobatus vermiculatus* (greasewood) Intermountain Wet Shrubland communities. According to the USNVC, these shrublands occur within areas of flat, poorly drained lowlands with a shallow water table. These areas correspond with the Intermountain Cold Desert Shrub and Desert Playas and Ephemeral Pools descriptions of the Nevada Key Habitats. Greasewood shrubs dominate, along with associates of sagebrush species, saltbush species (*Atriplex* spp.), rabbitbrush species, spiny hopsage (*Grayia spinosa*), and bud sagebrush (*Picrothamnus desertorum*). The herbaceous layer is typically sparse if existent, and soils are generally alkaline and moderately saline (NAFB 2018*a*).

At higher elevations along dry mountain slopes and foothills, the *Pinus monophylla - Juniperus osteosperma* (singleleaf pinyon - Utah juniper)/Shrub Understory Woodland Alliance occupies sites. These communities inhabit areas with rocky, shallow soils, and singleleaf pinyon and Utah juniper trees dominate the upper canopy. An assortment of understory shrubs (especially black sagebrush) and grasses comprise the understory species, with the non-native invasive species cheat grass (*Bromus tectorum*) dominating the understory of sites that are disturbed.

Ruderal sites exhibiting signs of disturbance on the North Range are classified to the *Bromus tectorum - Taeniatherum caput-medusae* (cheatgrass, medusahead) Ruderal Annual Grassland Alliance. These communities are dominated by annual grasses and forbs, particularly cheatgrass, Russian thistle (*Salsola tragus*), and saltlover (*Halogeton glomeratus*). The high fuel loads of these alliances may present an increased risk for wildland fires (NAFB 2021*b*).

A comprehensive vegetation species list for the Installation is provided in Appendix C. Table 2-11 below lists all USNVC and Provisional Alliances classified on the North Range NTTR. This work is ongoing and includes vegetative communities found in Ranges 4809A, 71S, 75E, 76, ECE, ECW, and TPECR of the North Range.

Table 2-11. North Range Alliance Level Vegetation Classifications

U.S. National Vegetation Classification Alliances
Achnatherum hymenoides - Pseudoroegneria spicata - Muhlenbergia pungens Grassland Alliance
Artemisia arbuscula ssp. *longiloba* Steppe and Shrubland Alliance
Artemisia bigelovii Steppe and Shrubland Alliance
Artemisia nova Steppe and Shrubland Alliance
Artemisia spp. Mixed Shrub Ruderal Understory Shrubland Alliance
Artemisia tridentata - Mixed Shrub Dry Steppe and Shrubland Alliance
Artemisia tridentata ssp. *tridentata - Artemisia tridentata* ssp. *xericensis* Dry Steppe and Shrubland Alliance
Artemisia tridentata ssp. *wyomingensis* Dry Steppe and Shrubland Alliance
Atriplex canescens - Ericameria nauseosa Desert Wash Alliance
Atriplex canescens Scrub Alliance
Atriplex confertifolia Scrub Alliance
Bromus tectorum - Taeniatherum caput-medusae Ruderal Annual Grassland Alliance
Ephedra nevadaensis - Lycium andersonii - Grayia spinosa Scrub Alliance
Ephedra viridis Colorado Plateau Shrubland Alliance
Eriogonum fasciculatum - Viguiera parishii Desert Scrub Alliance
Grayia spinosa Scrub Alliance
Juniperus osteosperma Great Basin Shrubby Woodland Alliance

Table 2-11. North Range Alliance Level Vegetation Classifications

U.S. National Vegetation Classification Alliances
Krascheninnikovia lanata Steppe and Dwarf-Shrubland Alliance
Menodora spinescens Scrub Alliance
Peucephyllum schottii - Pleurocoronis pluriseta Scrub Alliance
Pinus monophylla - Juniperus osteosperma Grassy Open Woodland Alliance
Pinus monophylla - Juniperus osteosperma Shrub Understory Woodland Alliance
Pleuraphis jamesii Grassland Alliance
Purshia stansburiana Scrub Alliance
Sarcobatus vermiculatus Intermountain Wet Shrubland Alliance
NTTR Provisional Alliances
Artemisia arbuscula Shrubland Alliance
Atriplex confertifolia - Atriplex canescens Mixed Scrub Alliance
Chrysothamnus greenei Scrub Alliance
Dry Lakebed Alliance
Ericameria albida Mixed Scrub Alliance
Ericameria albida Mixed Shrub Ruderal Understory Shrubland Alliance
Ericameria cooperi Scrub Alliance
Great Basin Intermountain Sparse Vegetation Rock Outcrop Alliance
Intermountain Sparse Rock Outcrop Alliance
Kochia americana Scrub Alliance
Menodora spinescens - Artemisia sp. Mixed Scrub Alliance
Prunus fasciculata Scrub Alliance
Tetradymia axillaris Scrub Alliance
Tetradymia canescens Scrub Alliance
Sparse *Atriplex canescens* Scrub Alliance
Sparse vegetation - Calcareous Mineral Soil Alliance

1606

1607

South Range Vegetation

The South Range of the NTTR lies in the northeastern portion of the Mojave Desert, among the driest of North America's arid lands, where precipitation is often less than four inches per year (Rundel and Gibson 1996). The area consists of predominantly warm desert scrub vegetative communities. Figure 2-20 shows Johnson's fishhook cactus in bloom on the South Range.

Figure 2-20. Johnson's fishhook cactus *Echinomastus johnsonii* in bloom on the Small Arms Range, 2020. Nellis Air Force Base Photo Library.

According to the NAFB South Range Vegetation Classification reports, shrublands are prevalent across the landscape, particularly those dominated by creosote bush (NAFB 2020*a*). These communities are common and widespread across the Mojave, Sonoran, and Colorado Deserts extending north into the transition zone with the Great Basin Desert. Currently, range maps with vegetation polygon delineations are available for Ranges 62B, 63A, 64A-F, and 65C, comprising 438,000 acres of the South Range (NAFB 2022*k*).

The NAFB South Range Classification reports (2017–- 2021) documented 27 Alliance level vegetative communities and 26 Provisional Alliances (NAFB 2017*b*, 2018*c*, 2019*b*, 2020*b*, 2021*c*). According to the reports, shrub-dominated communities were the most commonly observed, and were typical of vegetation found in Mojave Desert and transitional zone environments. Classification reports for the South Range also utilized Nevada Key Habitat types to describe vegetative communities. South Range reports noted nine Nevada Key Habitat types that are indicative of the Mojave Desert region. Key Habitats classified are Cliffs and Canyons, Desert Playas and Ephemeral Pools, Grasslands and Meadows, Intermountain Cold Desert Scrub, Lower Montane Woodlands and Chaparral, Mesquite Bosques and Desert Washes, Mojave Warm Desert and Mixed Desert Scrub, Sagebrush, and Sand Dunes and Badlands.

Several noteworthy vegetation community and habitat types are present on the South Range. Rock outcrop communities within the South Range frequently provide critical habitat to rare and specialized plant species (NAFB 2018*b*). The *Eriogonum wrightii – Eriogonum heermannii – Buddleja utahensis* (Wright's buckwheat–- Heerman's Buckwheat – Utah butterflybush) Scrub Alliance, *Purshia stansburiana* (Stansbury cliffrose) Scrub Alliance, communities typify these habitats. Additionally, the provisional communities *Ericameria nana* (dwarf goldenbush) Rock Outcrop Provisional Alliance, *Purshia tridentata* (antelope bitterbrush) Cliff & Scree Shrubland Provisional Alliance, and *Salazaria mexicana – Krameria erecta* Rock Outcrop Provisional Alliance are also representative of rock outcrop vegetative communities on the South Range, and suggest that these habitat types are not fully represented within the USNVC currently. These vegetative communities are located on edges of canyons, steep slopes, and cliffs and soils with these habitats are well-drained, shallow, and rocky. An assortment of low to mid shrub species dominate sites, especially Stansbury cliffrose, dwarf goldenbush, Mexican bladdersage (*Salazaria mexicana*), Utah butterflybush and buckwheat species (*Eriogonum* spp.). Herbaceous ground cover is sparse with perennial graminoids the most dominant associate.

Shrublands in the South Range are typically of the Mojave Desert and Transitional Zones. Saltbush shrubland communities occur on valley bottoms, playas, and alluvial slopes. In contrast to the North Range of the NTTR, shrubland communities dominated by creosotebush are significantly more prevalent (NAFB 2020*a*). Burrobrush is codominant with creosotebush, and an assortment of shrubs and dwarf shrubs associate within this community. Occasional emergent Joshua trees (*Yucca brevifolia*) may be present. For this reason, the provisional alliance *Yucca/Larrea tridentata–- Ambrosia dumosa* Wooded Scrub was developed to classify sites, rather than the *Larrea tridentata – Ambrosia dumosa* Bajada and Valley Desert Scrub Alliance in which Joshua trees are sporadic or absent. Soils are typically sandy, well-drained, and derived from colluvium or alluvium (NatureServe 2023).

Invasive vegetation is also present on the South Range, with *Bromus tectorum–- Taeniatherum caput-medusae* Ruderal Annual Grassland Alliance communities present, along with the herbaceous strata of the *Artemisia* spp. – Mixed Shrub Ruderal Understory Shrubland Alliance. Non-native invasive plant species within these communities are likely a result of anthropogenic disturbance such as fire and soil disturbance (NAFB 2019*b*). One community of particular note is the *Centaurea solstitialis – Isatis tinctoria – Salsola tragus* (yellow starthistle – Dyer's woad – Russian thistle) Ruderal Annual Forb Alliance, which is dominated by non-native invasive forb species, where cover may exceed 90% (NatureServe 2023). The density of invasive vegetation in this community has the potential negatively impact the military mission for training exercises and increase the fire hazard of the area (NAFB 2019*b*).

Joshua tree is an important plant species indicative of the desert southwest, and shrub and woodland communities (*Yucca brevifolia* Wooded Scrub Alliance and *Yucca/Larrea tridentata–- Ambrosia dumosa* Wooded Scrub Alliance) are common on the South Range (NAFB 2018*b*). Joshua trees occur in a generally open canopy, with a denser assortment of shrub species such as sagebrush species, yellow rabbitbrush (*Chrysothamnus viscidiflorus*), blackbrush, Nevada jointfir (*Ephedra nevadensis*), Eastern Mojave buckwheat (*Eriogonum fasciculatum*), and creosotebush in association. The herbaceous layer is open to intermittent and dominated by perennial grasses, with few forbs. Soils are variable and limit the distribution of vegetation (NatureServe 2023). Conflicting information regarding taxonomy and distribution from reputable sources of eastern Joshua tree (*Yucca jaegeriana*) and western Joshua tree may complicate certainty around which Joshua tree species are present at given site and to what extent (NAFB 2021*c*). This will require further clarification and study of vegetation classification efforts on the NTTR going forward.

A comprehensive vegetation species list for the installation is provided in Appendix C. Table 2-12 lists all USNVC and Provisional Alliances classified on the South Range NTTR. This work is ongoing and includes vegetative communities found in Ranges 61B, 62A, 63B, 65B, and 65C of the South Range.

Table 2-12. South Range Alliance Level Vegetation Classifications

U.S. National Vegetation Classification Alliances
Ambrosia dumosa Desert Dwarf Scrub Alliance
Artemisia spp. Mixed Shrub Ruderal Understory Shrubland Alliance
Artemisia tridentata Dry Steppe and Shrubland Alliance
Atriplex canescens Scrub Alliance
Atriplex confertifolia Scrub Alliance
Bromus tectorum - Taeniatherum caput-medusae Ruderal Annual Grassland Alliance
Centaurea solstitialis - Isatis tinctoria - Salsola tragus Ruderal Annual Forb Alliance
Coleogynne ramosissima Colorado Plateau Shrubland Alliance

Table 2-12. South Range Alliance Level Vegetation Classifications

U.S. National Vegetation Classification Alliances
Coleogynne ramosissima Mojave Desert Scrub Alliance
Encelia actonii - Encelia virginensis - Viguiera reticulata Desert Scrub Alliance
Ephedra nevadaensis - Lycium andersonii - Grayia spinosa Scrub Alliance
Ephedra torreyana Shrubland Alliance
Ericameria paniculata Mojave Desert Wash Scrub Alliance
Eriogonum wrightii - Eriogonum heermannii - Buddleja utahensis Scrub Alliance
Gutierrezia sarothrae - Gutierrezia microcephala Dwarf Shrubland Alliance
Hymenoclea salsola - Bebbia juncea Mojave - Sonoran Desert Wash Scrub Alliance
Larrea tridentata - Ambrosia dumosa Bajada and Valley Desert Scrub Alliance
Menodora spinescens Scrub Alliance
Mojave - Sonoran *Ambrosia salsola - Bebbia juncea* Desert Wash Scrub Alliance
Pinus monophylla - Juniperus osteosperma Shrub Understory Woodland Alliance
Pleuraphis rigida Desert Grassland Alliance
Prunus fasciculata - Salazaria mexicana Northern Mojave Desert Wash Scrub
Psorothamnus fremontii - Psorothamnus polydenius Desert Wash Scrub Alliance
Purshia stansburiana Scrub Alliance
Tamarix spp. Ruderal Riparian Scrub Alliance
Stipa speciosa - Hilaria rigida Grassland Alliance
Yucca brevifolia Wooded Scrub Alliance
NTTR Provisional Alliances
Ambrosia acanthicarpa Desert Wash Alliance
Ambrosia dumosa/Perennial Grassland Understory Alliance
Artemisia dracunculus Desert Wash Alliance
Atriplex confertifolia - Atriplex canescens Mixed Scrub Alliance
Desert Pavement Alliance
Dry Lakebed Alliance
Ephedra Rock Outcrop Alliance
Ephedra spp. - *Lycium* spp. Mixed Scrub Alliance
Ephedra torreyana - Acamptopappus shockleyi Scrub Alliance
Ephedra torreyana - Thamnosma montana Sparse Rocky Outcrop Alliance
Ericameria nana Rock Outcrop Alliance
Eriogonum corymbosum Sandy Slope Alliance
Gutierrezia spp. Ruderal Scrub Alliance
Hecastocleis shockleyi Scrub Provisional Alliance
Intermountain Sparse Rock Outcrop Alliance
Kochia americana Scrub Alliance
Larrea tridentata - Ephedra nevadensis Shrubland Alliance
Lycium andersonii Desert Valley Scrub Alliance
Opuntia basilaris Scrub Alliance

Table 2-12. South Range Alliance Level Vegetation Classifications

U.S. National Vegetation Classification Alliances
Pinus monophylla - Juniperus osteosperma/Yucca brevifolia Wooded Alliance
Psorothamnus arborescens Sparse Shrubland Alliance
Purshia tridentata Cliff and Scree Shrubland Alliance
Salazaria mexicana - Krameria erecta Rock Outcrop Alliance
Sparse *Gutierrezia* spp. Cliff and Rock Outcrop Alliance
Yucca/Larrea tridentata - Ambrosia dumosa Wooded Scrub Alliance
Yucca jaegeriana Wooded Scrub Alliance

Transition Zone

On the NTTR, a transitional zone between the Great Basin and Mojave Deserts runs along Pahute Mesa on the North Range, as shown in Figure 2-1. This area would be expected to include plants from both deserts occurring in unique associations that do not appear in other parts of either desert (Beatley 1976). Johnston et al. (1992) noted that transition-zone boundaries can be difficult to determine, especially where community changes are gradual. The transition zone on the NTTR represents an important area ecologically, supporting species from distinct biotic regions. A greater diversity of plant and animal species is indeed found there, and this may include unique species that could be described as understanding of the area grows. Generally, transition zones serve as corridors for some species and as barriers for others. On geologic time scales, species occupying transitional zones are often ephemeral, usually persisting less than 10,000 years (Hansen and di Castri 1992). Figure 2-21 shows a *Penstemon* species on the NTTR.

Figure 2-21. *Penstemon* species with perennial grasses on the South Range, 2023. Nellis Air Force Base Photo Library.

The Nature Conservancy conducted a statistical analysis of the vegetative makeup of 185 plots on the NTTR, sampled between 1994–1997 (The Nature Conservancy [TNC 2000]). Of the 185 plots, 78% were classified as either Great Basin or Mojave Desert vegetation types, 15% were classified as transition vegetation, and 7% were unclassified. Sampling of 185 plots was considered a bare minimum, and further sampling was strongly recommended; however, the available data support the hypothesis that most of the NTTR vegetation is closely associated with one desert or another. The Great Basin/Mojave Desert transition, where present, represents a small percentage of the NTTR vegetation (NAFB 1997).

Invasive Species

Nellis Air Force Base

Tamarisk (*Tamarix* spp.), or saltcedar, is a non-native invasvie species (NNIS) and is a perennial shrub that has had dramatic effects on riparian plant communities across the southwest and on NAFB (Gulf South Research Corporation 2012). The most common tamarisk species in the region is *T. ramosissima*, an arborescent shrub that aggressively colonizes areas where groundwater is shallow or seasonal moisture is available. Tamarisk is known for releasing salt into surrounding soils, which, in combination with the plant's aggressive growth and colonization, typically leads to the establishment of dense, monospecific stands that often crowd out and preclude native spices from becoming established.

Malta starthistle was first documented on NAFB in February 2009 during surveys for tamarisk (NAFB 2022*f*). It is an annual NNIS that resembles yellow starthistle and is often confused with it (USFS 2015*a*). Malta starthistle develops impenetrable thickets, is highly competitive for resource consumption, and can injure people and fauna through physical injury from its spines or neurotoxins (USFS 2015*a*). The weed has a deep tap root to reach water, rapid growth ability, is highly adaptable, and produces large amounts of seed; thereby increasing its invasive tendencies (USFS 2015*a*). Although scattered on NAFB, low lying terrain features where water pools or inundation occurs from water runoff, such as ditches, drainages, and borrow pits, support the densest populations of malta starthistle (NAFB 2022*f*).

Sahara mustard was first recorded on NAFB in 2011. Sahara mustard is an invasive annual that has a wide variety of habitats, but it most commonly found in dry sandy soils (USFS 2015*b*). Its short life cycle, seed longevity and production capacity, and influence on fire regimes make it a particularly troublesome invasive species (USFS 2015*b*). Formal surveys on NAFB or the NTTR have yet to determine the current extent of infestation. However, in 2019, Sahara mustard was observed dominating the sand dune complex within unimproved lands in Area II of NAFB (NAFB 2022*f*).

Additional information on NAFB and the NTTR's planning, surveying, and treatment efforts for these species is discussed in Section 7.11.

Nevada Test and Training Range

One indirect, widespread, and persistent effect of Euro-American settlement in this area is the presence of introduced annual and perennial plants. These species sometimes dominate local vegetation and are considered invasive. The three most prominent annual NNIS on the NTTR are Russian thistle, red brome (*Bromus rubens*), and cheatgrass. Salt lover is also a common invasive species. Red brome is desert-adapted and has become common on the South Range, whereas cheatgrass is adapted to cooler steppe environments and occurs primarily on the North Range. Both grasses are found in remote habitats that otherwise appear pristine and unaffected by Euro-American activities. Russian thistle, red brome, and cheatgrass are aggressive colonizers that may displace native populations of annuals on disturbed soils. If disturbance is not repeated, Russian thistle often does not persist; however, red brome and cheatgrass can continue to be the dominant annuals in certain habitats, regardless of the disturbance regime. These plants are particularly problematic in non-fire adapted desert vegetation, which generally has widely-spaced shrubs that do not carry fires. Invasive species such as annual grasses provide continuous fuel for fires that can consume large areas of vegetation. Native species not adapted to such fires may struggle to recolonize, resprout, or germinate from the seedbank, while annual invasive species thrive on the disturbance. The pest management program for NAFB and the NTTR includes control and management of invasive plants, more detailed information for which can be found in Section 7.11.

2.3.2.3 Future Vegetation Cover

Desert ecosystems are sensitive to climate drivers that exacerbate the already hot and dry conditions, increasing vulnerability for many species that already exist close to their physiological limits. As such, even small changes in temperature and precipitation can have a significant impact on plant composition, distribution, and abundance in this region. Interacting disturbances (e.g., flooding and wildfire) have the potential to further alter species survival and composition.

Creosote bush is a dominant member of most plant communities of NAFB, the NTTR South, and Ranges 77a and 77b on NTTR North. Because creosote bush requires summer rains for flowering success, the decreasing precipitation projected by climate models could have substantial negative impacts on the species' reproductive success. The iconic Joshua tree faces similar risks; the projected decrease in precipitation during its flowering period (March to May) could hinder the reproduction of trees, both directly (through water stress on individual trees) and indirectly (e.g., by influencing the plant-pollinator relationship and viable seed production, seed germination, seedling establishment, and recruitment). Water stress due to lower precipitation and higher temperatures could be particularly hard on seedlings, by hindering their growth. Species of low, shrub-like trees that thrive in riparian areas (e.g., cottonwood and mesquite [*Prosopis* spp.]) also could be sensitive to the expected climate changes, including increased minimum temperatures and altered flooding patterns. On the other hand, a drier climate might discourage invasive tamarisk, which could benefit efforts to control it.

Desert vegetation is expected to shift westward and upward in elevation over the coming century (Barrows 2011, Barrows and Murphy-Mariscal 2012) and, in some areas, may replace upslope vegetation that is less suited to the increasingly hot and seasonally dry conditions (Friggens et al. 2013, Lenihan et al. 2008). In addition, rising temperatures likely will enhance soil decomposition and reduce plant productivity over large areas. Loss of vegetative cover, coupled with increases in precipitation intensity (often associated with climate change) and climate-induced reductions in soil aggregate stability, could dramatically increase erosion rates.

The projected changes in climate may impact the success of invasive annuals on the installation, including cheatgrass and red brome. As described in Section 2.3.2.2, red brome is desert-adapted and has become common on NTTR South, whereas cheatgrass is adapted to cooler environments and occurs primarily on NTTR North. Although often present in different habitats, these species do occasionally co-occur. These *Bromus* species are both aggressive colonizers, and because they are now established on several parts of the installation, attempts to fully eradicate them have become impractical. Concerns caused by *Bromus* invasions include the creation of a grass-fire cycle (GFC) that can have long-term effects on the structure and species composition of native plant communities (Abella 2009, Engel and Abella 2011).

The impacts of climate change on *Bromus* invasion will depend largely on the amount and timing of precipitation. Models project that average annual precipitation at NAFB will decrease overall under most scenarios; however, several scenarios show the potential for increased precipitation concentrated during the fall and/or winter months (CEMML 2019). These precipitation patterns are reflected in other climate models for arid systems in North America (Westerling et al. 2003, IPCC 2007) and are expected to favor expansion of exotic grasses, increasing the risk of fire and favoring the GFC (Brooks et al. 2004). Alternatively, large portions of southern Nevada and southern Utah may become climatically unsuitable for cheatgrass in the case of hotter and drier conditions (CEMML 2020) and red brome may well expand to fill any range that cheatgrass vacates (Bradley 2009). Other factors relating to land use, soils, competition, or topography also will interact with climate change to determine *Bromus* success at the local scale (Bradley 2009). Ultimately, the combination of changing conditions and invasive grasses could result in conversion

to a grassland system (EcoAdapt 2017). Alternatively, the shift in climate with fewer invasive grasses and absence of fire could lead to a shrub-dominated ecosystem or ecosystem that is shrub-dominated and interspersed with grassy patches (CEMML 2019).

2.3.2.4 Turf and Landscaped Areas

The moderate climate regime of NAFB allows for the proliferation of a wide variety of deciduous trees, evergreen trees, shrubs, perennial species, vines, and grasses within improved areas where supplemental irrigation can be provided. Improved grounds at NAFB include areas of turf grasses and ornamental landscaping that require regular maintenance, such as mowing, irrigation, and fertilizing. Overall maintenance of the turf and landscaped areas of NAFB is directed by the Grounds Maintenance Plan.

Current landscaped areas represent a mixture of plant species due to old and new landscaping practices. Past reports indicate that the preferred mixture of turf grasses for NAFB was a 60%-30%-10% mix of Kentucky bluegrass (*Poa pratensis*), Italian domestic ryegrass (*Lolium perenne* var. *multiflorum*), and creeping red fescue (*Festuca rubra*). With regular irrigating, this mix can be maintained as attractive turf; however, warm-season grasses, such as buffalo grass, Bermuda grass, or *Zoysia* sp., would require less irrigation and be better adapted to the desert environment. Deciduous and evergreen trees are also maintained at the installation, all supported with irrigation and shallow groundwater.

Nellis AFB landscaping practices evolve with the southern Nevada urban forestry community's knowledge and expertise. Some species thought to survive well in this environment are no longer considered climate-resilient (e.g. Arizona ash [*Fraxinus velutina]*). Also, planting only native vegetation is not necessary and only limits species options. The installation will plant a variety of tree species, native and non-native, to reduce the vulnerability of tree canopies to pests, disease, and climatic stressors. The current, authorized vegetation list used by NAFB is the Southern Nevada Water Authority's 2021 Water Smart Landscapes Program Plant List. This list was updated in-house to reflect NAFB's needs more closely to provide species that will be resilient as temperatures increase and precipitation decreases. The Southern Nevada Water Authority's website is a valuable resource for comprehensive landscape watering information, including local watering restrictions and irrigation-method guidance (Southern Nevada Water Authority 2021).

Since 1994, NAFB has been recognized as a Tree City by the Tree City USA Program of the Arbor Day Foundation. The program recognizes towns and counties across the nation that have implemented successful urban forestry projects. NAFB programs supporting the inventory and maintenance of trees on the base include the 2017 Urban Forest Inventory, ongoing effort to maintain the inventory, and collaboration with the Nevada Division of Forestry to monitor and improve the urban forest (NAFB 2018*c*; Table 2-13). The species in Table 2-13 represent species planted on NAFB historically. Some of these species are not currently recommended by the southern Nevada urban forestry community. However, the installation has updated its suitable planting list and will continue to update it as needed.

Table 2-13. Landscape plant species occurring within improved grounds on Nellis Air Force Base as recorded from the 2017 Urban Forest Inventory.

Common Name	Scientific Name	Common Name	Scientific Name
African Sumac	*Searsia lancea*	Chinese Elm	*Ulmus parvifolia*
Apple	*Malus spp.*	Lemon Scented Gum	*Eucalyptus citriodora*
Argyle Apple	*Eucalyptus cinerea*	European Fan Palm	*Chamaerops humilis*
Arizona Cypress	*Hesperocyparis arizonica*	Mexican Fan Palm	*Washingtonia robusta*
Black Locust	*Robinia pseudoacacia*	Mojave Yucca	*Yucca schidigera*
Blue Paloverde	*Parkinsonia florida*	Mondel Pine	*Pinus brutia var. eldarica*
California Fan Palm	*Washingtonia filifera*	Netleaf Hackberry	*Celtis laevigata var. reticulata*
Callery Pear	*Pyrus calleriana*	Shamel Ash	*Fraxinus uhdei*
Canary Island Date	*Phoenix canariensis*	Siberian Elm	*Ulmus pumila*
Catclaw Acacia	*Acacia greggii*	Silktree	*Albizia julibrissin*
Chastetree	*Vitex agnus-castus*	St. John's Bread	*Ceratonia siliqua*
Cherry Plum	*Prunus cerasifera*	Sugar Sumac	*Rhus ovata*
Chinaberrytree	*Melia azedarach*	Sweet Almond	*Prunus dulcis*
Chinese Pistache	*Pistacia chinensis*	Sweet Desert Willow	*Chitalpa x tashkentensis*
Common hackberry	*Celtis occidentalis*	Tamarisk	*Tamarix ramosissima*
Coolabah	*Eucalyptus microtheca*	Texas Ebony	*Ebenopsis ebano*
Dalby Myall	*Acacia stenophylla*	Texas Mountain Laurel	*Sophora secundiflora*
Desert Willow	*Chilopsis linearis*	Texas Red Oak	*Quercus buckleyi*
Edible Fig	*Ficus carica*	Thornless Chilean	*Prosopis chilensis*
European Olive	*Olea europaea*	Valley Oak	*Quercus lobata*
Fremont's	*Populus fremontii*	Velvet Ash	*Fraxinus velutina*
Glossy Privet	*Ligustrum lucidum*	Western Honey Mesquite	*Prosopis glandulosa var. torreyana*
Holly Oak	*Quercus ilex*	White Mulberry	*Morus alba*
Italian Cypress	*Cupressus sempervirens*	White Poplar	*Populus alba*
Jerusalem Thorn	*Parkinsonia aculeata*	Whiteflower Kurrajong	*Brachychiton populneum*
Joshua Tree	*Yucca brevifolia*	Whitethorn Acacia	*Acacia constricta*

2.3.3 Fish and Wildlife

Wildlife occurring on NAFB and the NTTR is representative of the Mojave and Great Basin deserts. No fish have been documented within the water resources onsite. Further information on common wildlife is given below. Threatened and endangered species are discussed in Section 2.3.4.

2.3.3.1 Herpetofauna

Reptiles are found across NAFB and the NTTR, while amphibians are relatively scarce and are found only in areas with water. Observations, from dedicated herpetofauna surveys or incidental observations, have

1845 begun to provide a picture of the distribution of herpetofauna across NAFB and the NTTR. Table 2-14
1846 summarizes records of herpetofauna observed on NAFB and/or the NTTR during surveys from 2005–2021.

Table 2-14. Herpetofauna observed on Nellis Air Force Base and the Nevada Test and Training Range, 2005–2021.

Common Name	Scientific Name	Observations			
		North Range	South Range/ CAFB*	NAFB/ SAR	Total
Federal- and State-Protected Herpetofauna Species					
Desert Tortoise	*Gopherus agassizii*	0	31	11	42
Nevada Species of Conservation Priority (SGCN)					
Banded Gila Monster	*Heloderma suspectum*	0	2	0	2
Chuckwalla	*Sauromalus ater*	15	55	19	89
Desert Horned Lizard	*Phrynosoma platyrhinos*	120	73	78	271
Desert Iguana	*Dipsosaurus dorsalis*	0	17	50	67
Desert Night Lizard*	*Xantusia vigilis*	0	3	1	4
Great Basin Collared Lizard	*Crotaphytus bicinctores*	113	91	14	218
Great Basin Spadefoot Toad	*Spea intermontane*	113+	0	0	113+
Long-nosed Leopard Lizard	*Gambelia wislizenii*	76	68	21	165
Long-tailed Brush Lizard	*Urosaurus graciosus*	0	0	104	104
Mojave Fringe-toed Lizard	*Uma scoparia*	0	0	403	403
Mojave Shovel-nosed Snake	*Chionactis occipitalis*	6	8	0	14
Panamint Rattlesnake	*Crotalus stephensi*	472	12	0	484
Regal Ringneck Snake	*Diadophis punctatus regalis*	1	0	0	1
Sidewinder	*Crotalus cerastes*	12	21	30	63
Spotted Leaf-nosed Snake	*Phyllorhynchus decurtatus*	0	2	2	4
Western Red-tailed Skink	*Plestiodon gilberti*	48	0	0	48
Western Banded Gecko	*Coleonyx variegatus*	11	19	62	92
Other Native Herpetofauna					
California Kingsnake	*Lampropeltis californiae*	9	4	1	14
Coachwhip (Red Racer)	*Coluber flagellum*	18	6	5	29
Desert Night Snake	*Hypsiglena chlorophaea*	7	1	0	8
Glossy Snake	*Arizona elegans*	5	17	3	25
Great Basin Gopher Snake	*Pituophis catenifer deserticola*	120	7	4	131
Great Basin Rattlesnake	*Crotalus oreganus lutosus*	110	0	0	110
Long-nosed Snake	*Rhinocheilus lecontei*	26	2	2	30
Mojave Fringe-toed Lizard	*Uma scoparia*	0	0	403	403

Table 2-14. Herpetofauna observed on Nellis Air Force Base and the Nevada Test and Training Range, 2005–2021.

Common Name	Scientific Name	Observations			
		North Range	South Range/ CAFB*	NAFB/ SAR	Total
Mojave Patch-nosed Snake	*Salvadora hexalepis mojavensis*	10	5	1	16
Sagebrush Lizard	*Sceloporus graciosus*	4	0	0	4
Side-blotched Lizard	*Uta stansburiana*	147	79	130	356
Southwestern Speckled Rattlesnake	*Crotalus pyrrhus*	0	0	13	13
Striped Whipsnake	*Coluber taeniatus*	71	0	0	71
Tiger Whiptail	*Aspidocelis tigris*	102	108	271	481
Western Fence Lizard	*Sceloporus occidentalis*	239	0	0	239
Western Groundsnake	*Sonora semiannulata*	4	3	1	8
Western Toad	*Anaxyrus boreas*	100+	—	—	100+
Woodhouse's Toad	*Anaxyrus woodhousii*	0	0	32	32
Yellow-backed Spiny Lizard	*Sceloporus uniformis*	117	43	1	161
Zebra-tailed Lizard	*Callisaurus draconoides*	133	118	11	262
Non-native/Introduced Herpetofauna					
Mediterranean Gecko	*Hemidactylus turcicus*	0	0	14**	14**
Rough-tailed Bowfoot Gecko	*Cyrtopodion scabrum*	0	0	90	90

*2021 is the last year that Creech AFB was included in herpetofauna surveys
**Many are likely rough-tailed bowfoot geckos that were misidentified.

Presence and distribution of herpetofauna are further discussed in the following paragraphs. Further information regarding detections and distribution of herpetofauna on NAFB and the NTTR is in the Final Report 2021 Reptile and Amphibian Surveys (NAFB 2022*j*). Threatened and endangered species and Nevada SGCN are discussed in Section 2.3.4.

Herpetofauna populations on NAFB and the NTTR tend to coincide with the transition from Mojave Desert to Great Basin Desert habitats. Certain Mojave Desert species, including the sidewinder (*Crotalus cerastes*, BLM Sensitive and Nevada SGCN), the chuckwalla (*Sauromalus ater*, BLM Sensitive, Nevada SGCN), and western banded gecko (*Coleonyx variegatus*, Nevada SGCN) occur surprisingly far north along the western portions of the NTTR, where lower-elevation Mojave Desert habitat is present. Mojave Desert species documented on NAFB and southern portions of the NTTR include the sidewinder, chuckwalla, desert iguana (*Dipsosaurus dorsalis*, BLM Sensitive, Nevada SGCN), western banded gecko, desert night lizard (*Xantusia vigilis*), southwestern speckled rattlesnake (*Crotalus pyrrhus*), and spotted leaf-nosed snake (*Phyllorhynchus decurtatus*, Figure 2-22). The Mojave fringe-toed lizard (*Uma scoparia*) was documented on NAFB in 2019, and is the second population documented in Nevada.

Figure 2-22. Spotted leaf-nosed snake on Nellis Air Force Base. Nellis Air Force Base Photo Library.

Some Great-Basin-associated species found on the northern and higher-elevation portions of the NTTR include the Western fence lizard (*Sceloporus occidentalis*), striped whipsnake (*Coluber taeniatus*), and Great Basin rattlesnake (*Crotalus oreganus lutosus*). The Panamint rattlesnake (*Crotalus stephensi*, Nevada SGCN, Figure 2-23) can be found within the rocky hills of the North Range.

Numerous species considered Mojave-Great Basin generalists are widespread on both the northern and southern portions of the NTTR, and most have been documented on NAFB as well. Among these are the zebra-tailed lizard (*Callisaurus draconoides*), tiger whiptail lizard (*Aspidocelis tigris*), yellow-backed spiny lizard (*Sceloporus uniformis*), desert horned lizard (*Phrynosoma platyrhinos*, BLM Sensitive, Nevada SGCN), Great Basin collared lizard (*Crotaphytus bicinctores*, BLM Sensitive, Nevada SGCN), long-nosed leopard lizard (*Gambelia wislizenii*, BLM Sensitive, Nevada SGCN), and Great Basin gopher snake (*Pituophis catenifer deserticola*).

Figure 2-23. Panamint rattlesnake on the North Range, 2020. Nellis Air Force Base Photo Library.

Only three amphibians have been documented on NAFB and the NTTR. The Great Basin spade-foot toad (*Spea intermontane*) can be found on the North Range around Breen Creek and George's Water, the western toad (*Anaxyrus boreas*) can be found on the North Range, and the Woodhouse's toad (*Anaxyrus woodhousii*, Figure 2-24) can be found around the golf course ponds on NAFB. Two introduced geckos have been documented on NAFB to date: the Mediterranean gecko (*Hemidactylus turcicus*) and the rough-tailed bowfoot gecko (*Cyrtopodion scabrum*). Introduction and distribution of the rough-tailed bowfoot gecko is further discussed in the 2021 NAFB Reptile and Amphibian report (NAFB 2022*j*). While only one rattlesnake documented on the installation is a SGCN (the sidewinder), NDOW has taxonomic and research interest in all native rattlesnake species (J. Jones, herpetologist, Nevada Department of Wildlife, personal communication, 2017). The Mojave rattlesnake (*Crotalus scutulatus*) has not yet been documented on NAFB or the NTTR, but could occur. Figure 2-25 and Figure 2-26 are maps of observations for snake species on NAFB. Figure 2-27 and Figure 2-28 are maps of snake observations on the NTTR.

Figure 2-24. Woodhouse's toad on the Nevada Test and Training Range, 2019. Nellis Air Force Base Photo Library.

Figure 2-26 and Figure 2-28 show observations of venomous snakes (rattlesnakes) on the NAFB and NTTR, respectively.

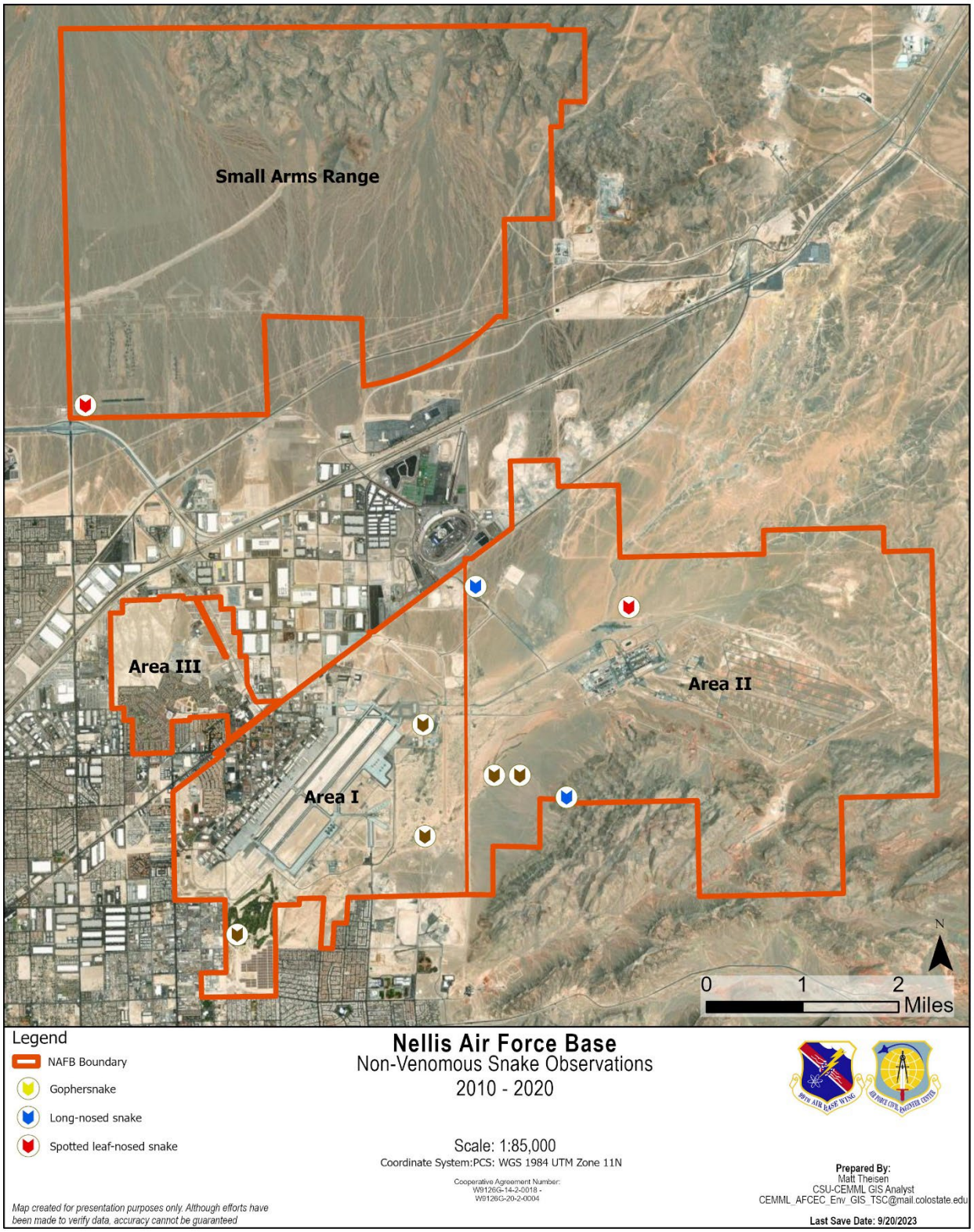


Figure 2-25. Non-venomous snake observations on Nellis Air Force Base and the Small Arms Range, 2010–2020.

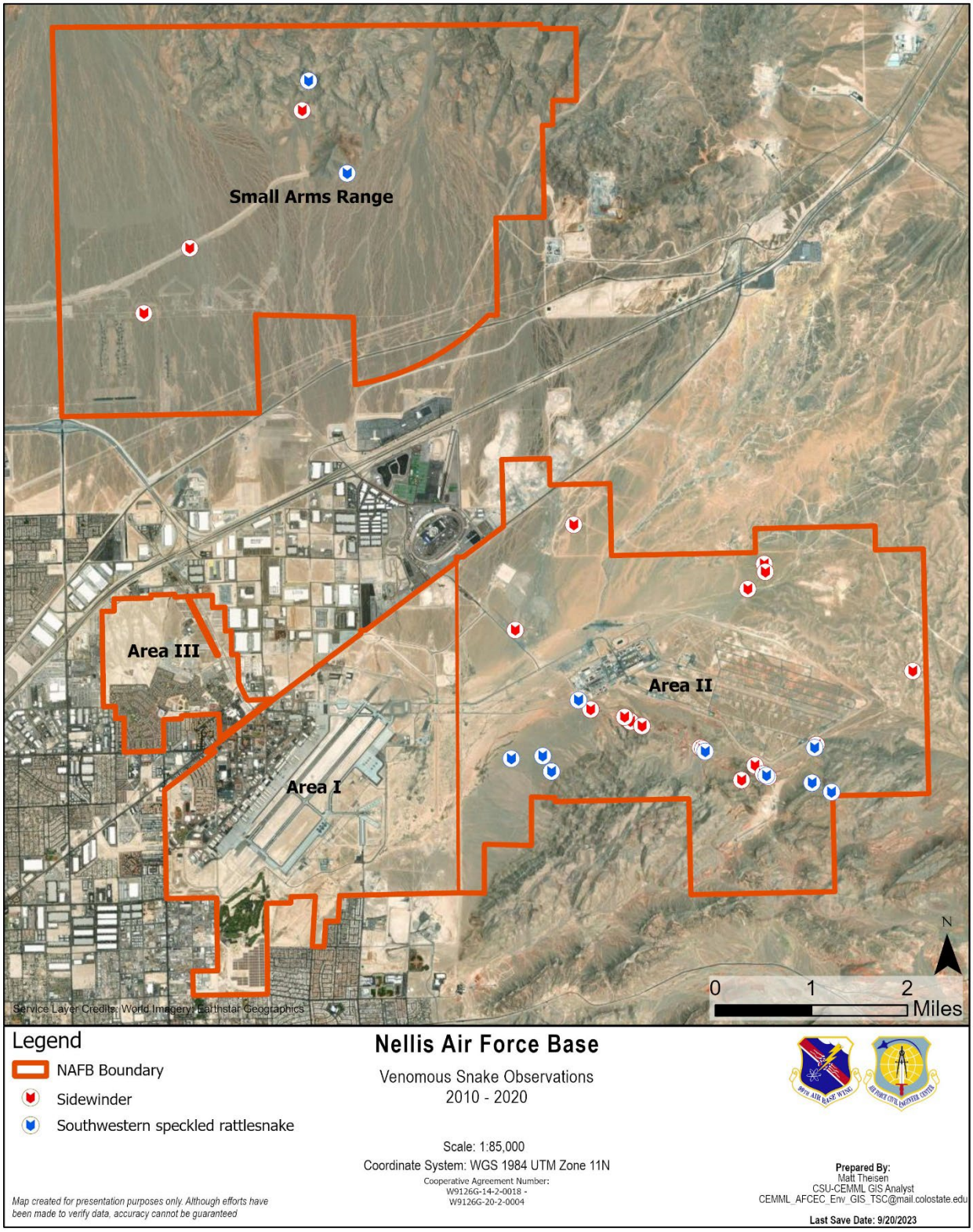
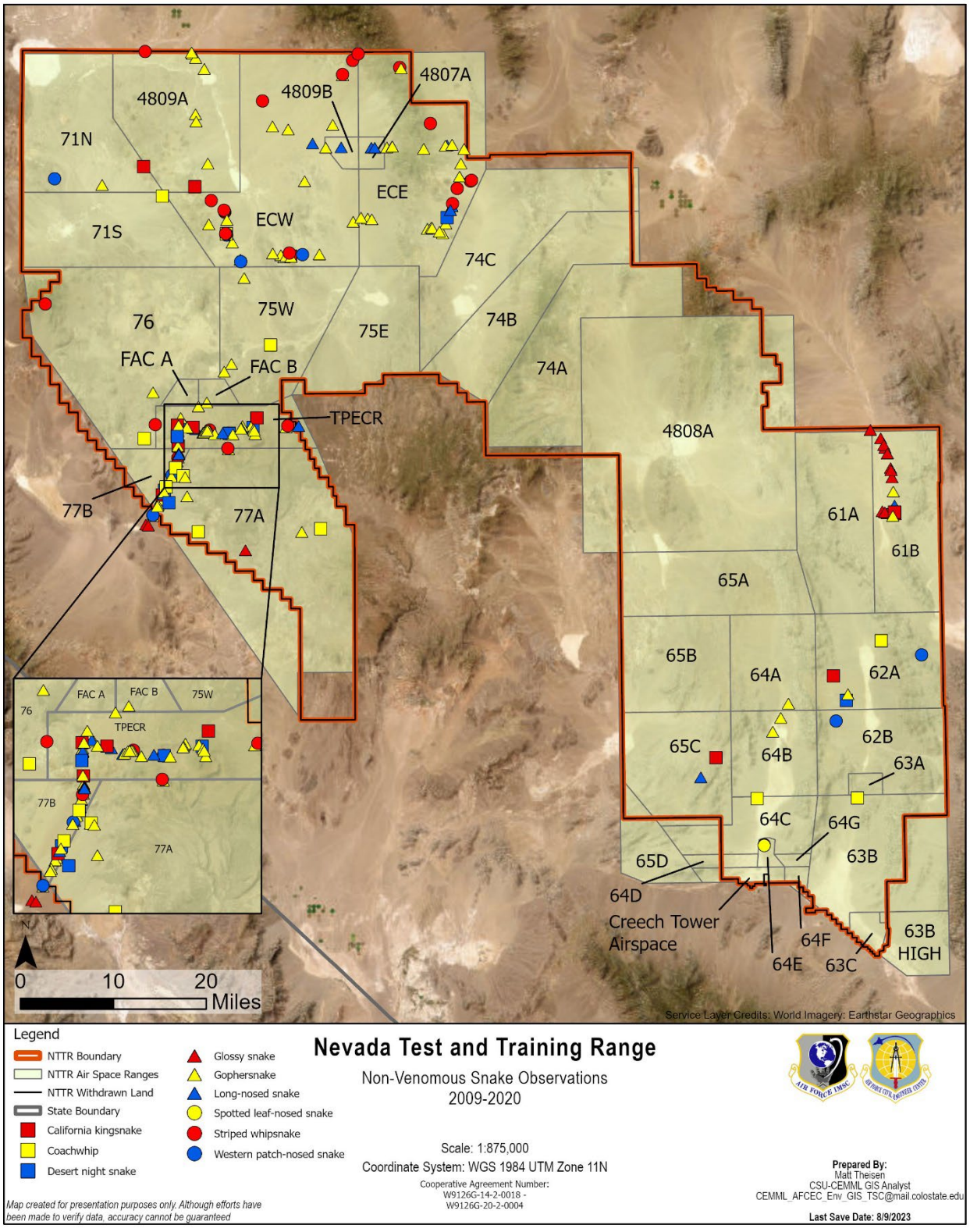


Figure 2-26. Venomous snake observations on Nellis Air Force Base and the Small Arm Range, 2010–2020.

1919



1920

1921 Figure 2-27. Non-venomous snake observations on the Nevada Test and Training Range, 2009–2020.

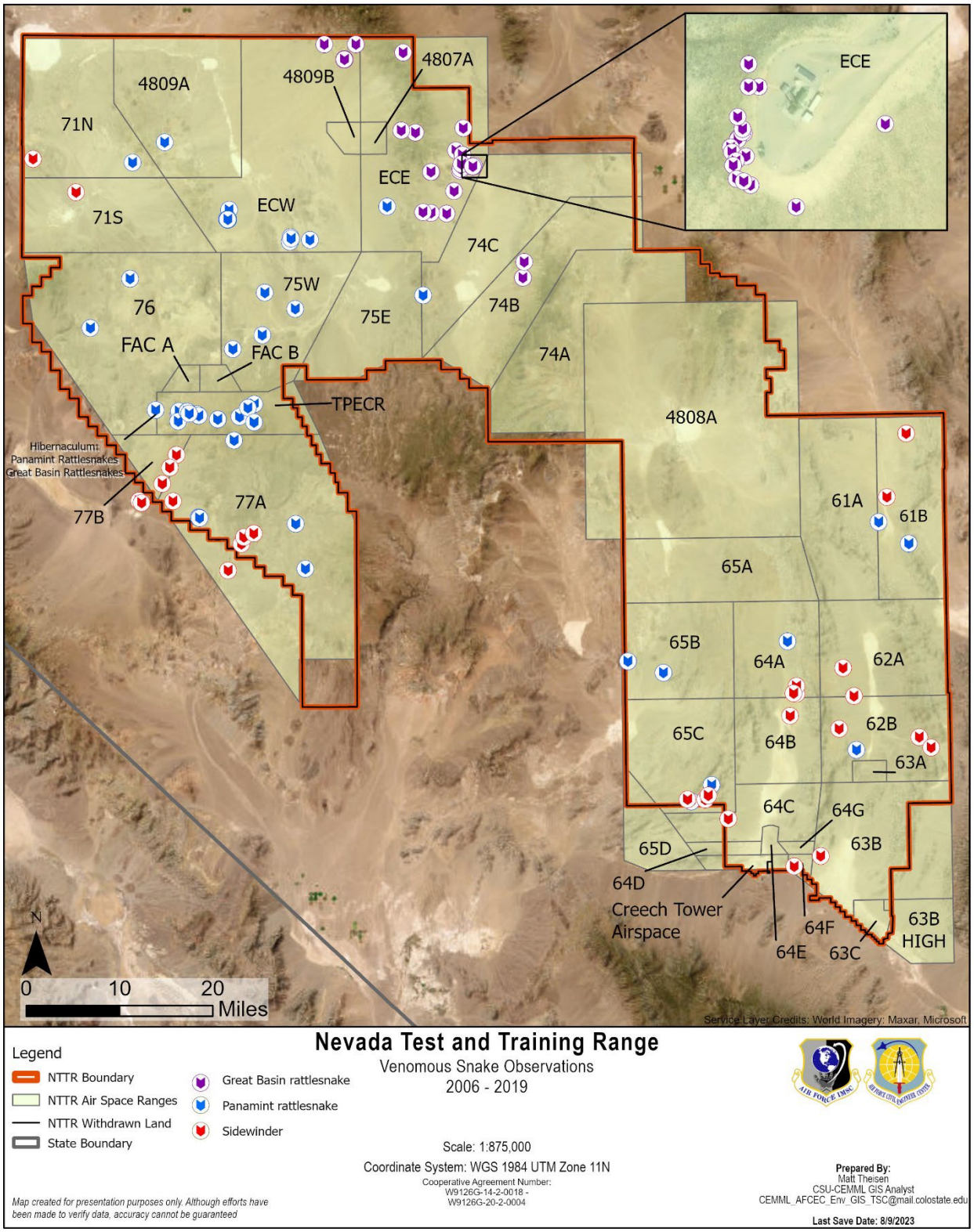


Figure 2-28. Venomous snake observations on the Nevada Test Training Range, 2006–2019.

2.3.3.2 Native Birds

Together, NAFB and the NTTR encompass a diverse array of bird habitats within the Great Basin and Mojave Desert ecoregions.

Figure 2-29. Yellow warbler in tamarisk on Nellis Air Force Base. Nellis Air Force Base Photo Library.

The NNRP initiated surveys to inventory and monitor birds in 2007, and these efforts have expanded over the years to include a large variety of survey types designed to assess presence, distribution, and productivity of migratory birds and raptors across the installation. There are now considerable data for presence and distribution of many avian species across most of the installation. A total of 205 species have been documented. Fifteen special-status bird species are known to occur on the installation. See Appendix B for a complete list of species and classification, and Sections 2.3.4 and 7.4 for further discussion. Figure 2-29 shows a yellow warbler (*Setophaga petechia*) at NAFB, and Figure 2-30 shows a western tanager (*Piranga ludoviciana*) at the NTTR.

Bird Populations by Habitat

Figure 2-30. Male western tanager at Indian Spring 3 on the North Range. Nellis Air Force Base Photo Library.

Birds present in the Mojave Desert creosote scrub plant communities found on NAFB and much of the South Range of the NTTR include the horned lark, Costa's hummingbird (*Calypte costae*), loggerhead shrike (*Lanius ludovicianus*; BLM Sensitive, DoD Partners in Flight [PIF] MSS [Mission Sensitive Species], MBTA, Nevada SGCN and Sensitive), mourning dove (*Zenaida macroura*), black-throated sparrow (*Amphispiza bilineata*), western burrowing owl (*Athene cunicularia hypugeae*; BLM Sensitive, USFWS BCC, DoD PIF MS, Nevada SGCN), greater roadrunner (*Geococcyx californianus*), lesser nighthawk (*Chordeiles acutipennis*), and Gambel's quail (*Callipepla gambelii*) (NAFB 2012, NAFB 2022*g*). Le Conte's thrasher (*Toxostoma lecontei*, BLM Sensitive, USFWS BCC, DoD PIF MSS, Nevada SGCN), an uncommon and secretive resident of the arid Southwest, prefers sparsely vegetated creosote scrub.

This more structurally diverse desert scrub habitat is preferred by Bendire's thrasher (*Toxostoma bendirei*, BLM Sensitive, MBTA, USFWS BCC, DoD PIF MSS, Nevada SGCN), a rare resident of southern Nevada that has been observed once on the South Range of the NTTR (Great Basin Bird Observatory [GBBO] 2010, NAFB 2022*g*). The cactus wren (*Campylorhyncus brunneicapillus*) is often associated with stands of cholla cactus, and Scott's oriole (*Icterus spurius*) is occasionally observed nesting in Joshua trees (NAFB

2012, NAFB 2022*g*). Phainopepla (*Phainopepla nitens*), Lucy's warbler (*Oreothlypis luciae*), and black-tailed gnatcatchers (*Polioptila melanura*) are associated with riparian scrub habitat dominated by mesquite (GBBO 2010, NAFB 2012, NAFB 2022*g*).

During wet years, playas on the NTTR may provide habitat and foraging opportunities for many species of ducks, geese, and shorebirds that are seasonal migrants. On the NTTR, most surface waters are ephemeral and attract waterfowl only for a short time following storm events. Small populations may inhabit permanent bodies of water located around seeps and springs. In general, the number of waterfowl found in these areas is small and transient. Figure 2-31 shows green-winged teal (*Anas crecca*) within a playa on the NTTR and Figure 2-32 shows a Townsend's solitaire at a spring on the NTTR.

Sagebrush communities on the NTTR provide habitat for a variety of bird species, including the sage thrasher (*Oreoscoptes montanus*, BLM Sensitive, USFWS BCC, Nevada SGCN and Sensitive), sagebrush sparrow (*Artemisiospiza nevadensis*), common poorwill (*Phalaenoptilus nuttallii*), and horned lark (*Eremophila alpestris*). Less frequently observed species include the green-tailed towhee (*Pipilo chlorurus*), common nighthawk (*Chordeiles minor*), and western meadowlark (*Sturnella neglecta*). Brewer's sparrow (*Spizella breweri*, BLM Sensitive, MBTA, Nevada SGCN and Sensitive) is also found in sagebrush communities and is state protected and further classified as Sensitive. Chukar (*Alectoris chukar*) is a non-native species listed as a state upland game bird and has been introduced into the area, where it typically inhabits rocky habitat and desert scrub near springs and other freshwater sources (NDOW 2023).

Figure 2-31. Green-winged teal on a flooded playa on the Nevada Test and Training Range, 2019. Nellis Air Force Base Photo Library.

Canyons and cliffs in the NTTR provide structure for habitat that attracts raptors and other cliff-nesting avian species. Some of the birds commonly using the cliffs and canyons of the NTTR include golden eagle (*Aquila chrysaetos*, BGEPA, BLM Sensitive, Nevada SGCN, DoD PIF MSS), prairie falcon (*Falco mexicanus*), peregrine falcon (*Falco peregrinus*; BLM Sensitive, MBTA, Nevada Endangered and Sensitive), white-throated swift (*Aeronautes saxatalis*), rock wren (*Salpinctes obsoletus*), and canyon wren (*Catherpes mexicanus*) (NAFB 2012, NAFB 2022*g*).

Figure 2-32. Townsend's solitaire at spring on the Nevada Test and Training Range. Nellis Air Force Base Photo Library.

The pinyon-juniper woodlands support the greatest bird diversity in the area. Species commonly found in this habitat include the blue-gray gnatcatcher (*Polioptila caerulea*), gray vireo (*Vireo vicinior*), black-throated gray warbler (*Dendroica nigrescens*), juniper titmouse (*Baeolophus ridgwayi*), gray flycatcher (*Empidonax wrightii*), pinyon jay (*Gymnorhinus cyanocephalus*; BLM

Sensitive, USFWS BCC, DoD PIF MSS, Nevada SGCN), and Townsend's solitaire (*Myadestes townsendi*) (NAFB 2012, NAFB 2022*g*).

In general, the variety of bird species increases where vegetation and habitat associations are more diverse. An example is locations where Joshua trees, riparian vegetation, or large cacti are present; these areas draw a variety of birds commensurate with the diversity of their structure (GBBO 2010; NAFB 2022*g*).

2.3.3.3 Small Mammals

Terrestrial small mammals are common across NAFB and the NTTR. This group serves as an important food source for carnivores, raptors, snakes, and some lizards. They also disperse seeds, facilitate seed germination; mix and aerate soils; and play a role in nutrient cycles.

Most small mammals on NAFB and the NTTR are representatives of five families in the Order *Rodentia*. Other mammals documented, though not specifically trapped, include small to medium-sized carnivores and leporids (Table 2-15). Many surveys specific to leporids have been conducted either as part of the pygmy rabbit surveys, or prey-base assessments for golden eagles on the NTTR. Other small- to medium-sized carnivores and leporids either have been spotted incidentally during surveys or documented in wildlife camera photos. Mesocarnivores have generally had stable populations on NAFB and the NTTR to date. One exception to this is the kit fox (*Vulpes macrotis*), which has experienced drastic declines on the NTTR, likely due to the ongoing regional drought from 2019–2021.

Table 2-15. Small- to medium-sized carnivores and leporids documented on the Nevada Test and Training Range.

Common Name	Scientific Name
Leporids	
Desert Cottontail	*Sylvilagus audubonii*
Pygmy Rabbit	*Brachylagus idahoensis*
Black-tailed Jackrabbit	*Lepus californicus*
Nuttall's Cottontail	*Sylvilagus nuttallii*
Felids	
Bobcat	*Lynx rufus*
Canids	
Coyote	*Canis latrans*
Kit Fox	*Vulpes macrotis*
Gray Fox	*Urocyon cinereoargenteus*
Procyonids	
Ringtail	*Bassariscus astutus*
Mephitids	
Western Spotted Skunk	*Spilogale gracilis*
Mustelids	
Long-tailed Weasel	*Mustela frenata*
American Badger	*Taxidea taxus*

In 2005, the NNRP initiated surveys to identify the species composition, distribution, population size estimates, and habitat usage of small mammals. Surveys consist of setting traps across the multiple habitats found throughout NAFB and the NTTR. In total, 22 species of small mammals have been captured and identified, including seven special-status species (NAFB 2022*l*). Special status species are further discussed in Section 2.3.4. Locations of all trapping sites are shown in Figure 2-33 and Figure 2-34. Species are listed in Appendix B. Recent surveys have shown a significant decrease in small mammal populations on the NTTR, likely due to the recent regional drought which is likely enhanced by climate change (NAFB 2022*l*).

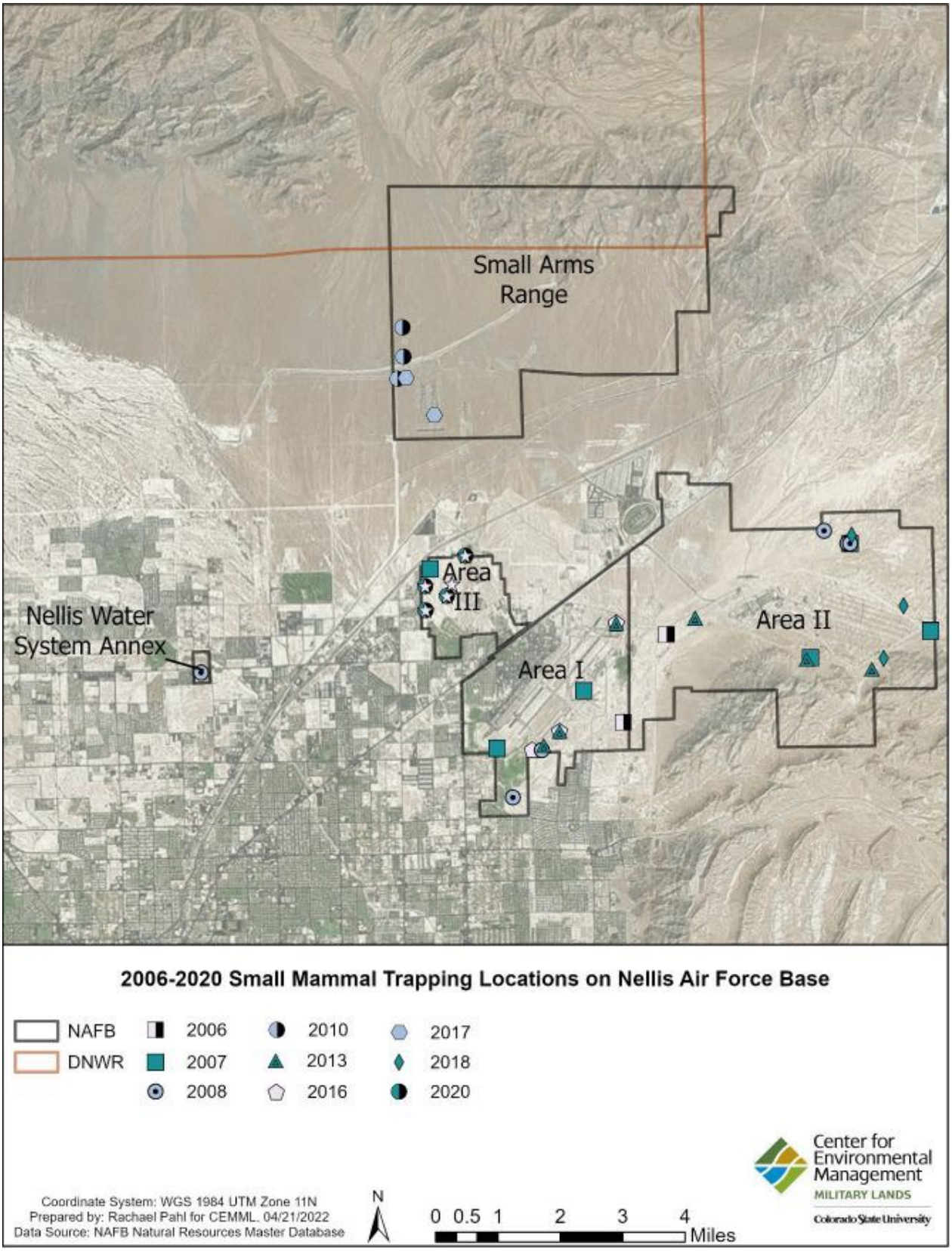


Figure 2-33. Small mammal trapping locations on Nellis Air Force Base, 2006–2020.

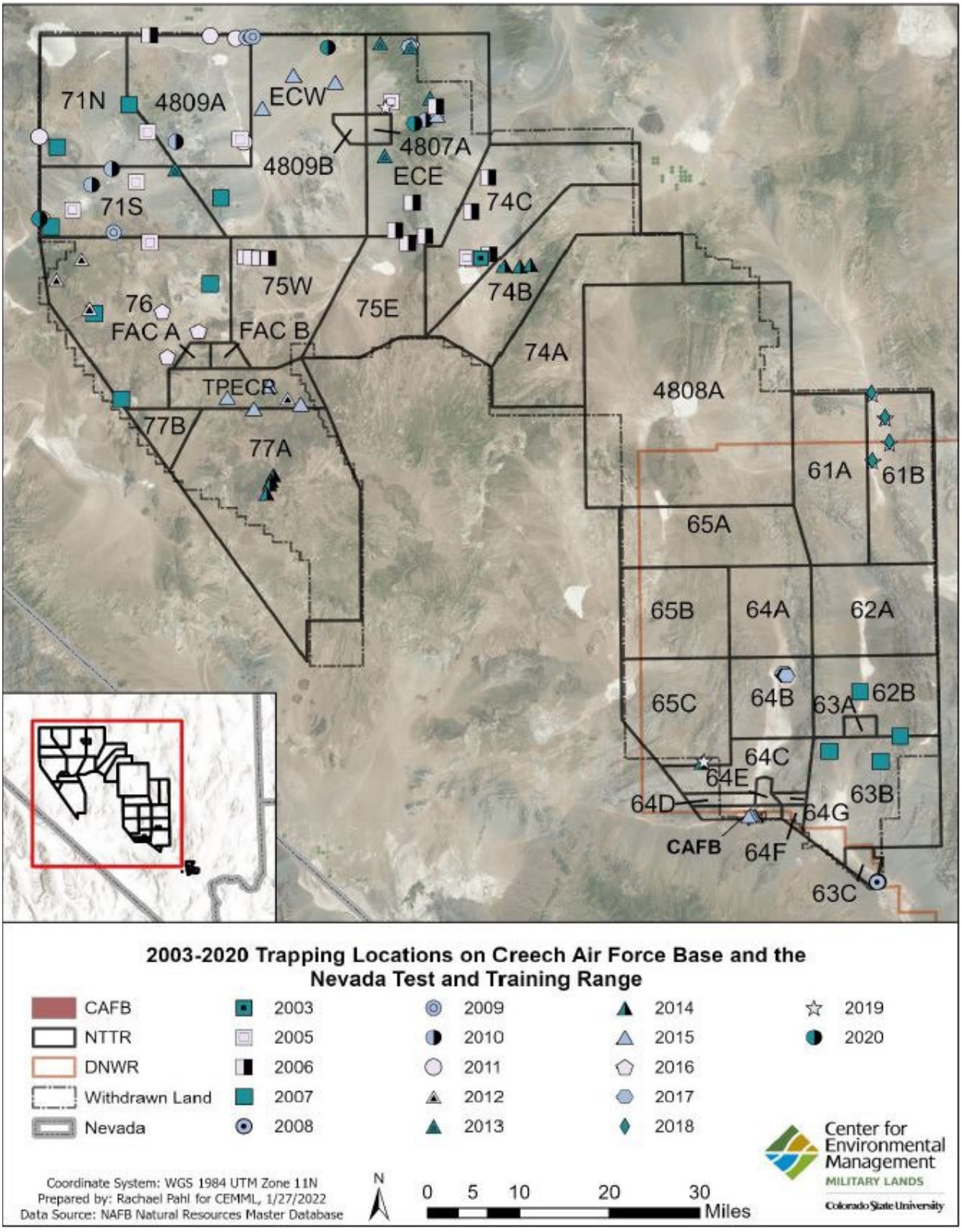


Figure 2-34. Small mammal trapping locations on the Nevada Test and Training Range, 2003–2020.

2.3.3.4 Bats

Bats are predominantly discussed in the threatened and endangered species and species of concern section of this INRMP (Section 2.3.4.4). Although not all species discussed within that section are federally listed, they are grouped together due to their significant recent declines, sensitivity to environmental degradation, status as indicator species, and conservation significance. However, a general description of bat populations is given below.

NAFB and the NTTR support a diverse array of bat species. Bat surveys have been conducted during 1996–1997 and 2008–2021 timeframes to establish a baseline. A total of 22 species have been documented, 14 of which have some form of protection status (Figure 2-35 shows a Townsend's big eared bat). The diversity of bats is likely due to the diversity of habitats, presence of water, and cave systems for hibernacula or roosting.

Figure 2-35. Townsend's big-eared bat (*Corynorhinus townsendii*) captured on the Nevada Test and Training Range in 2019. Nellis Air Force Base Photo Library.

The most recorded species on the installation is the California myotis (*Myotis californicus*, BLM Sensitive, Nevada SGCN), accounting for 34% of acoustic records. Other common species include the Mexican free-tailed bat (*Tadarida brasiliensis*, BLM Sensitive, Nevada Protected), canyon bat (*Parastrellus hesperus,* BLM Sensitive and Nevada SGCN), western small-footed myotis (*Myotis ciliolabrum*, BLM Sensitive, Nevada Protected and SGCN), and the Yuma myotis (*Myotis yumanensis*, BLM Sensitive, Nevada Protected) (NAFB 2022*a*). Bat monitoring sites are shown in Figure 2-36, Figure 2-37, and Figure 2-38. Special status species are further discussed in Section 2.3.4.4. A comprehensive list of all captures and recordings along with details about survey methodology and strategies are described in Section 2.3.4, 7.4, Appendix B, or the most recent bat survey report (NAFB 2022*a*). Descriptions of historical bat survey methodologies and results are given in the most recent bat survey report (NAFB 2022*a*).

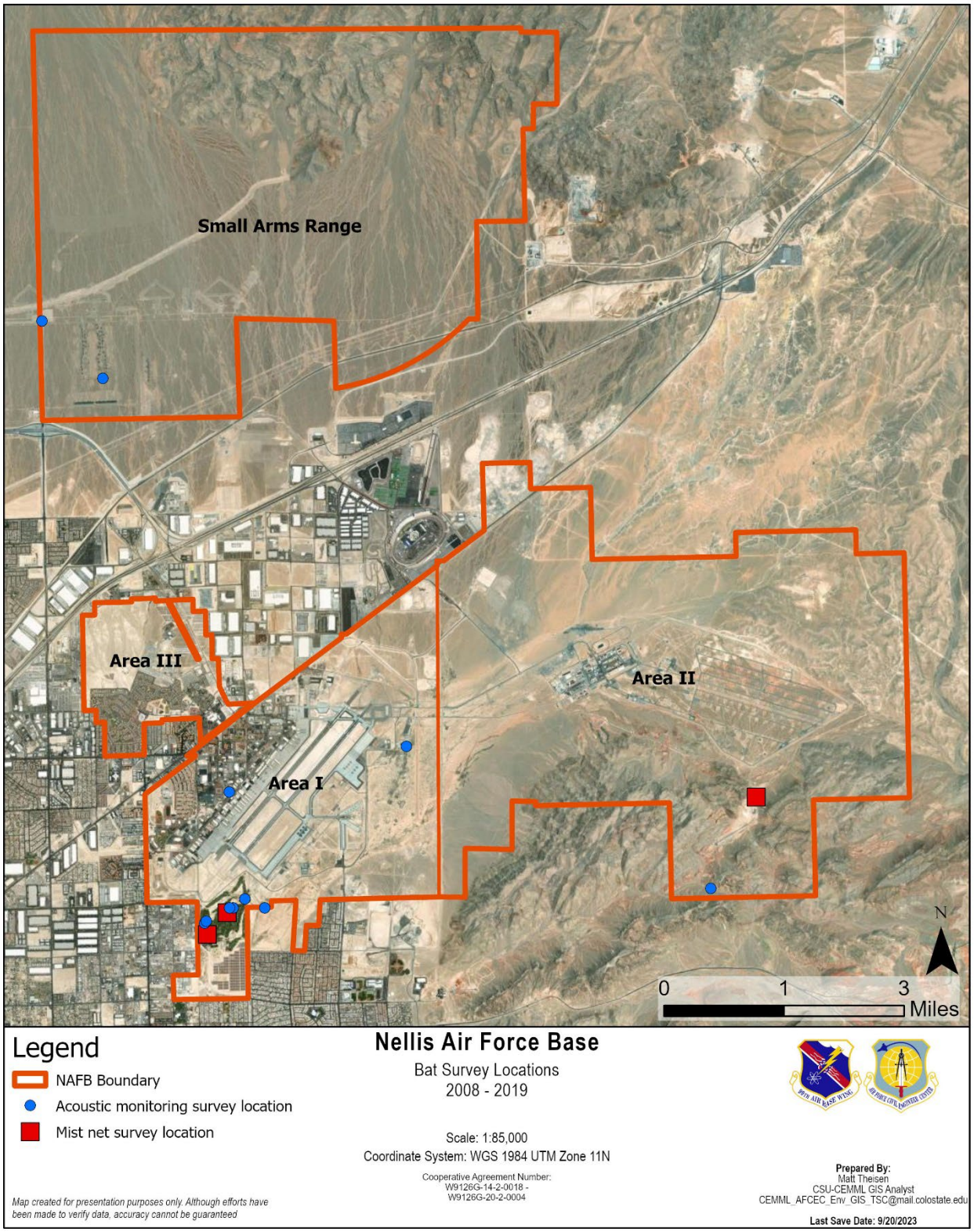
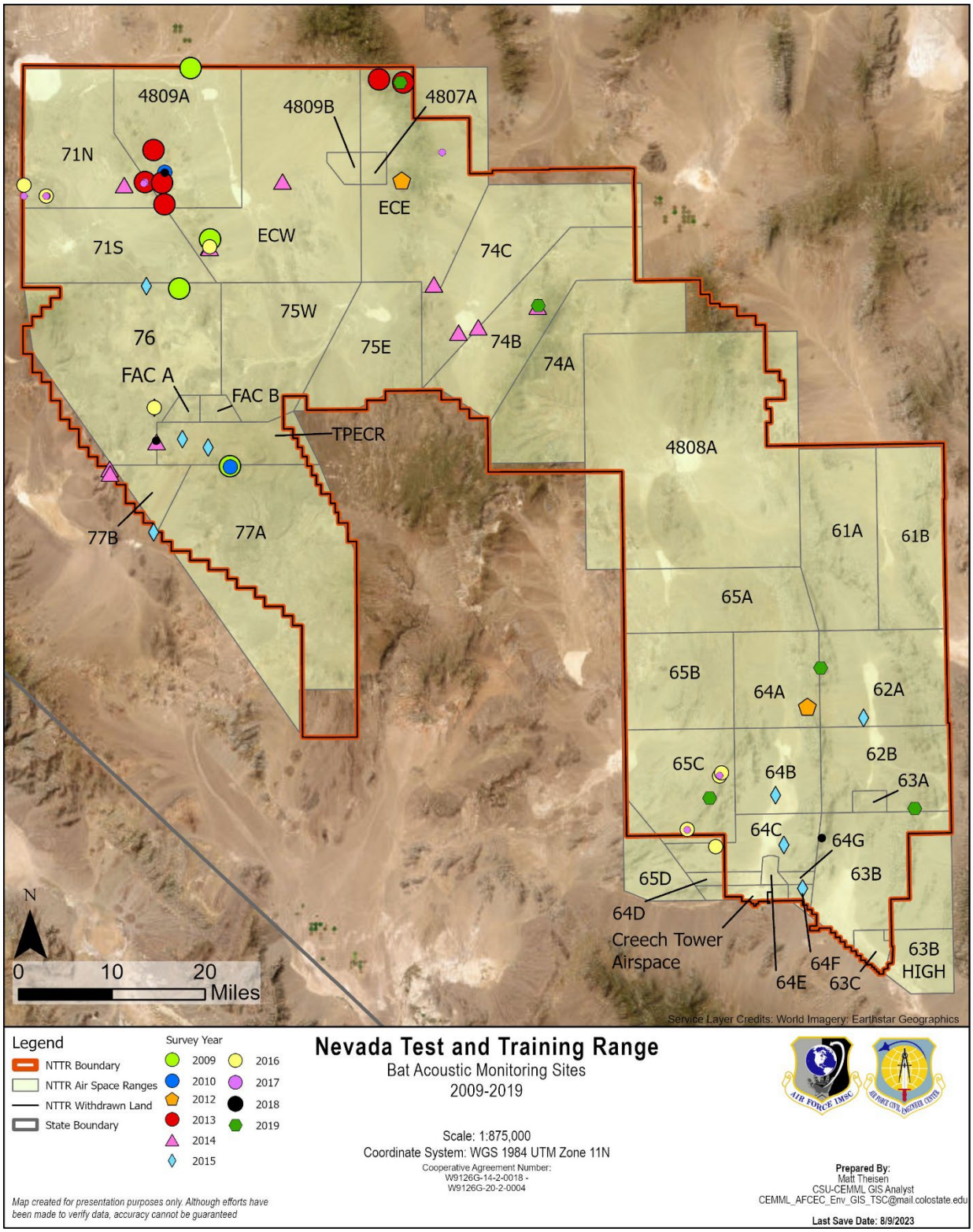


Figure 2-36. Bat acoustic monitoring and mist netting sites on Nellis Air Force Base, 2008–2019.

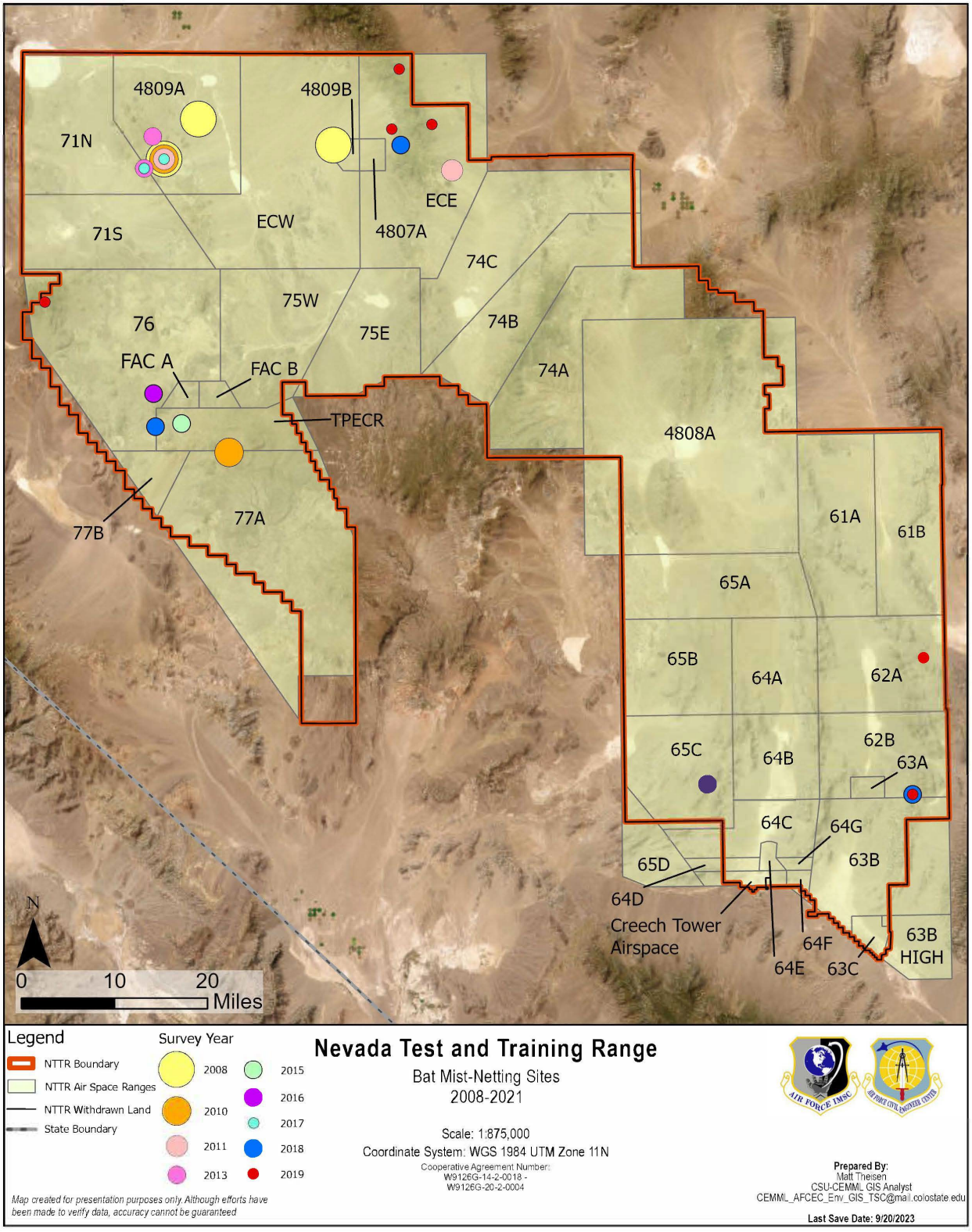
2076



2077

2078 Figure 2-37. Bat acoustic monitoring sites on the Nevada Test and Training Range 2009–2019.

2079



2080

2081 Figure 2-38. Bat mist-netting sites on the Nevada Test and Training Range, 2008–2021. Traditional mist
2082 was not conducted in 2020 or 2021 due to USFish and Wildlive Service moratorium on handling bats.

2.3.3.5 Large Mammals – Including Wild Horses and Burros

Mule deer (*Odocoileus hemionus*, Nevada SGCN and Game Species, Figure 2-39), pronghorn (*Antilocapra americana*), desert bighorn sheep (*Ovis canadensis nelson*, BLM Sensitive, Nevada SGCN and Game Species), and mountain lion (*Puma concolor*) are the prominent native large mammal species found on the NTTR. They serve as indicators of habitat conditions on the range. If populations of these animals remain at stable levels or have small and regular fluctuations, then it is likely that habitat is suitable and also stable. Large mammals have been historically monitored using wildlife cameras on the NTTR. Wildlife camera locations are shown in Figure 2-40.

Mule Deer

In general, mule deer reside year-round in the mountain ranges throughout the North Range of the NTTR. Preferred habitat includes open woodlands with an understory of big sage, black sagebrush, bitterbrush (*Purshia tridentata*), cliffrose (*Purshia mexicana*), and other shrubs that provide cover. Mule deer prefer mountains and steeper terrain, as a means of avoiding depredation by mountain lions. It is likely that mule deer move between mountain ranges; however, no regular migration pattern has been documented (USAF 1985). Limited water distribution during the summer and lack of cover appear to limit deer movements during the winter and spring. During aerial surveys, the animals tend to hide under trees and shrubs, making detection extremely difficult. As such, the only population count data that are available are extracted from other flora and fauna surveys. Mule deer have been detected at every water source on the North Range.

Figure 2-39. Mule deer on the North Range, 2018. Nellis Air Force Base Photo Library.

Figure 2-41 displays mule deer observations on the NTTR, both by trail cameras and during biological surveys.

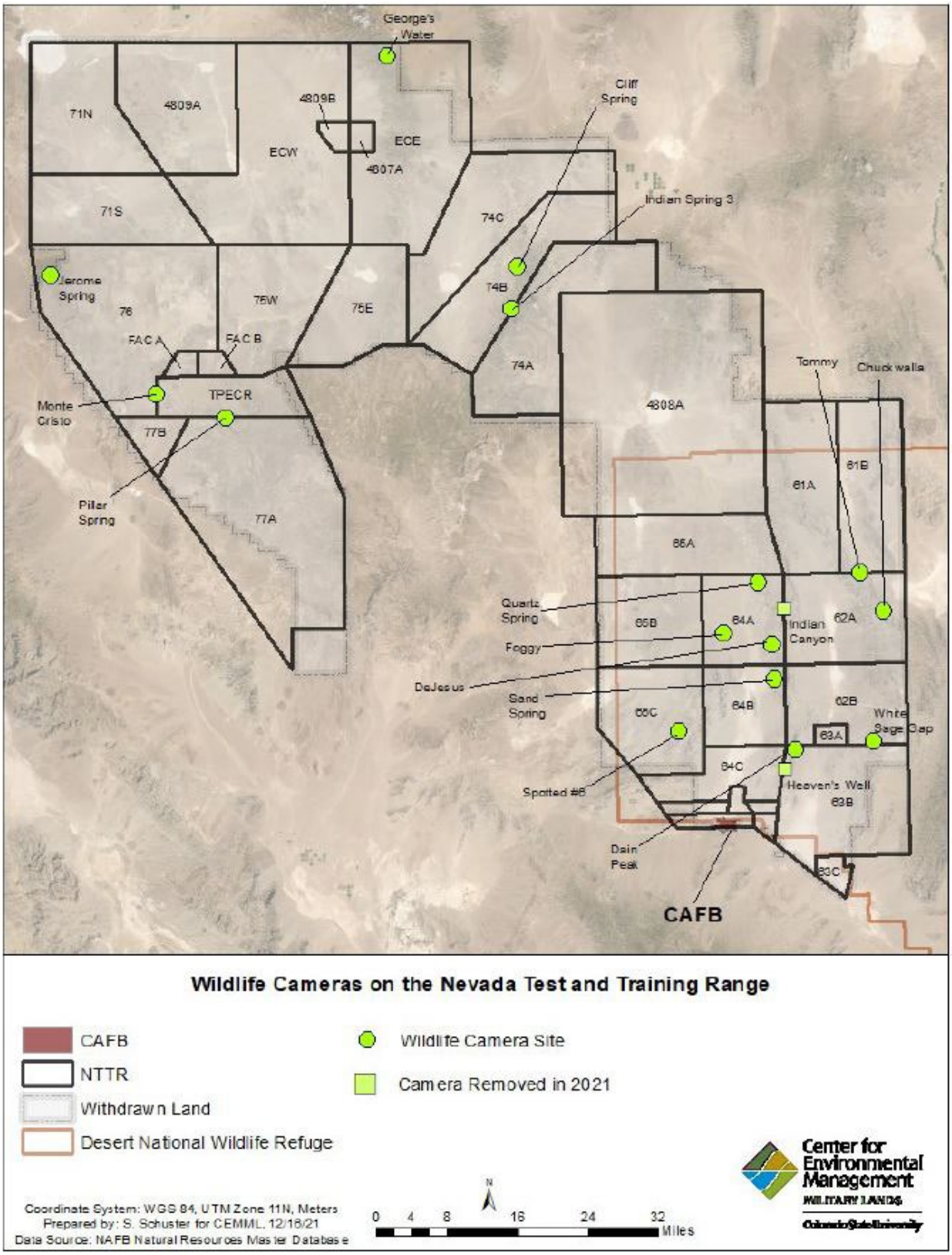


Figure 2-40. Wildlife camera locations on the Nevada Test and Training Range in 2021.

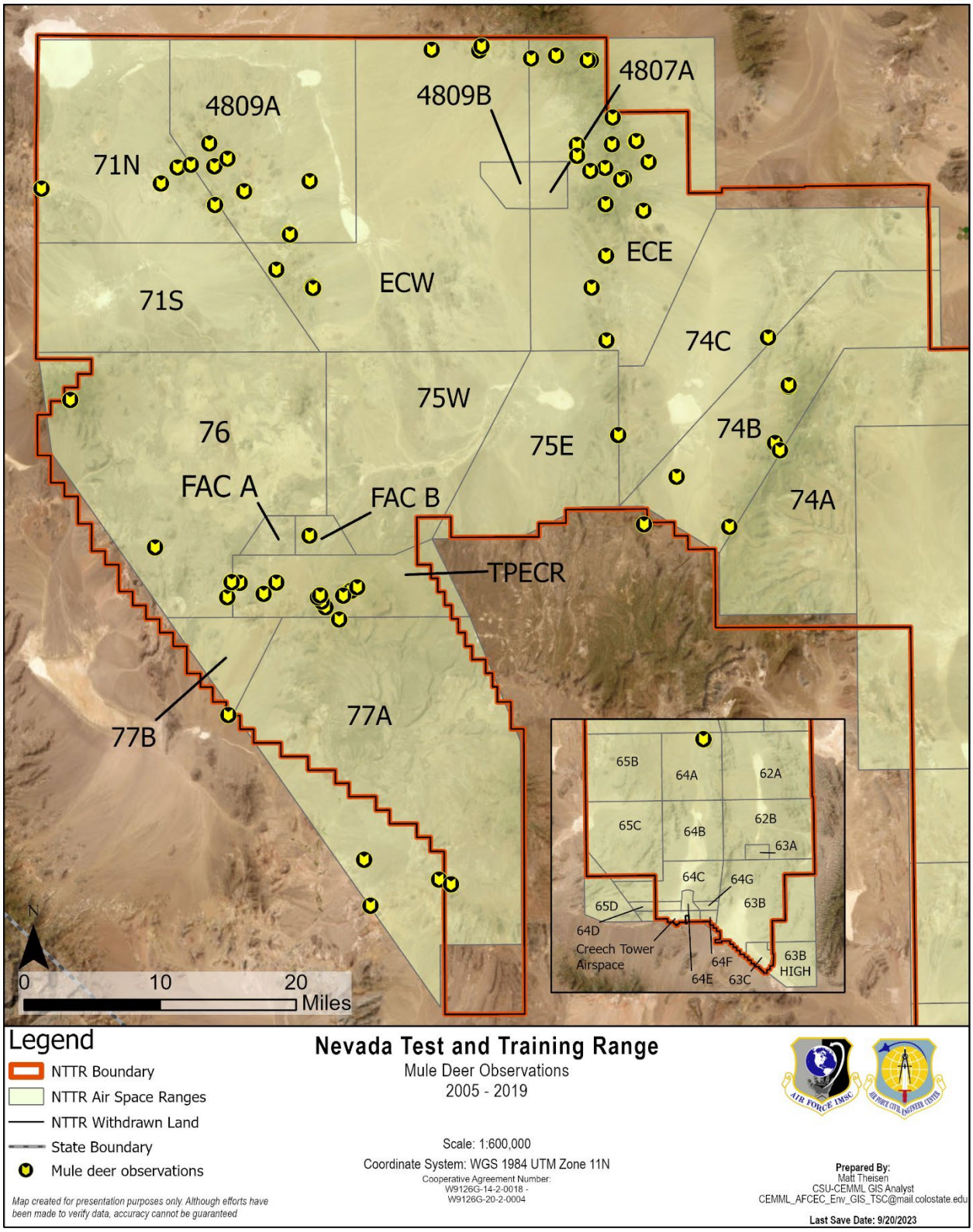


Figure 2-41. Mule deer observations on the North Range, 2005–2019.

Pronghorn

The pronghorn is an archetypical member of the open ranges of western North America (Figure 2-42). Pronghorn are an indicator species of healthy sagebrush ecosystems, which are found on the North Range. Pronghorn diet is comprised of forbs such as globemallow (*Sphaeralcea* spp.) in the spring and early summer and shrubs such as sagebrush (*Artemisia* spp.) in the winter (Koerth et al. 1984). Breeding occurs between late July and early October, and fawns are born in late May. Outside of the breeding season, pronghorn are gregarious, foraging in pairs or small herds of varying sizes (White et al. 2012). Unlike mule deer, pronghorn prefer open habitats. When pronghorn detect danger, they can flee quickly, reaching speeds of 60 miles per hour.

Figure 2-42. Pronghorn on the North Range in 2021. Nellis Air Force Base Photo Library.

Annual aerial surveys from 2005 until 2021 recorded an average of 175 individuals. On the NTTR, pronghorn are year-round residents in the Cactus Flat, Kawich Valley, Sand Spring Valley, and Emigrant Valley in the North Range. Pronghorn have been recorded by motion-sensor cameras at every water source on the North Range except George's Water. Pronghorn males have been observed regularly near the southern border of the South Range. Populations on the NTTR appear to be highest where water sources are less than 1-2 miles apart.

Overall, the population on the NTTR has been relatively stable during the last two decades, despite fluctuations due to competition from wild horses. The population residing on the NTTR stabilized after growing steadily for the first five years of surveys. This increase could be attributed to the large-scale wild horse gathering in 2007, favorable weather patterns, or predator population declines. Additionally, there was a population dip from 2014–2017, then a rebound from 2017–2018, likely due to a horse removal in 2018. However, observations decreased significantly in 2021. This could potentially be due to horse population expansions or drought. Figure 2-43 shows recorded locations for pronghorn during the annual surveys. The red dots do not necessarily represent single animals; rather, they depict where at least one animal was observed. For further information on historical surveys, reference the 2021 report (NAFB 2022*n*).

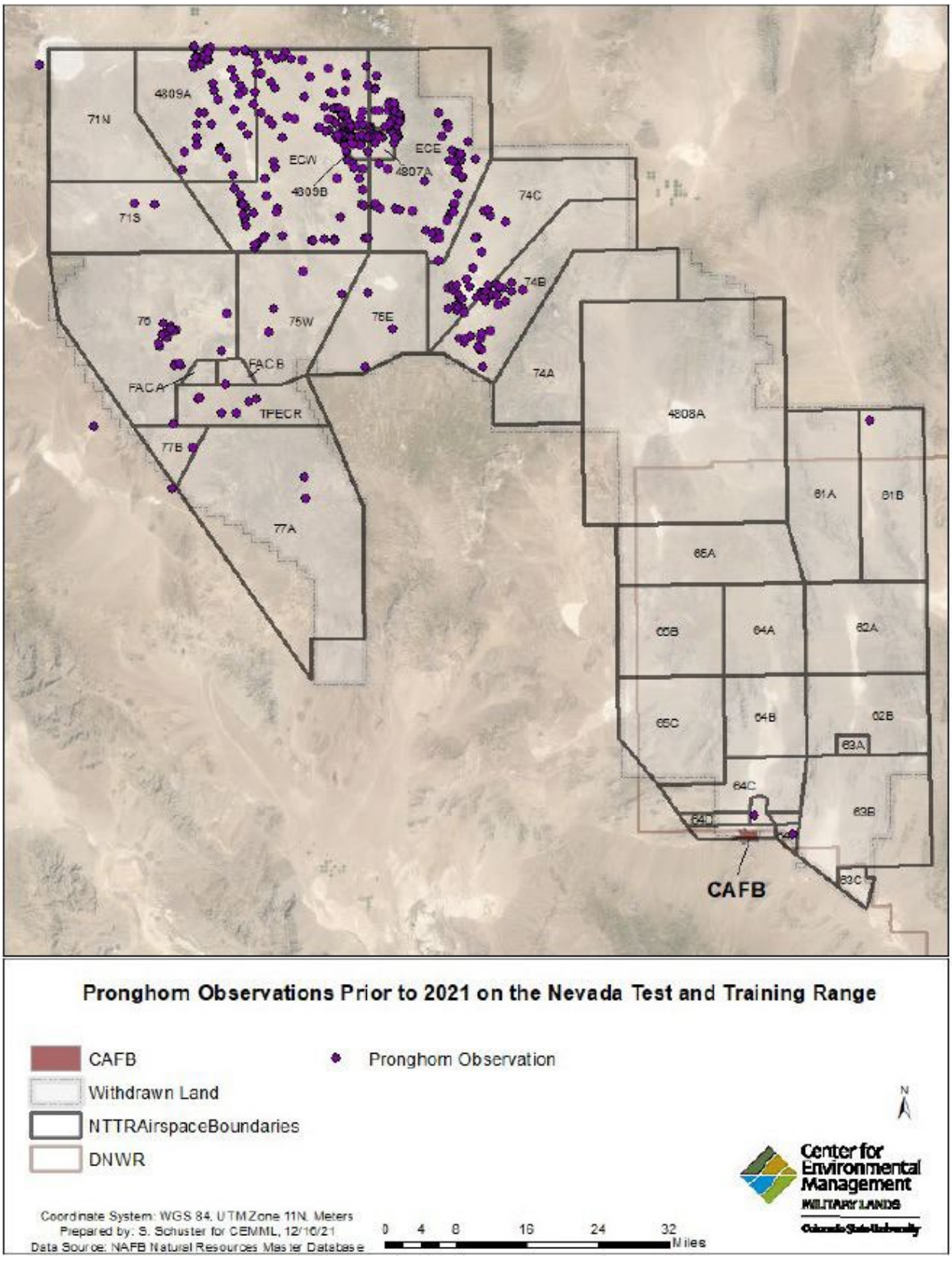


Figure 2-43. Pronghorn observations on the Nevada Test and Training Range prior to 2021.

Desert Bighorn Sheep

Desert bighorn sheep reside in arid mountainous habitats, with steep, rocky terrain (Figure 2-44). Ewes have shorter and thinner horns than rams. Bighorn sheep are often found near escape terrain, which is described as a slope of at least 60% with a contiguous, 450-foot buffer zone with slopes of 40% to 60% (McKinney et. al 2003). Desert bighorn sheep often stay within 900 feet or less of escape terrain (Singer et. al 2001). The mating season, or rut, begins at the end of July and continues through early September. Gestation lasts approximately 180 days. Bighorn sheep are gregarious, except during lambing season. During late December through February, pregnant ewes depart from the herd and go to rugged and remote areas to give birth.

Figure 2-44. Desert bighorn sheep ewe and lamb at Pillar Spring on the North Range, 2017. Nellis Air Force Base Photo Library.

Bighorn sheep are extremely vulnerable to respiratory diseases. Most recently, a virulent bacterium, *Mycoplasma ovipneumoniae*, has been implicated as acting in concert with other pathogens and causing a debilitating pneumonia. The pathogens are not shown to be harmful to people, but the pneumonia has affected bighorn populations across the western states, including Nevada. Lambs are most susceptible, as their immune systems are not fully developed. Infected animals will cough and might have a bloody nose, and although some may survive, most will die. This pneumonia is highly transmissible by inhalation or physical contact. The pathogen is thought to be transmitted initially from domesticated sheep (*Ovis aries*), which are seemingly immune to it but capable of infecting wild bighorn sheep (Besser et al. 2014). Chronically infected adults can linger and continually infect weaker lambs, so removal of infected individuals can help curb the spread.

NAFB and the NTTR have conducted bighorn sheep surveys from 2007–2021. Surveys have consisted of collaring efforts, genetic sampling efforts, aerial surveys, and motion sensor cameras. Survey results combined with those from NDOW surveys indicate the bighorn population on the NTTR is declining and has low lamb recruitment. This is likely due to the ongoing 2018–2021 drought in tandem with viral pneumonia, but could also be due to herd movements. Like pronghorn, bighorn sheep herds can be fluid, with adults moving into and out of the herd throughout the seasons. Specific details regarding bighorn decline and historical survey efforts and results are given in the most recent Final Wild Horse and Large Mammals Report (NAFB 2022*n*).

Figure 2-45 shows a broad overview of where desert bighorn sheep have been observed during annual surveys on the NTTR. Sheep are concentrated within the far eastern mountain ranges of the South Range, and the far western ranges of the North Range. Bighorn sheep have been observed at almost every major water source on the NTTR except Sumner Spring, George's Water, Breen Creek, Cliff Spring, and Wildhorse Spring by wildlife camera. These springs are all located on the North Range, but are in non-ideal habitat for desert bighorn sheep since they do not contain escape terrain. Wildhorse Spring is far from the Cactus Range, in the middle of rolling hills of greasewood and less palatable forage.

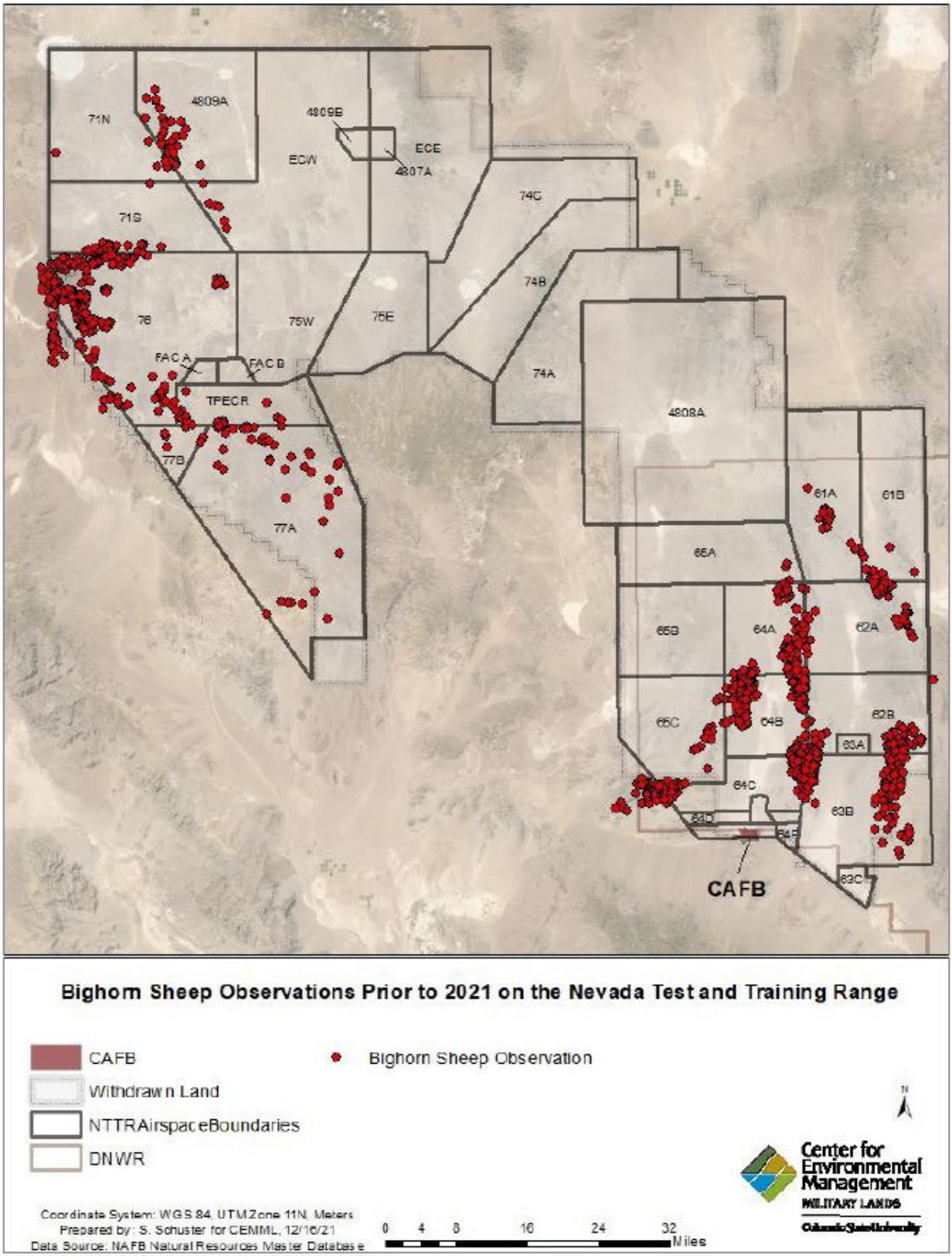


Figure 2-45. Desert bighorn sheep observations on the Nevada Test and Training Range prior to 2021.

Mountain Lion

The mountain lion (also known as puma, cougar, or panther, Figure 2-46) is a top predator found throughout mountainous habitats in western North America. The favored terrain of mountain lions is rocky cliffs and gradual slopes with juniper and other woody shrubs that afford cover when stalking prey (Dixon 1982, Logan and Irwin 1985). Mountain lions feed primarily on mule deer, but they will prey on bighorn sheep when the opportunity arises. Mountain lions are secretive, having been seen on the NTTR only a handful of times during other surveys. Mountain lions have been caught on motion-sensor cameras at George's Water, Jerome Spring, and Pillar Spring in the North Range, as well as White Sage Gap on the South Range.

Figure 2-46. Mountain lion cubs on the Nevada Test and Training Range in 2021. Nellis Air Force Base Photo Library.

Wild Horses and Burros

Throughout the past 200 years, ranchers, miners, and indigenous peoples have released horses and burros (*Equus asinus*) into western states, including Nevada. Both wild horse and burros are present on the NTTR due to this history of releases. Wild horses on the North Range are shown in Figure 2-47.

Horse populations commonly fluctuate on the NTTR. Fluctuations are primarily due to natural population increases and subsequent gathering by the BLM. The BLM bases gathering on meeting appropriate management levels determined by their management obligation. Historically, the number of wild horses increased on the NWHR from 800 in 1977 to a peak of 10,000 in 1993 (SAIC and DRI 1999). Due to concerns about overpopulation and over-grazing by wild horses, the NWHR Herd Management Plan established an Appropriate Management Level of 2,000 wild horses on the NWHR in 1989. The most recent Appropriate Management Level was set by the Record of Decision for the NTTR Resource Management Plan (RMP) EIS (BLM 2004a) in 2004 and determined to be 300 to 500 horses.

Figure 2-47. Wild horses on the North Range, 2023. Nellis Air Force Base Photo Library.

The NAFB conducted horse and burro population count surveys from 2009–2021 and have recently implemented range utilization surveys. The BLM also conducts their own independent surveys. Figure 2-48 shows where horses and burros have been observed on the NTTR during aerial surveys. This map shows a

broad overview of preferred areas for equines on the NTTR; the red points do not represent individual animals but rather where they have been observed. It is rare that a single animal will be observed during the survey. Most of the points represent multiple animals. Wild burros migrate onto the NTTR from adjacent BLM-managed lands in the Goldfield, Stonewall Mountain, and Thirsty Canyon areas.

Wild horse and burro populations negatively impact the ecosystems they colonize. Unmanaged feral herds have the potential to change native vegetation profiles, increase erosion and compete with and exclude native fauna, particularly excluding native ungulates from water sources (Davies and Boyd 2019). An extreme example of the negative impacts of wild horse grazing is seen in the Kawich Valley. Where wild horses are present, vegetation has been uniformly cropped to heights of less than eight inches. The closely cropped plants on the NTTR do not represent the condition of vegetation before horses were introduced. Horses severely degrade wetland health as well (Kaweck et al. 2018). A report by Dames and Moore (1997) cited wild horses as the source for degradation at springs and seeps on the NTTR**.** In recent years, Sumner Spring and the sagebrush stand surrounding it were badly trampled by wild horses, and it went dry from overuse in 2018 (NAFB 2022*n*). As a result, some seeps and springs outside the NWHR have been fenced by the USAF to prevent grazing and trampling, which has allowed vegetation to recover and become suitable for native wildlife. Feral horse and burro herds consume already scarce water and forage resources, which are likely to become less available due to climate change.

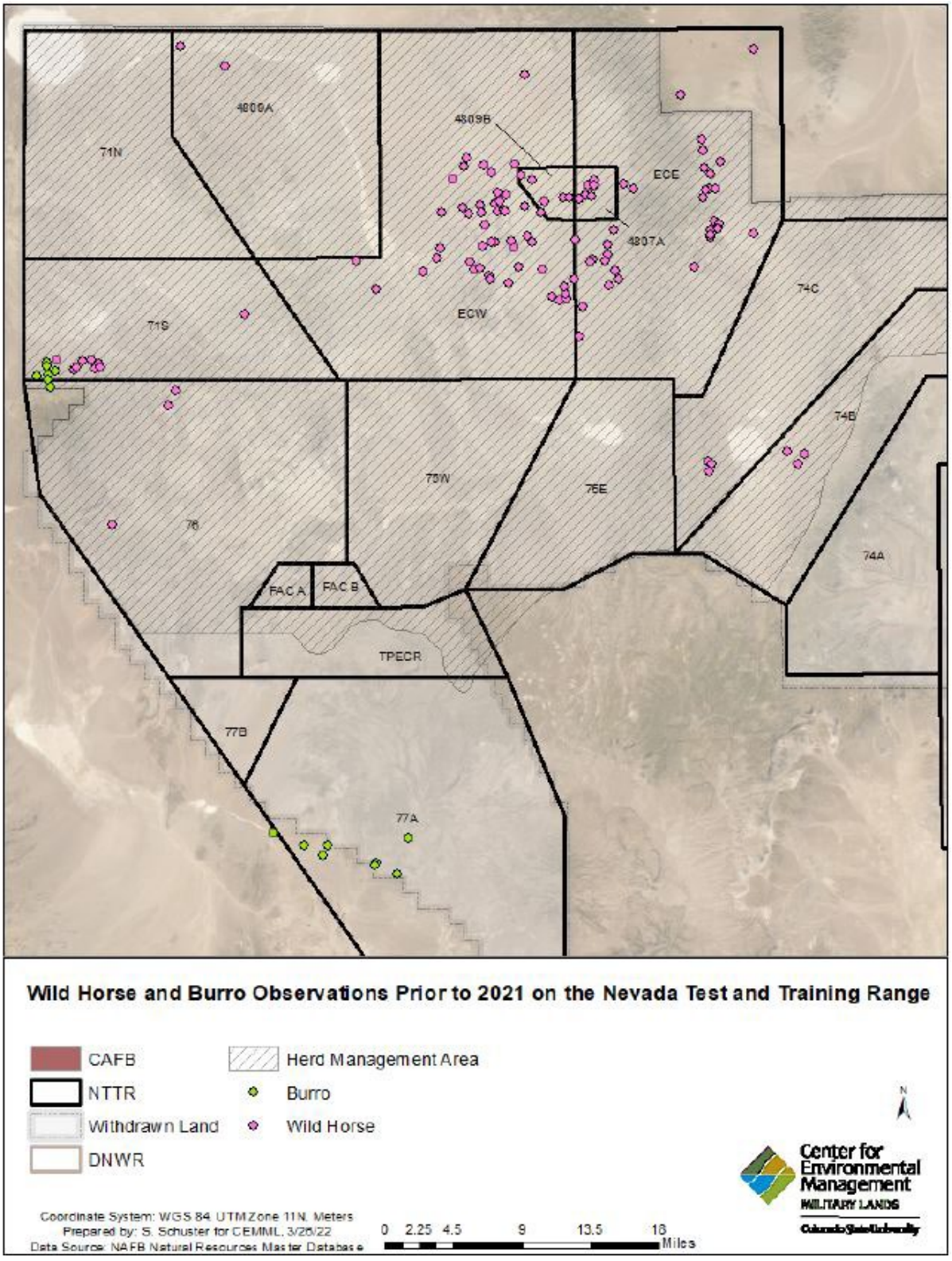


Figure 2-48. Wild horse and burro observations on the Nevada Test and Training Range prior to 2021.

Domestic Animals

One cattle grazing allotment exists on the NTTR, which extends into a small area of the North Range. It is fenced and grazing animals do not wander freely across the NTTR.

2.3.3.6 Climate Impacts on Fish and Wildlife

Although climate change impacts to fish and wildlife are expected across the U.S., they are projected to be more pronounced in the Southwest (Archer et al. 2008). Impacts to wildlife communities across NAFB and the NTTR may be significant. A changing climate likely will favor newly arriving species, which often can outcompete native species, especially when native species are already experiencing reduced fitness due to shifting environmental conditions (Hellmann et al. 2008).

Climate-change-induced shifts in vegetation may cause loss of important foraging grounds for herbivorous animals, such as mule deer, bighorn sheep, and desert tortoises. Pronghorn, however, have shown a preference for shrubland and may benefit from the change.

Aquatic habitats are already limited in these desert ecosystems and are likely to become further restricted as precipitation decreases. Higher air temperatures can degrade quality, particularly in lentic systems. As water temperatures rise in lentic systems, lower dissolved oxygen content impairs water quality, particularly for larval amphibians and aquatic macroinvertebrates. Warmer water temperatures can also increase the chances of algal blooms, further depleting dissolved oxygen content and degrading habitat quality (Paerl et al. 2011). The loss of quality aquatic habitats likely would displace amphibians, such as the Great Basin spade-foot toad and the western toad. Flow monitors set up at Breen Creek will increase installation knowledge on how changes in climate and precipitation are linked to water abundance in wetland habitats and amphibian impacts.

Decreased precipitation also could pose additional direct and indirect threats to many terrestrial wildlife species present on the installations. For example, if insect abundance is reduced due to decreased precipitation, a number of species that rely on insects (e.g., multiple myotis species, the canyon bat, pallid bat (*Antrozous pallidus*, BLM Sensitive, Nevada Protected), sage thrasher, sagebrush sparrow, horned lark, loggerhead shrike, greater roadrunner, burrowing owl, side-blotched lizard [*Uta stansburiana*], zebra-tailed lizard, and small mammal species) may suffer. These bottom-up effects on the food chain could continue, as smaller animals are an important food source for larger predatory mammals, such as American badger (*Taxidea taxus*), coyote (*Canis latrans*), kit fox, gray fox (*Urocyon cinereoargenteus*), and bobcat (*Lynx rufus*). Precipitation may also fall in fewer but more intense storm events (McAfee et al. 2021, University of Nevada 2023), which may cause increased erosion and subsequently threaten native vegetation and wildlife.

Of special note is the documented collapse of Mojave Desert bird communities due to climate change (Iknayan and Beissinger 2018). Decreasing precipitation and increasing periods of extreme heat have led to losses in bird species richness and occupancy probabilities. These effects are likely occurring at NAFB and the NTTR, which are in the Mojave Desert ecoregion and have projected decreases in precipitation.

2.3.4 Threatened and Endangered Species and Species of Concern

In this INRMP, rare species that are federally listed or candidate species for federal listing, state-protected species, or BLM special-status species are referred to as species of concern. Below are descriptions of federal and state guidance that protect species of concern. Applicability to NAFB and the NTTR are given in the descriptions. Appendix E is a comprehensive list of all rare species (as defined above) that have been documented on or potentially could occur on NAFB or the NTTR.

Endangered Species Act (ESA)

The ESA protects species that are federally listed as threatened or endangered (T&E) by prohibiting the import, export, or take of T&E species and implementing recovery plans through interagency cooperation. The ESA also requires that all federal agencies shall proactively seek to conserve threatened and endangered species and shall utilize their authorities to further the purpose of this act (ESA 7(a)1, AFMAN 32-7003 3.38.1). According to AFMAN 32-7003 3.38.1, installations with known federally listed T&E species, or habitats supporting T&E species, must address T&E species conservation in the INRMP.

Consultation with the USFWS must be performed for USAF actions that may affect a listed species. These species include those that have been documented to occur or those listed on the USFWS Information for Planning and Consultation (iPaC) website, unless those species are determined to not exist on base. iPaC species are listed in Appendix E.

Federal Candidate Species

Candidate species have had a 12-month status review finding that listing is "warranted but precluded" by species with higher listing priority. Candidate species do not have legal protection under the ESA, but the NNRP implements conservation and recovery efforts when practical and not in conflict with the installation's mission. The USAF provides candidate plants and animals protections similar to those afforded for threatened and endangered species (AFMAN 32-7003 3.38.1).

Migratory Bird Treaty Act (MBTA)

The MBTA prohibits the killing, capturing, selling, trading, and transport of migratory bird species or any part, nest, or egg of MBTA-designated species, and federal activities must strive to minimize such take. Species considered migratory are listed under Title 50 Part 10.13 in the Act. Prior authorization to take a migratory bird species may be obtained by the USFWS if a special need exists or certain criteria are met (16 U.S.C. §703–712).

Definitions and the prohibition of incidental take under the MBTA have changed multiple times during recent presidential administrations. Most recently, the USFWS published a final ruling on 04 October 2021 that the implementation of the MBTA prohibits incidental take. However, the USAF is partially exempted from this prohibition. On 30 August 2006, a MOU between the DoD and the USFWS to "Promote the Conservation of Migratory Birds" was approved and states that "readiness activities" by the Armed Forces are exempt from the incidental taking of migratory birds (DoD and USFWS 2006). Other activities by the military mission are not exempt and must follow the regulations of the MBTA.

EO 13186 also provides guidelines and responsibilities for federal agencies to protect migratory bird species.

Bald and Golden Eagle Protection Act (BGEPA)

The Bald and Golden Eagle Protection Act prohibits capturing, trapping, molesting, disturbing, obtaining, selling, hunting, or transporting bald eagles, golden eagles, their nests, feathers, or eggs (16 U.S.C. 668-668c). The installation's missions, training activity, and development cannot negatively impact or take these species, unless the installation has the proper permits in place. The USFWS-proposed revisions to regulations authorizing incidental take permits were published in the Federal Register in September 2022.

BLM Sensitive Species

BLM Manual 6840, section 6840.01, "Special Status Species Management Manual for the Bureau of Land Management", identifies BLM special-status species as (1) species listed or proposed for listing under the ESA and (2) species requiring special management consideration to promote their conservation and reduce the likelihood and need for future listing under the ESA and which are designated as Bureau sensitive by the State Director(s). All federal candidate species, proposed species, and delisted species in the five years following delisting will be conserved as Bureau "sensitive species".

Nevada Protected Species

Fauna

AFMAN 32-7003 Section 3.38.1 requires the USAF to protect and manage state-listed species when consistent with the mission. Certain fishes, birds, amphibians, and mammals are protected under the jurisdiction of Nevada per Nevada Administrative Code (NAC) Chapter 503. Nevada has varying levels of state protection for wildlife: state protected, endangered, threatened, or sensitive.

A state-protected species is defined by a limited population; distribution only found within Nevada; significant ecological, scientific, educational, or other value; or the USFWS considers it T&E or a candidate species. Nevada endangered species are categorized by danger of extinction throughout all or a significant portion of its range. Similarly, a species or subspecies is determined threatened in Nevada when it is likely to become an endangered species in the near future throughout all or a significant portion of its range. A state-sensitive species is defined by a population or distribution in significant decline; a threatened population, or the USFWS considers it T&E or a candidate species. Nevada protected species have no open hunting season, require permit or authorization to hunt, take, possess, handle, move, or temporarily possess (NAC 503).

The NWAP is a comprehensive management guide, identifying the state's SGCN. Nevada SGCN are species in need of conservation that have the potential of becoming threatened or endangered, but the status offers no legal protections. The NWAP also identifies Key Habitats essential for the conservation of SGCN and provides guidance for conservation actions. NAFB and the NTTR will protect and conserve these landscapes when not in conflict with the military mission. NDOW plans to release an updated NWAP in fall 2023.

Flora

Under NAC 527.090, native Nevada flora are fully protected if listed as critically endangered and threatened with extinction. These plants may not be removed or destroyed except pursuant to a permit issued by the State Forester. This list is generated by the State Forester Firewarden pursuant to NAC 527.010.

The NDNH current tracking list (NDNH 2022) was used to identify state protection designations for species included in this INRMP, along with referencing the most recent revision of NAC 503.

Department of Defense Partners in Flight Mission Sensitive Species (DoD PIF MSS)

The DoD supports avian conservation through its collaboration with Partners in Flight (PIF). Specifically, DoD PIF provides the DoD with "expertise on the management and conservation of birds and their habitats to sustain and enhance the military mission" (DoD 2021). DoD PIF has created a Mission-Sensitive Species list of birds that have the "highest potential to impacts DoD missions if the species are listed under the ESA" (DoD 2021).

USFWS Birds of Conservation Concern (BCC)

The Fish and Wildlife Conservation Act mandates the USFWS to identify species and populations of all migratory nongame birds that require additional conservation action to prevent potential listing under the ESA. To comply with this mandate, the USFWS Birds of Conservation Concern 2021 (USFWS 2021) identifies bird species that represent the highest conservation priorities of the USFWS. Bird species are excluded from consideration for the BCC 2021 if they only occur irregularly or tangentially in the U.S. or are not protected under the MBTA or the ESA (USFWS 2020*b*). The USFWS identified "Bird Conservation Regions" and species may be considered BCCs for a specific region, not necessarily throughout the species' entire range. This designation does not grant any legal protection. The aim of the USFWS is to propagate collective and proactive conservation actions amongst various stakeholders and across borders.

Pollinators

Pollinators play a vital role in maintaining native habitats. Compliance with current regulations, laws, and policies related to pollinator conservation is essential for promoting healthy habitats to sustain the USAF mission. Certain pollinator species listed under the ESA, MBTA, and/or state laws retain the highest level of protection. However, all pollinators are granted consideration under Presidential Memorandum 14946 "Creating a Federal Strategy to Promote the Health of Honey Bees and Other Pollinators". To sustain the mission and ecological integrity on USAF installations, Air Force Civil Engineering Center (AFCEC) and USFWS issued the "U.S. Air Force Pollinator Conservation Strategy," which implements management practices to support pollinators, especially those with regulatory protections, and enhance their habitat. Further guidance can be taken from the U.S. Air Force Pollinator Conservation Strategy and Reference Guide (USFWS 2017), an important resource for identifying ways to support this ecologically significant group.

Other Guidance

Other guidance documents include the Great Basin Bird Observatory's Nevada Comprehensive Bird Conservation Plan (2010), PIF's Landbird Conservation Plan (Rosenberg et. al 2016), and the Strategic Plan for DoD Bird Conservation and Management (Partners in Flight 2014).

2.3.4.1 Herpetofauna

Desert Tortoise

The Mojave population of the desert tortoise was listed as threatened under the ESA in 1990. The desert tortoise is also protected by the state of Nevada as a threatened species. Protection is warranted due to declining populations resulting from habitat loss and fragmentation, disease, and direct mortality by human activity.

The desert tortoise is a terrestrial species found in arid and semi-arid deserts. It occupies a variety of habitats from desert flats and slopes dominated by creosote scrub at lower elevations to the black brush and juniper woodland ecotone at intermediate elevations. The desert tortoise requires soils that are friable enough to construct burrows yet firm enough to prevent burrow collapse. Rocky habitats are also occupied, as they dig under rocks to create burrows, and their food sources are often present in washes/draws that funnel rainwater. The tortoise is considered a keystone species because its burrows often provide shelter for a wide variety of other wildlife in the Mojave Desert, and they promote nutrient cycling in desert soils.

The desert tortoise is an herbivore that feeds on a wide variety of desert plants, including grasses, flowers, annual plants, woody perennials, and cacti. Long-lived (up to 100 years) and slow-growing, females reach sexual maturity at 14–20 years of age. They have a low reproductive rate, thus populations can be sensitive to the effects of mortality caused by humans. For example, ravens prey on hatchling desert tortoises, and

people incidentally providing resources to ravens (e.g., water sources, nesting sites, garbage and other food sources) have led to much larger raven populations than those naturally occurring. These often lead to correspondingly high depredation on young desert tortoises.

The desert tortoise ranges from extreme southwestern Utah and northwestern Arizona, to southern Nevada, and southern California in the Mojave Desert. In central Arizona and southeastern California, the Mojave population of the desert tortoise is replaced by the Sonoran Desert tortoise (*Gopherus morafkai*). In Nevada, the desert tortoise is found in southern Lincoln and Nye Counties and throughout most of Clark County in areas where it has not been displaced by human development.

Desert tortoise numbers have continued to decline throughout the Mojave Desert despite the development of a comprehensive recovery plan and state and federal protections. Reduced tortoise density can be the result of one or many factors such as: drought, reduced habitat quality, disease, increased predation, road mortality, fire, invasive species, low juvenile survival, etc. As the population continues to decline, areas of higher density can become islands. This isolation is extremely damaging to threatened and endangered species, and further compounds factors driving decline. As a result, it is vital to maintain connectivity and, when practical, implement tools (i.e. translocation, habitat restoration, disease monitoring, etc.) to bolster tortoise density and/or habitat quality.

Installation Population

NAFB and the NTTR have been conducting surveys for the desert tortoise since the 1990s. A detailed summary of historical specific survey efforts, methods, and results can be found in the most recent Final Desert Tortoise Report (NAFB 2022*c*). A general summary of the installation population of desert tortoises based on historic surveys is summarized in the following paragraphs.

Figure 2-49. A juvenile Mojave desert tortoise in the South Range, 2021. Nellis Air Force Base Photo Library.

The desert tortoise has been documented on NAFB, the SAR, and the NTTR (South Range). Figure 2-49 shows a desert tortoise on NAFB Area II. Densities observed on NAFB and the SAR are significantly higher than the NTTR, ranging from moderate to high densities on most of the installation. The remaining area of the installation has unsuitable habitat. On the NTTR, the desert tortoise may range as far north as the southern corner of the North Range (Ranges 77a and 77b) evidenced by one class 5 carcass found in Range 77A and a class 2 pallet and class 5 scat found in Range 77B in 2020 (K. McCarty, CEMML, personal communication). NAFB biologists determine the condition of desert tortoise sign based on classes adapted from Averill-Murray (2000) and Woodman and Berry (1984). Classes range from 1-5, with class 1 being the newest, freshest sign, and class 5 being the oldest and most deteriorated. For further information on sign condition categories, reference the 2021 Final Desert Tortoise Report (NAFB 2022c). Fleur de Lis Canyon/Oasis Wash appears to be suitable habitat, although there is no evidence of inhabitance. Relative abundance surveys indicate that most tortoise habitat on the South Range supports a low abundance of desert tortoises (NAFB 2022*c*). A small portion of the South Range supports moderate to high abundance of desert tortoises. Desert tortoise densities on the NTTR are comparable but slightly above estimates for the 2016 Eastern Mojave Recovery Unit

(USFWS 2011). Data from the NTTR surveys in 2019 suggest that a significant desert tortoise mortality event occurred in the last decade. The data also indicate it was not anthropogenically driven since most carcasses were found far from targets and roads (NAFB 2022*c*).

Locations of live desert tortoise sightings and modelled habitat for the NAFB, South Range, and North Range are shown in Figure 2-50, Figure 2-51, and Figure 2-52. Further details on survey objectives, progress, and results can be found in the 2021 Desert Tortoise Annual Report (NAFB 2022*c*). Biological opinions and current and future management are discussed further in Section 7.4.1.1.

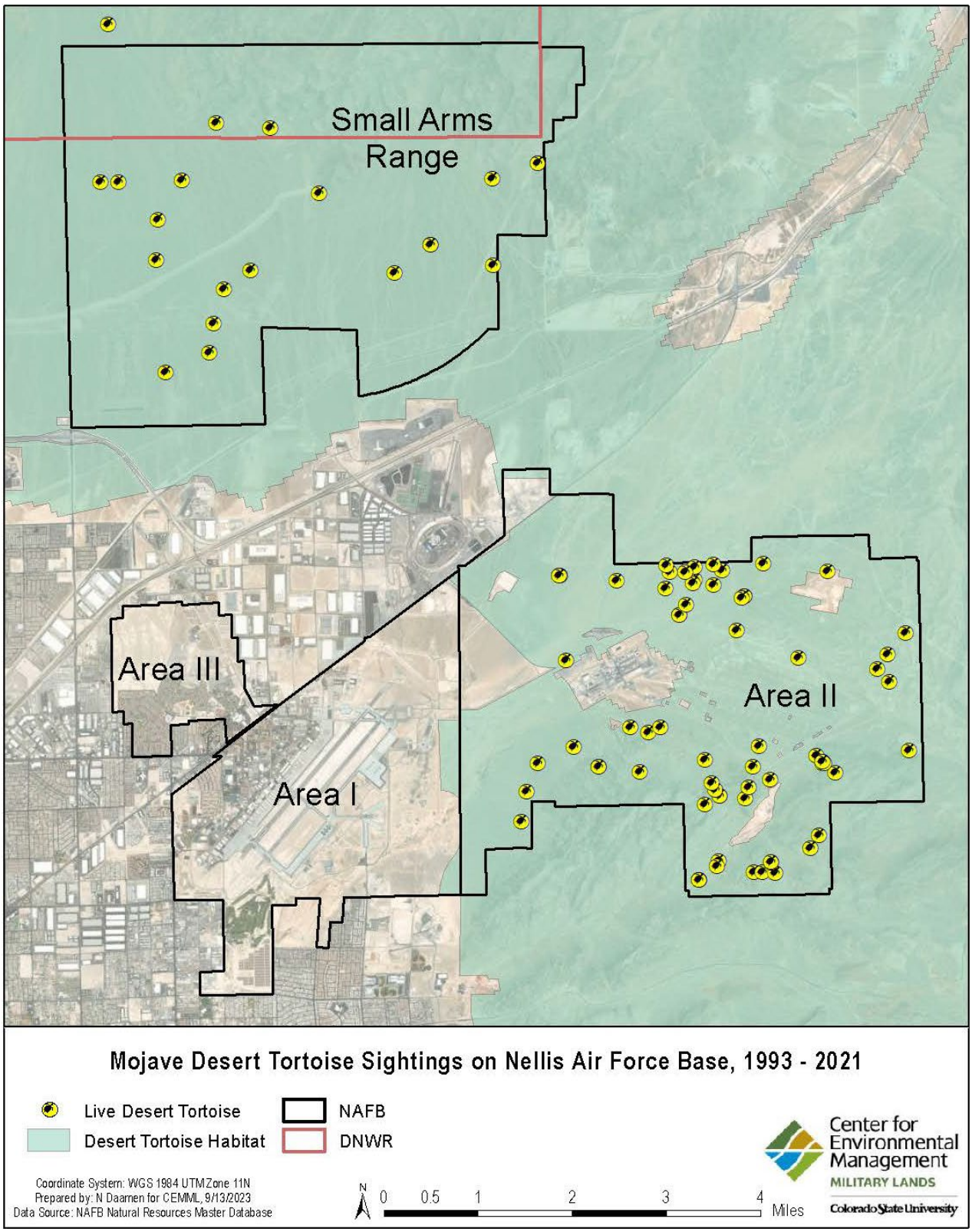
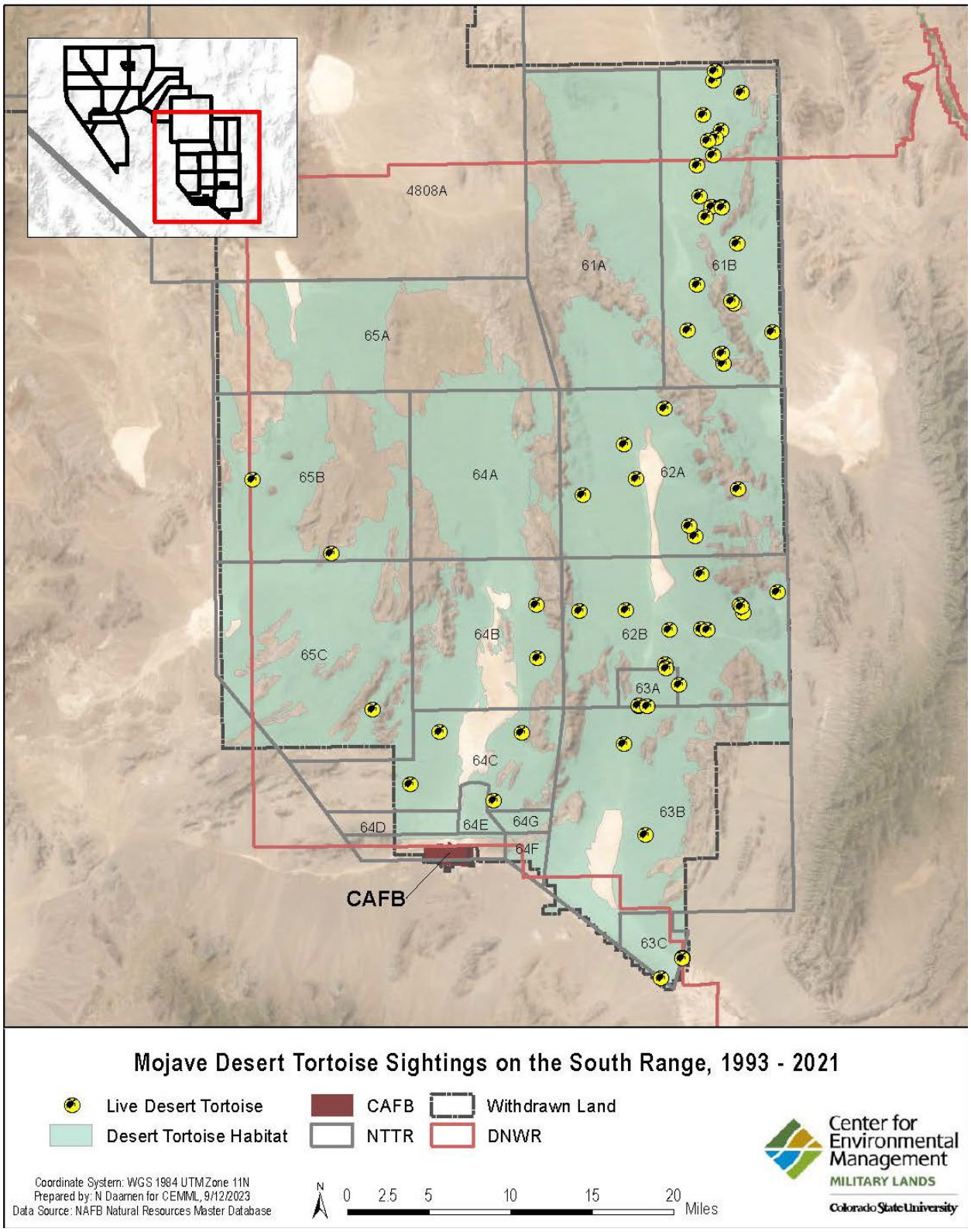


Figure 2-50. Live desert tortoise sightings and modelled habitat on Nellis Air Force Base, 1993-2021.



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2481 Figure 2-51. Live desert tortoise sightings and modelled habitat on the South Range, 1993 – 2021.

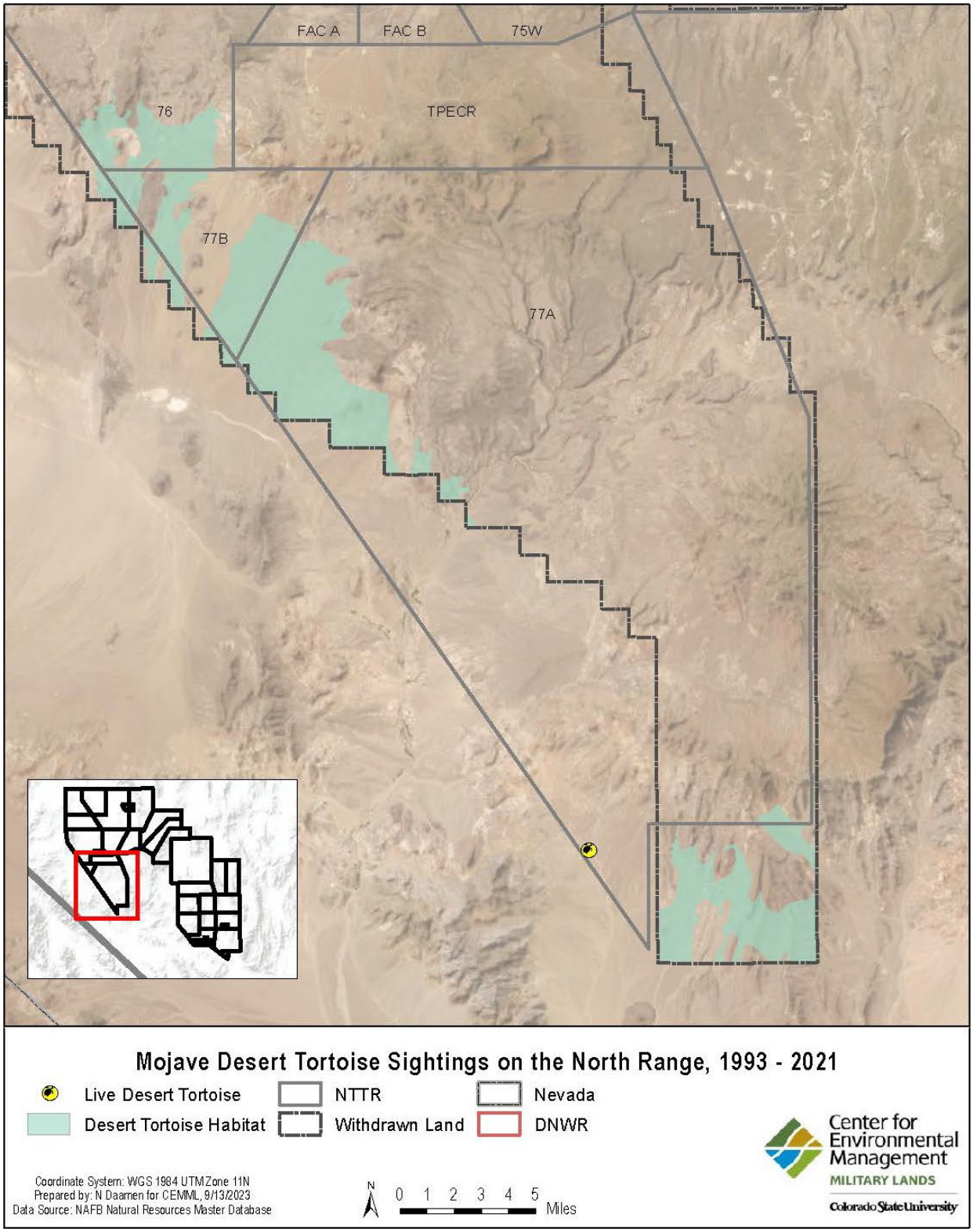


Figure 2-52. Live desert tortoise sightings and modelled habitat on the North Range, 1993 – 2021.

Banded Gila Monster

The banded Gila monster (*Heloderma suspectum cincum*; Figure 2-53), hereafter referred to as the Gila monster, is classified as protected by the state of Nevada under NAC 503.080, and identified as a sensitive species by the BLM.

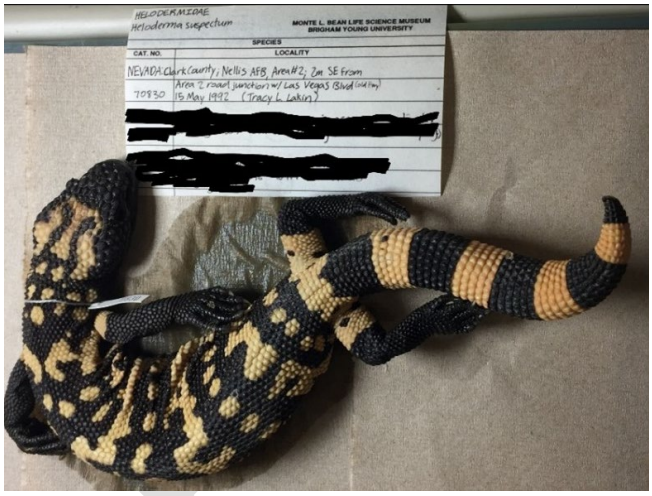


Figure 2-53. Gila monster collected 15 May 1992 from Nellis Air Force Base Area II. Photo: Stephen Stocking.

The Gila monster is found primarily in the eastern and northern Mojave Deserts of southern California, southern Nevada, northwestern Arizona, and extreme southwestern Utah. The Gila monster is found primarily in Mojave Desert scrub, where it appears to prefer rocky hillsides, canyons, and areas with large rocks. These areas are often remote and steep, which contributes to difficult searching conditions. Gila monsters are secretive and very difficult to detect. In the northern Mojave Desert, the Gila monster is most active March to early June, and it spends 96% of its life underground (Beck 2005). This makes survey efforts challenging, especially on the NTTR, where access is limited. The Gila monster is one of only two venomous lizard species in North America. Gila monsters feed on squamate (snake and lizard) eggs, desert tortoise eggs, eggs and hatchlings of ground-nesting birds, and newborn and juvenile mammals. The Gila monster is a facultative nest predator and uses its excellent sense of smell and memory to find hidden nests (Beck 2005).There have been three documented observations of a Gila monster on NAFB and the NTTR. The first was in NAFB Area II in 1992 (NAFB 2017*c*), but the other two have been relatively recent. There was one documented during bighorn sheep guzzler maintenance in 2013, and another incidentally on trail camera in 2020, both on the South Range (NAFB 2022*j*). In addition to these observations, there have been three recent records by NDOW in the Apex Hills east of the SAR (Figure 2-53), so it is likely they occur on the SAR (J. Jones, herpetologist, Nevada Department of Wildlife, personal communication, 2017). The Gila monster has been observed in multiple locations throughout Clark County, and is found in southern Lincoln and Nye Counties. There are documented occurrences on the DNWR along Alamo Road, very close to the NTTR boundary; therefore, they likely occur in the Desert Range and Pintwater Ranges.

Mojave Fringe-toed Lizard

The Mojave fringe-toed lizard (MFTL) (Figure 2-54) is classified as protected by NAC 503.080, and inhabits sand-dune habitat in the Mojave and northern Colorado Deserts in California and Arizona to the south of NAFB (NAFB 2022*b*). It is also considered BLM Sensitive. The MFTL was first recorded in Nevada in 2016 on the Amargosa Dunes along the California state line (Jones and Stocking 2017). The MFTL is a medium-sized lizard with a flattened body and snout-vent lengths of 2.6 to 3.9 inches. MFTLs are characterized by a back pattern of black spots broken by a scattering of eye-like spots (ocelli) consisting of tan or cream circles with small orange dots in the center. This pattern provides camouflage in its habitat; these lizards occur at elevations of 300 to 3,000 feet and are restricted to sand dune habitats. MFTLs are uniquely adapted, with their fringed toes providing the ability to run fast on sand. Other adaptations to sand include a counter-sunk jaw, overlapping eyelids, earflaps, and valved nostrils (Stebbins 2003). MFTLs forage for both arthropods and plant matter, including insects, scorpions, leaves, flowers, grasses, and dried

seeds. Predators of MFTLs include hawks, shrikes, burrowing owls, greater roadrunners, coyotes, American badgers, snakes, and long-nosed leopard lizards (Stebbins 2003, Norris 1958, Jones and Lovich 2009).

MFTLs populations are facing threats of habitat degradation as well as off-road vehicle use mortality strikes, an increasing threat as human expansion continues in the western Mojave Desert (Jennings and Hayes 1994). MFTLs are not listed under the ESA but are designated as BLM Sensitive. Due to their recent discovery in Nevada, the Nevada Natural Heritage Program and NDOW have yet to determine state status.

Figure 2-54. Mojave fringe-toed lizard at Nellis Air Force Base Area II, 2021.

The MFTL was first documented on NAFB in 2019 in the sand dune habitat of Area II. It is the first documented observation of this species in Clark County. After their discovery on NAFB in 2019, monitoring efforts of visual encounter surveys began and 29 MFTLs were observed in the northeast portion of NAFB Area ll. In 2020 and 2021, survey efforts expanded to repeatable line distance transects combined with mark-recapture surveys with passive integrated transponder (PIT) tags, visual implant elastomers, and/or tail clips for genetic sampling. In 2020, 190 individuals were detected, and 191 individuals were documented in 2021 during transect surveys or incidentally between transects. All MFTL observations occurred in NAFB Area ll, no MFTL were documented in the North or South Range (NAFB 2022*b*).

Figure 2-55 shows MFTL observations in Area II of NAFB. For further information on the MFTL, its life history, and observed location on NAFB, refer to the 2021 Candidate Species Report for NAFB (NAFB 2022*b*). For future management efforts, refer to Section 7.4.1.3.

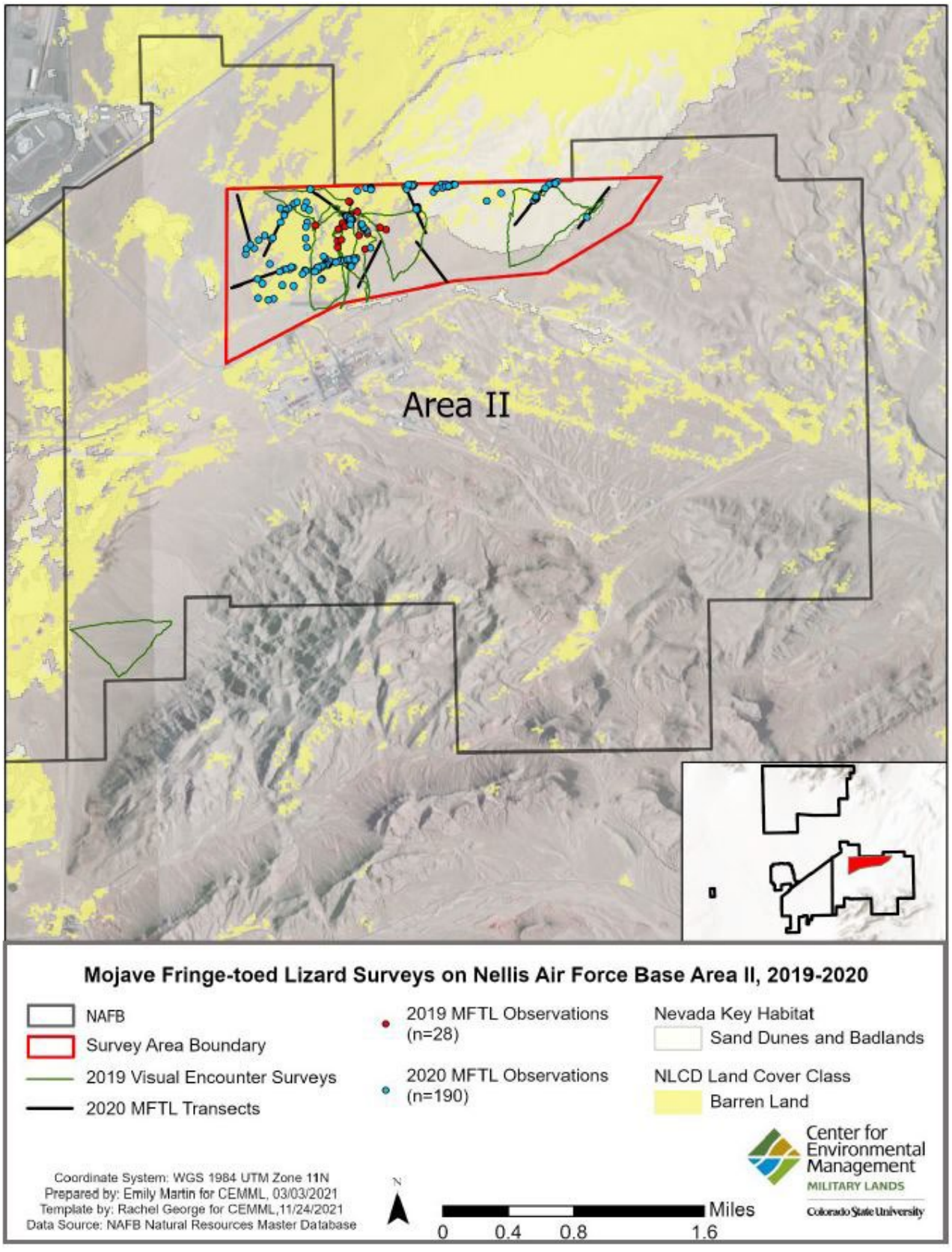


Figure 2-55. Mojave fringe-toed lizard observations and survey routes from 2019-2020.

Other Herpetofauna

NAFB and the NTTR support numerous herpetofauna with Nevada SGCN status. These species include the chuckwalla, desert horned lizard, desert iguana, desert night lizard, Great Basin collared lizard, Great Basin spadefoot toad, long-nosed leopard lizard (Figure 2-56), long-tailed brush lizard (*Urosaurus graciosus*), Mojave shovel-nosed snake (*Chionactis occipitalis*, BLM Sensitive), panamint rattlesnake, regal ringneck snake (*Diadophis punctatus regalis*), spotted leaf-nosed snake, sidewinder, western red-tailed skink (*Plestiodon gilberti rubricaudatus*, BLM Sensitive), and the western banded gecko. Further information regarding locations of SGCNs is included in the 2021 Reptile and Amphibian Survey Final Report (NAFB 2022*j*).

Figure 2-56. Long-nosed leopard lizard sleeping in a creosote bush. Nellis Air Force Base Photo Library, 2021.

Undocumented Species

Several species with protected status could occur on NAFB and the NTTR based on habitat. Further information will be added to this plan if they are documented during regular surveys.

2.3.4.2 Native Birds

Golden Eagle

One of North America's largest raptors, the golden eagle is protected by the BGEPA and MBTA. It is also BLM Sensitive, Nevada SGCN, and DoD PIF MSS. The golden eagle primarily occurs only on the NTTR due to a lack of foraging and breeding habitat at NAFB. The NTTR encompasses a vast amount of golden eagle habitat for both nesting and foraging and supports a population of resident golden eagles. Figure 2-57 shows a golden eagle chick in a nest in the Cactus Range within the North Range, 2019.

Figure 2-57. Golden eagle chick in nest on the North Range, 2019. Nellis Air Force Base Photo Library.

The NNRP initiated ongoing golden eagle surveying efforts in 2011. Survey methods included aerial helicopter surveys to identify and monitor nests and reproductive success, powerline surveys, and prey-base surveys. Each year from 2011 through 2021, surveyors flew both the North and South Ranges of the NTTR multiple times during the nesting season to view known golden eagle nests, find new nests, and assess reproductive success.

All historically observed golden eagle nests are shown in Figure 2-58. Nests with high fidelity (to which eagles have returned year after year) are shown in Figure 2-59.

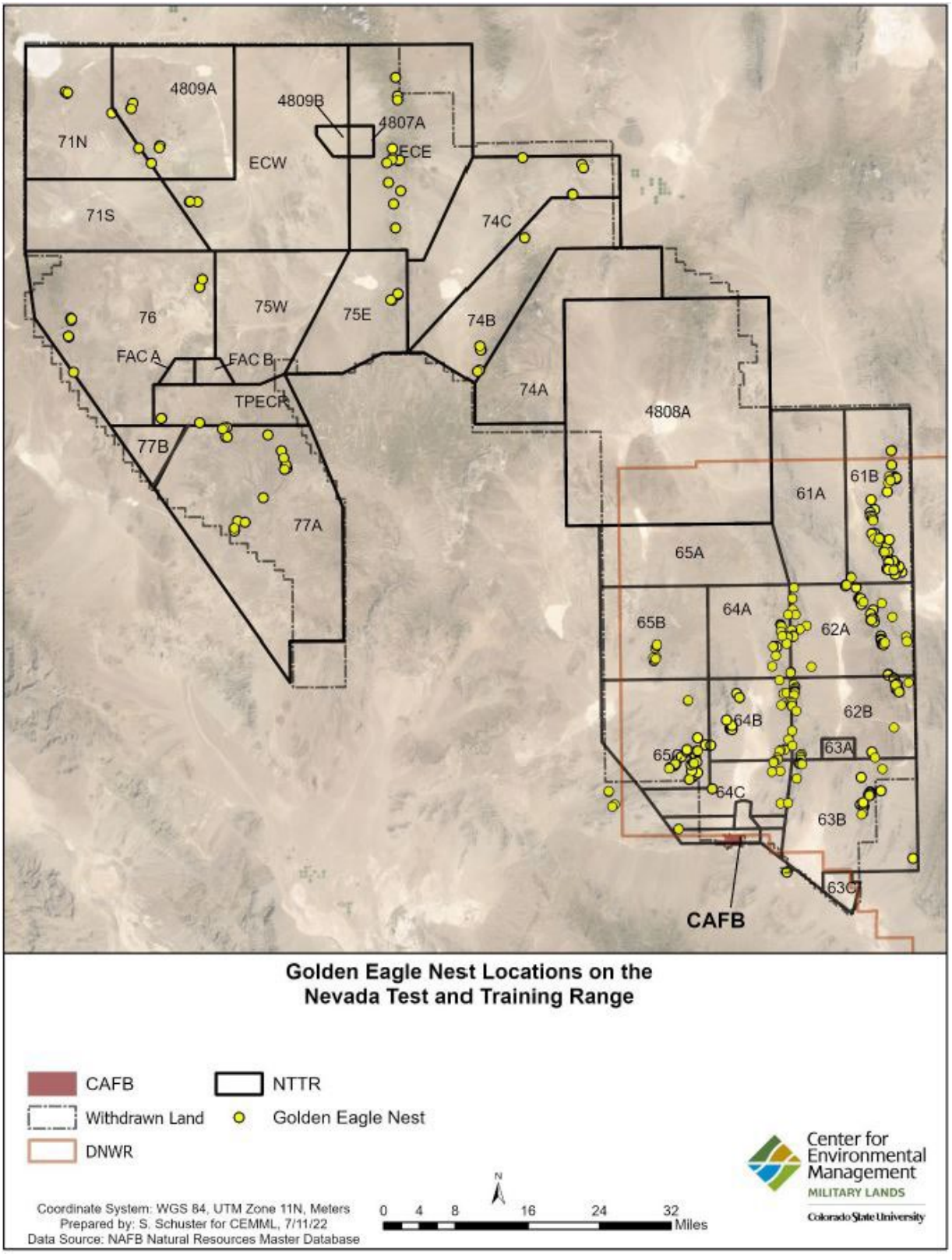


Figure 2-58. Observed active golden eagle nests on the Nevada Test and Training Range, 2011-2020.

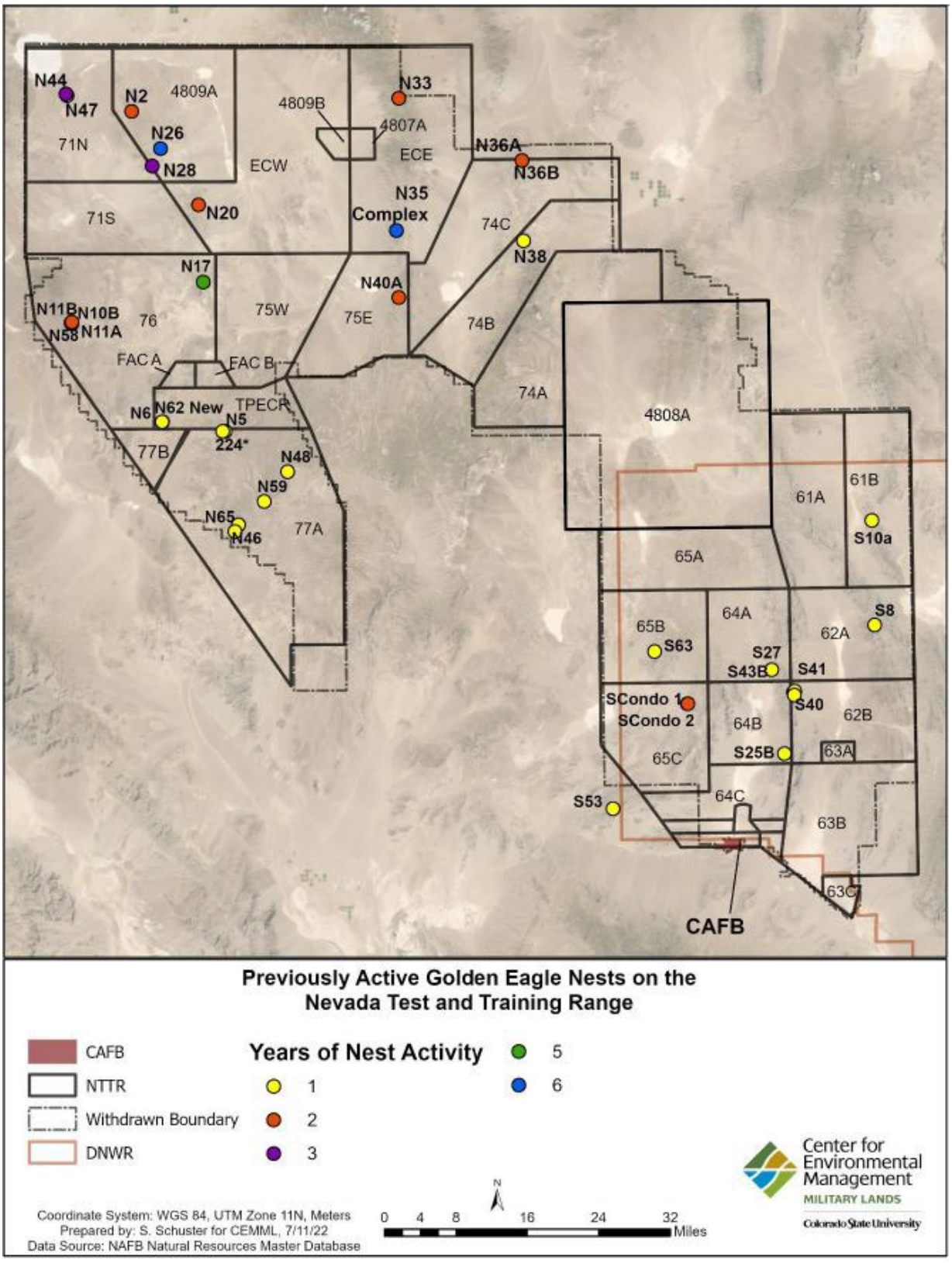


Figure 2-59. Repeated use golden eagle nests on the Nevada Test and Training Range, 2011-2020.

Western Burrowing Owl

Figure 2-60. Burrowing owl perched near a burrow at the Sloan Channel on Nellis Air Force Base Area I, 2020. Nellis Air Force Base Photo Library.

The western burrowing owl is a small, ground-dwelling owl that inhabits arid landscapes, including some urban and agricultural environments. Figure 2-60 shows a burrowing owl adult at NAFB. It is classified as BLM Sensitive, Nevada SGCN, USFWS BCC, DoD PIF MSS, and is protected by the MBTA. Burrowing owls help control small mammal and rodent populations and help prevent spreading of diseases carried by small mammals Burrowing owls have been slowly declining in the U.S. due to habitat loss, pesticide use, and vehicle collisions (Audubon 2023, National Wildlife Federation [NWF] 2023). Similarly, burrowing owls have experienced impacts to their habitat on NAFB in recent years due to increased development, and this encroachment is likely to continue in the future with ongoing base expansion.

Historical survey efforts from 2009 through 2021 have documented the western burrowing owl at many locations across NAFB and both the North and South Ranges of the NTTR. Western burrowing owls on NAFB and the NTTR may be migratory or year-round residents (NAFB 2012, NAFB 2022*g*). Additionally, the western burrowing owl that occurs at NAFB and the NTTR is genetically unique, and may represent a distinct genetic strain of burrowing owl. Burrowing owl observation locations and burrows from historical surveys are given in Figure 2-61, Figure 2-62, Figure 2-63, and Figure 2-64. These maps also show the locations of other special-status bird species. Historical survey efforts are further discussed in Section 7.4 and the most recent 2021 Candidate Species Report (NAFB 2022*b*).

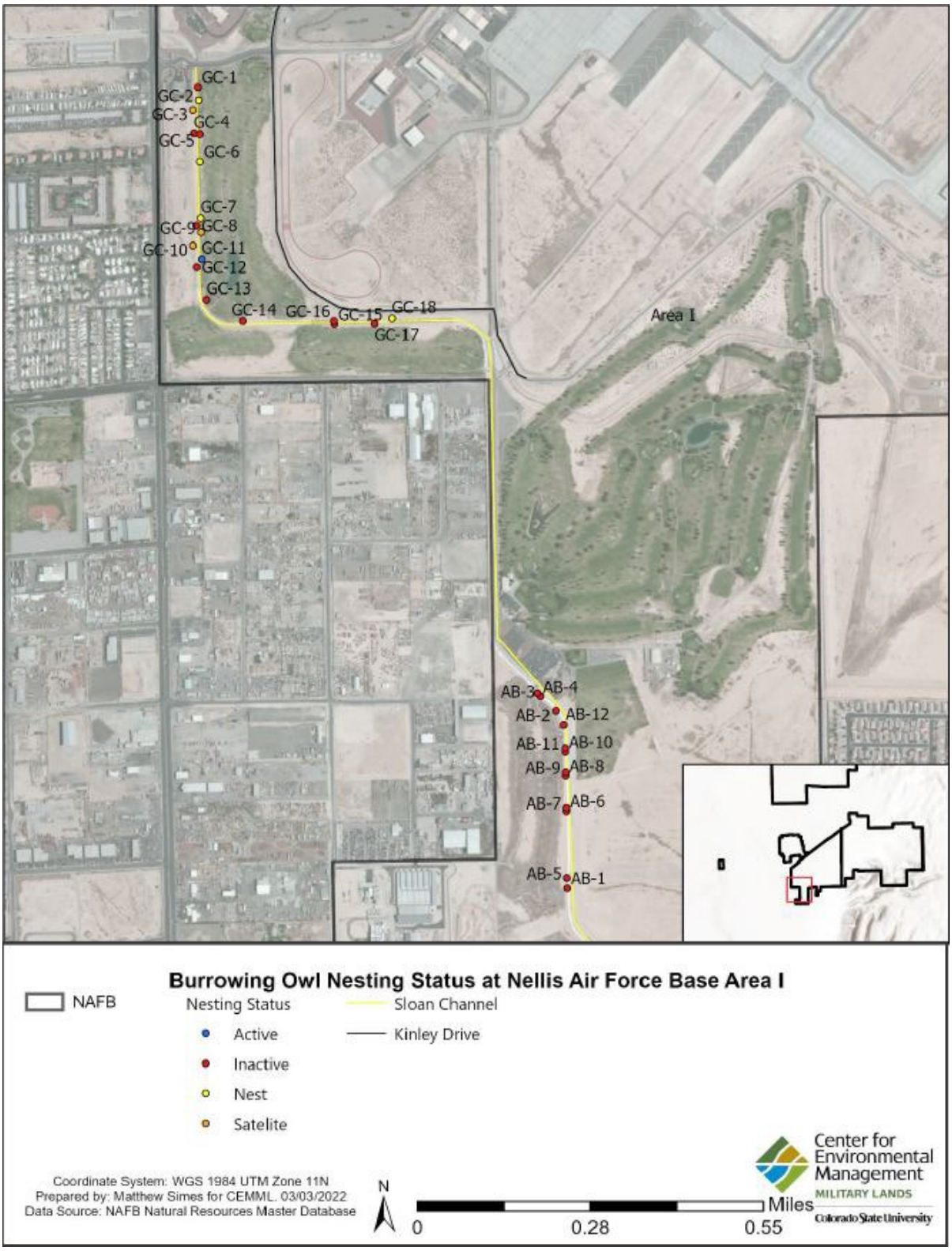


Figure 2-61. Burrowing owl burrow locations and status on Nellis Air Force Base in 2021.

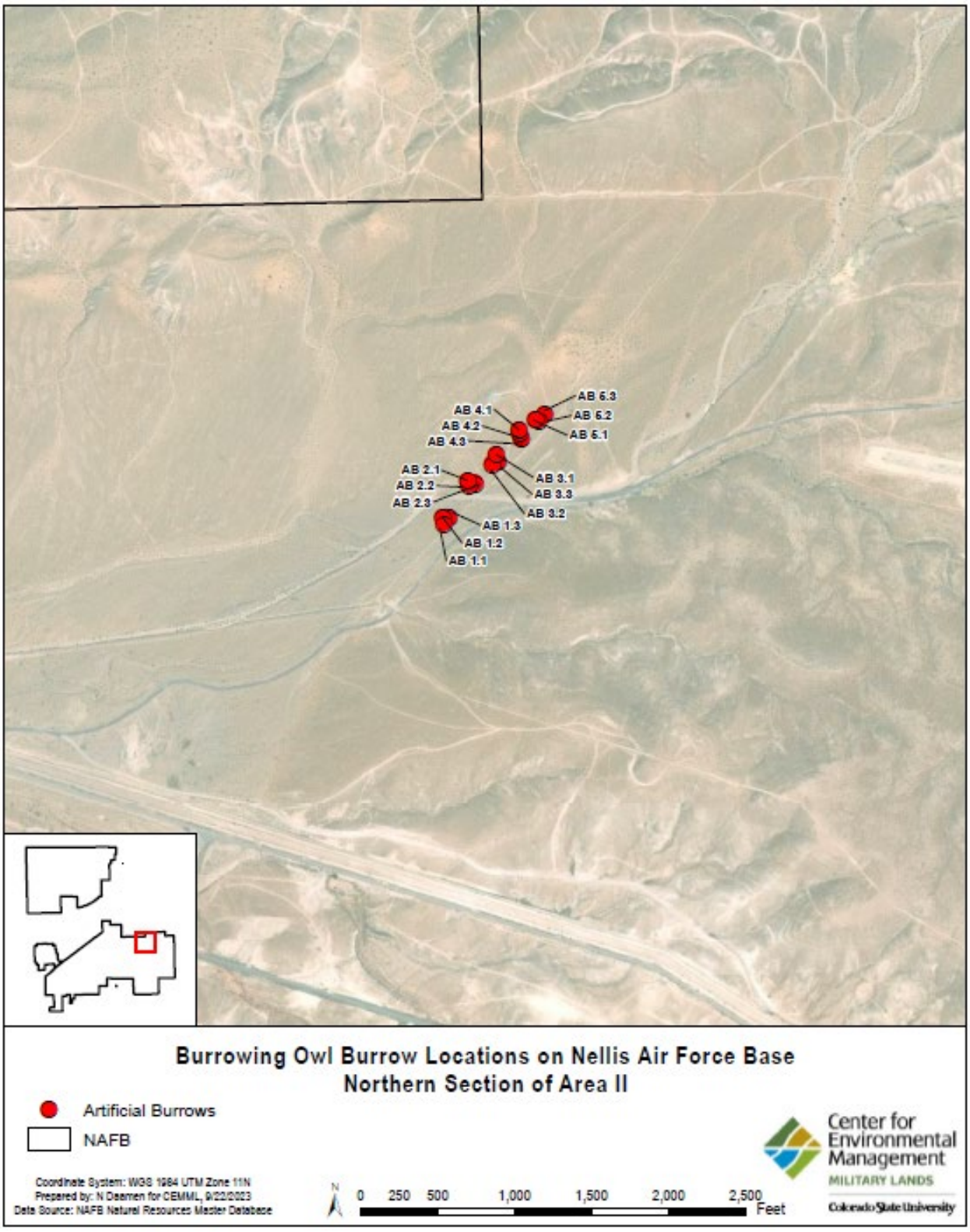
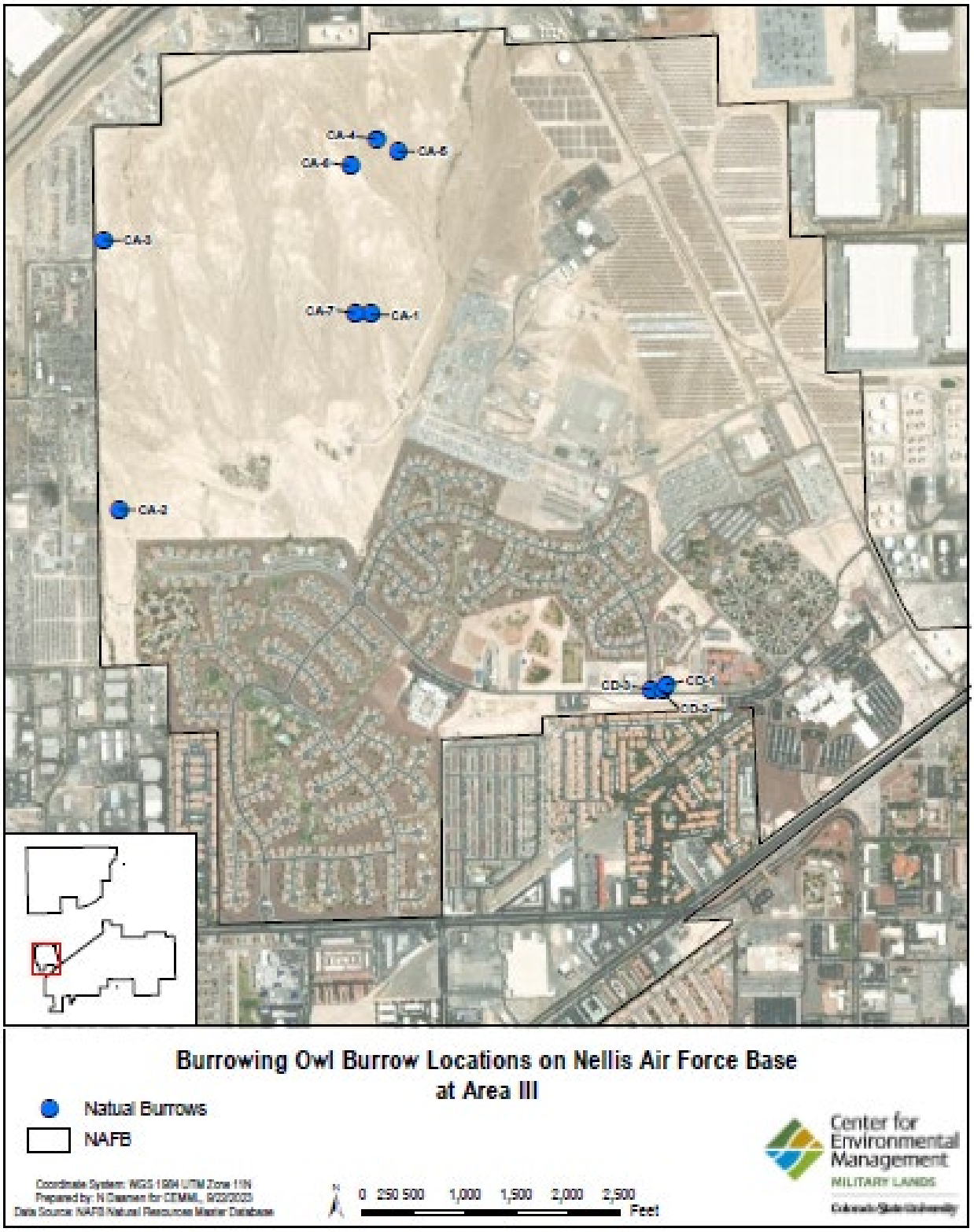


Figure 2-62. Burrowing owl artificial burrow locations on Nellis Air Force Base.



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2636 Figure 2-63. Burrowing owl burrow locations on Nellis Air Force Base.

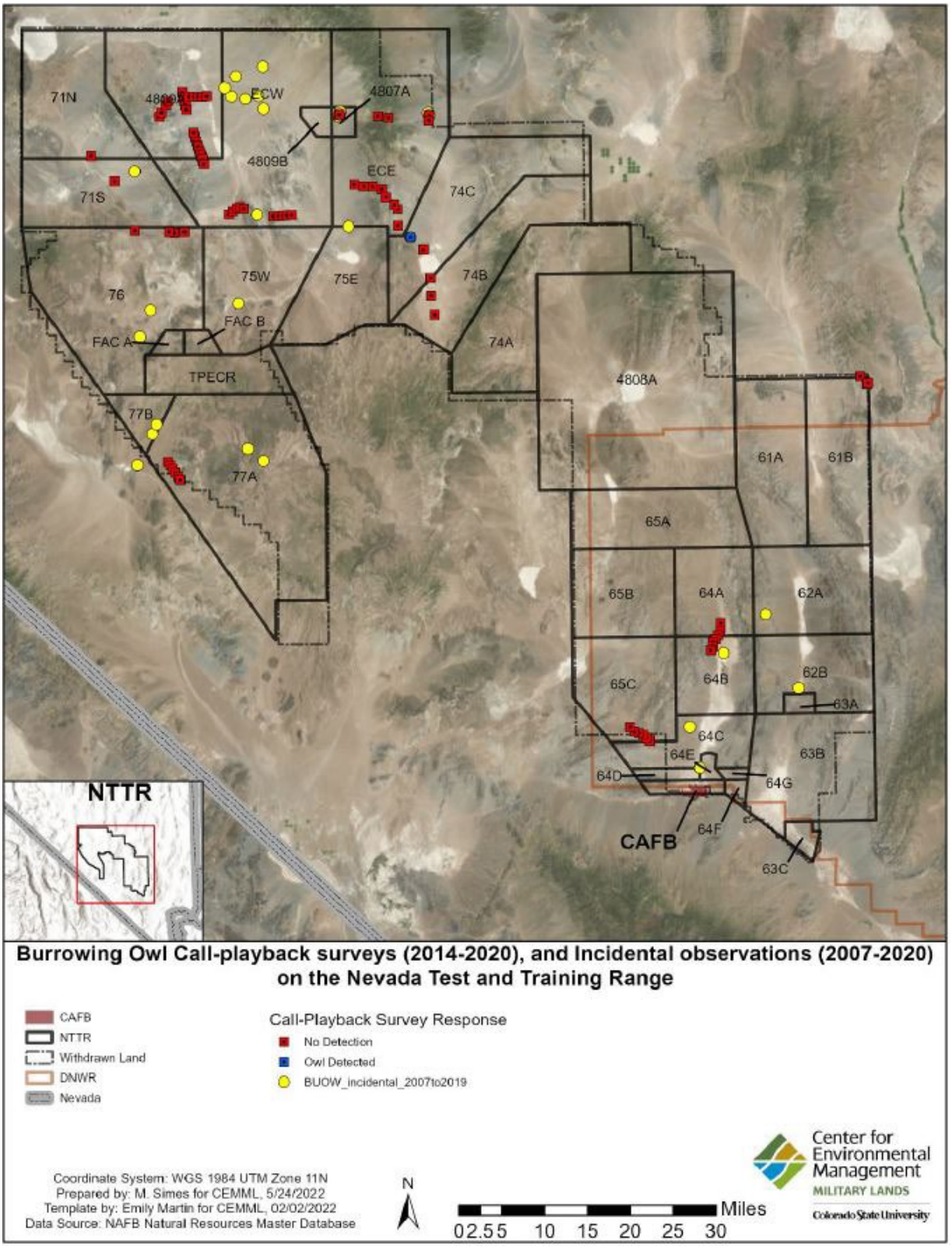

Figure 2-64. Burrowing owl call-playback responses (2014 – 2020) and incidental sightings (2007 – 2020) on the Nevada Test and Training Range.

Greater Sage-Grouse

The greater sage-grouse (*Centrocercus urophasianus*, Figure 2-65) is protected by the state of Nevada as an upland game bird and is a SGCN and a BLM sensitive species. It is also considered a DoD PIF MSS.

Figure 2-65. Greater sage-grouse. Photo: US Fish and Wildlife Service.

The greater sage-grouse is dependent upon sagebrush communities, which are found only on the peripheries of the Kawich Range within the North Range. A small brood of greater sage-grouse (one hen with two or three chicks) was observed by NNRP biologists in the Breen Creek area in 2011, which NDOW had delineated as critical late-summer habitat for the greater sage-grouse.

In 2015, during aerial surveys for other wildlife species, there were unconfirmed sightings of sage-grouse in the Breen Creek area. There have been no further sage-grouse observations. It is thought that sage-grouse are transient on the NTTR due to the suboptimal condition of the sagebrush stands within installation boundaries. In recent years, some stands, such as those around Sumner Spring, have been badly trampled by wild horses (NAFB 2022*n*).

Raptors

Five other sensitive raptor species been documented on NAFB and the NTTR, and a sixth raptor species has potential to occur on the installation. The Swainson's hawk (*Buteo swainsoni*, BLM Sensitive, MBTA, Nevada SGCN) and ferruginous hawk (*Buteo regalis*, BLM Sensitive, USFWS BCC, MBTA, Nevada SGCN) have been observed nesting in Joshua tree habitat on the NTTR. The state-endangered peregrine falcon nests in the cliffs of the NTTR (Figure 2-66). These three raptors are encountered frequently, both during surveys and incidentally.

Figure 2-66. Peregrine falcon on cliff nest on the South Range, 2022. Nellis Air Force Base Photo Library.

The fourth sensitive species is the northern goshawk (*Accipiter gentilis*, BLM Sensitive, Nevada SGCN and Sensitive). It was identified in the summer of 2012 via remote wildlife camera photographs taken at Cooper's Meadow, and in 2020 at Jerome Spring (NAFB 2012, NAFB 2022*g*). See Figure 2-67 for observations of these raptor species across the installation.

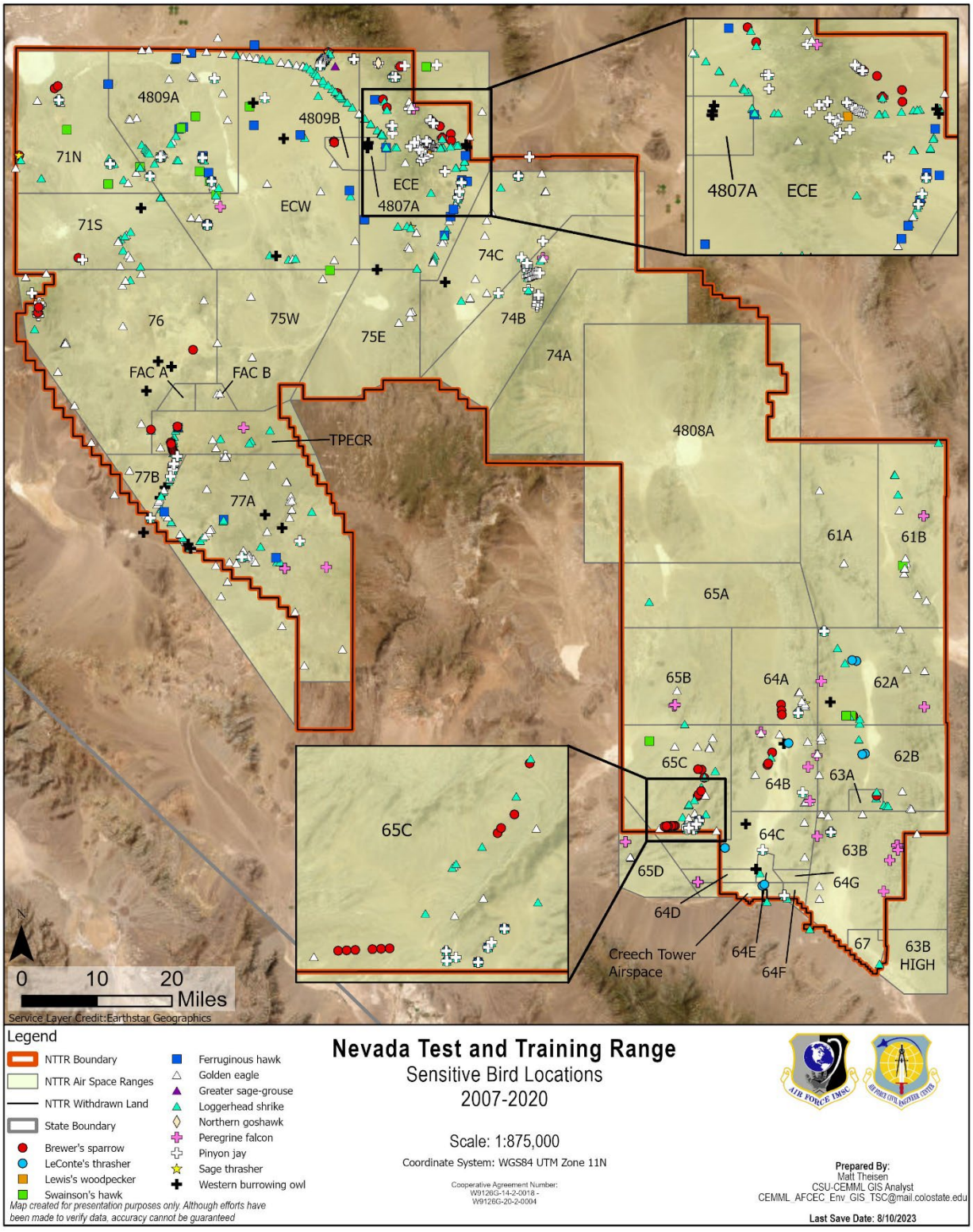

Figure 2-67. Special-status bird species on the Nevada Test and Training Range, 2007-2020. Symbols indicating observations of pinyon jays may represent single, dozens, or hundreds of pinyon jays.

The fifth species, the bald eagle, is a large, state-endangered raptor protected by the MBTA and BGEPA. It is also BLM Sensitive, and Nevada Sensitive and an SGCN. It is an infrequent passage migrant across the installation, such as in 2018. NAFB and the NTTR do not contain any suitable breeding or wintering habitat, such as high-elevation coniferous forest, trees near open water, or agricultural lands.

Passerines, Near-passerines, and Shorebirds

Le Conte's thrasher is designated as BLM Sensitive, USFWS BCC, DoD PIF MSS, and Nevada SGCN. The sage thrasher, is designated as BLM Sensitive, USFWS BCC, and Nevada SGCN and Sensitive. They are both protected by the MBTA and both occur on the NTTR (NAFB 2022*g*). Le Conte's thrasher is an uncommon resident of the Mojave Desert that inhabits sparsely vegetated creosote scrub habitat, such as that on the South Range of the NTTR, where the species has been documented (NAFB 2022*g*). The sage thrasher has been observed on both the North and South Ranges of the NTTR in open shrubland habitats. Bendire's thrasher was documented once in Range 65C on the South Range in 2021 (NAFB 2022*g*; not shown in map). Bendire's thrasher is a rare resident in southern Nevada and prefers Mojave shrubland environments with scattered, taller vegetation, such as mesquite or Joshua trees. This habitat occurs on both NAFB and the South Range of the NTTR (GBBO 2010). Bendire's thrasher has the same protections as Le Conte's thrasher.

The pinyon jay is classified as BLM Sensitive, USFWS BCC, DoD PIF MSS, and Nevada SGCN. It is also protected by the MBTA. Lewis's woodpecker (*Melanerpes lewis*) has the same protections. They both inhabit the pinyon-juniper ecosystem found on the North Range (Figure 2-67). Lewis's woodpecker has been observed at the Wells System Annex during a stationary point count, but mostly within mixed pinyon jay flocks in the North Range during Nevada Bird Count point counts (NAFB 2022*g*). The black rosy-finch (*Leucosticte atrata*) is classified as BLM Sensitive, USFWS BCC, and Nevada SGCN. It is also protected by the MBTA. It inhabits and breeds within high-elevation mountains in the central U.S. much of the year. In winter, the black rosy-finch occupies open areas at lower elevations such as high deserts, montane shrublands, and even abandoned mine entrances. All of these habitats are well represented on the North Range, so there is considerable potential for winter presence of black rosy-finch (GBBO 2010).

The loggerhead shrike is classified as BLM Sensitive, DoD PIF MSS, Nevada SGCN and Sensitive (Figure 2-68). It is also protected by the MBTA. It is a year-round resident frequently observed hunting from atop fence posts and other conspicuous perches on NAFB and both the North and South ranges of the NTTR (Figure 2-67 and Figure 2-70). Brewer's sparrow is classified as BLM Sensitive, Nevada SGCN and Sensitive, and is protected by the MBTA. It is a passage migrant and winter resident found on NAFB and the NTTR (NAFB 2022*g*).

Figure 2-68. Loggerhead shrike perched on barbed wire at Nellis Air Force Base, 2022. Nellis Air Force Base Photo Library.

The western snowy plover (*Charadrius alexandrinus nivosus*) is classified as BLM Sensitive, USFWS BCC, and Nevada SGCN. It is also a DoD PIF MSS. It nests in areas where water is present throughout the entire breeding season, but it depends on ephemeral wetlands and playa habitats throughout much of its lifecycle for foraging. The NTTR encompasses numerous dry lakebeds that are characterized by brief, infrequent, and

irregular water availability. Although dry and virtually lifeless most of the year, they support migratory and resident shorebirds and waterfowl by providing habitat and foraging opportunities when full. Hence, western snowy plover could potentially use ephemeral wetlands across the range throughout the nonbreeding season (GBBO 2010).

Phainopepla is a silky flycatcher that favors lowland riparian and mesquite/catclaw habitats in which mistletoe (*Phoradendron californicum*) grows as a parasite. Figure 2-69 shows a phainopepla. Mistletoe produces berries that compose the diet of the phainopepla along with insects. As the phainopepla was previously designated as BLM Sensitive, the NNRP initiated targeted surveys for the species and its preferred habitat from 2010–2016. Many observations of phainopepla and suitable phainopepla habitat were made during this timeframe, particularly at the Wells System Annex and Area II of NAFB. The Wells System Annex and Area II both encompass mesquite bosques infested with desert mistletoe. Phainopepla was recorded on NAFB as recently as 2021 (NAFB 2022*g*).

Figure 2-69. Phainopepla. Nellis Air Force Base Photo Library.

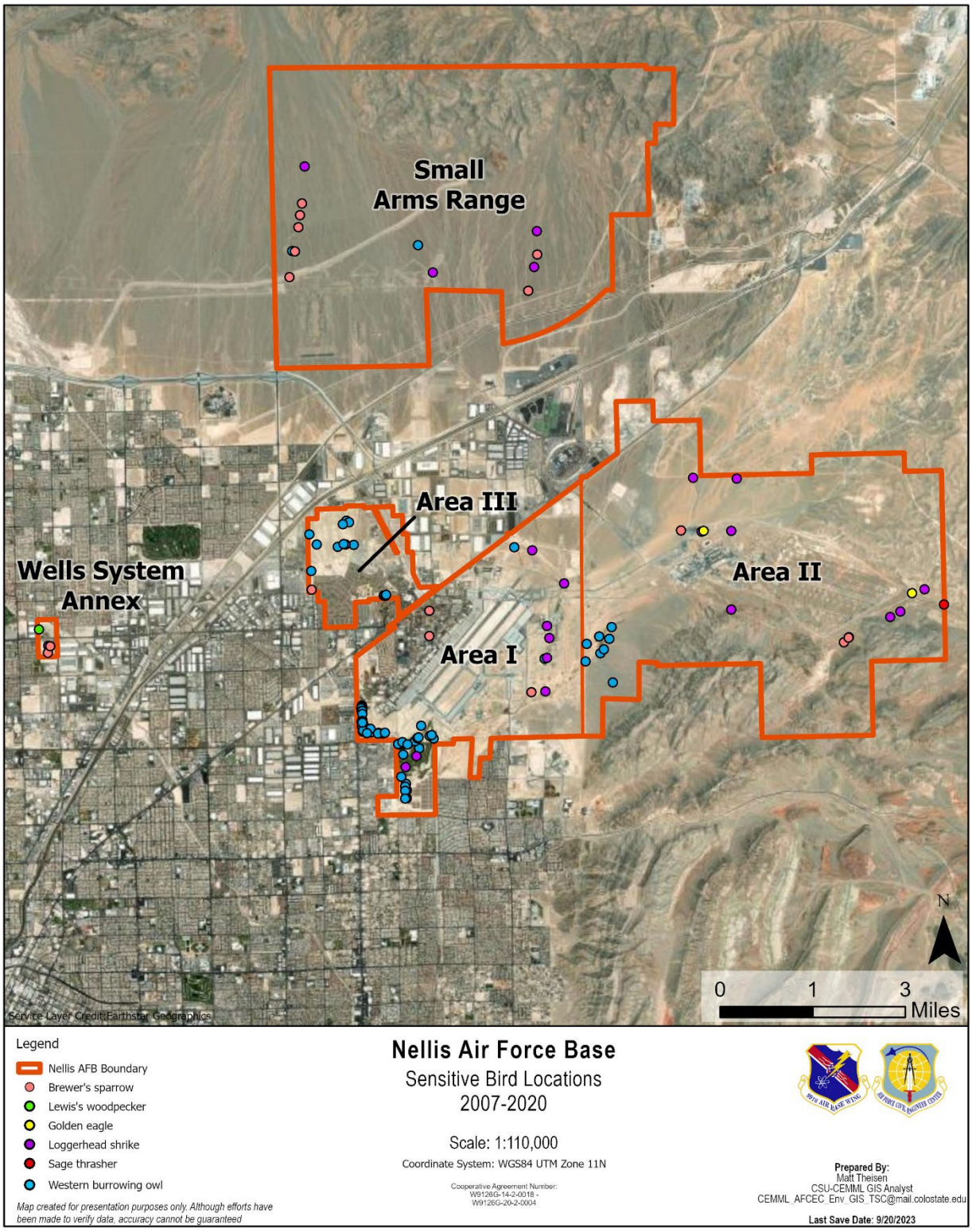

Figure 2-70. Special-status bird species on Nellis Air Force Base, 2007-2020.

2.3.4.3 Small Mammals

Figure 2-71. Pale kangaroo mouse on the North Range. Nellis Air Force Base Photo Library.

Two species of small mammals that occur on the NTTR are Nevada Protected: the dark kangaroo mouse (*Microdipodops megacephalus*) and the pale kangaroo mouse (*Microdipodops pallidus*, Figure 2-71). They are also BLM Sensitive and Nevada SGCN. The pale kangaroo mouse prefers fine, sandy soils with little to no gravel cover at elevations of 4,000 to 5,750 feet (Reid 2006). Pale kangaroo mice are found in valley bottoms dominated by saltbush and greasewood. Although primarily granivorous, pale kangaroo mice will supplement their summer diet with insects (WAPT 2012). The dark kangaroo mouse also prefers sandy soils, but it is found on gravelly soil in areas where its range overlaps with that of the pale kangaroo mouse. The dark kangaroo mouse is found at elevations of 3,900 to 6,700 feet (Reid 2006) in areas dominated by big sagebrush, rabbitbrush, and horsebrush. Seeds are its primary food source, but like the pale kangaroo mouse, it will feed on some insects (WAPT 2012). Through 2021, 51 pale kangaroo and three dark kangaroo mice have been documented on the North Range (NAFB 2022*l*). Small mammal survey locations are shown in Figure 2-33 and Figure 2-34.

Botta's pocket gopher (*Thomomys bottae*), and pygmy rabbit are both classified as BLM Sensitive and Nevada SGCN, and are found on NAFB and the NTTR. Botta's pocket gopher is found in a variety of habitats and soil types. It is largely fossorial and feeds on bulbs, roots, and other vegetative matter (WAPT 2012). The pygmy rabbit is the smallest leporid in the world (Himes and Drohan 2007), with an average body length of only 9.5 inches. It has been identified on the northern end of the Kawich Range within the NTTR. The pygmy rabbit is distinguishable from juvenile cottontails by its lack of a white tail and relatively shorter ears compared to its head size (Reid 2006). Pygmy rabbits are endemic to the Great Basin Desert and the adjacent intermountain regions in the Northwest (Himes and Drohan 2007). They are considered a game mammal by the state of Nevada. Surveys to date have not indicated any evidence of rabbit hemorrhagic disease virus serotype 2 (RSBV2) within the installation's population, but this disease could devastate the rabbit population, with subsequent effects on predator populations and other rabbit species.

The desert kangaroo rat (*Dipodomys deserti*), NDOW SGCN, is found at elevations up to 5,600 feet in sandy soils, and eats a variety of plant materials including grasses, mesquite seeds, and creosote seeds. The species is primarily nocturnal, but it will be active during the day when cleaning burrows or excavating new ones (Reid 2006). Merriam's shrew (*Sorex merriami*) is a BLM Sensitive shrew that inhabits various types of grasslands. It feeds on insects, and is generally active year-round (Montana Natural Heritage Program 2023). It has only been documented once on the installation, in 2011.

Other species that are likely to occur on the installation but have not yet been documented are the sagebrush vole (*Lemmiscus curatus*) and the Inyo shrew (*Sorex tenellus*).

2.3.4.4 Bats

Bat surveys have been conducted during 1996–1997 and 2008–2021 timeframes. Survey locations for the 2008–2021 timeframes are illustrated in Figure 2-36, Figure 2-37, and Figure 2-38. Surveys have included

both mist-net and acoustic monitoring methods. Most surveys are conducted on the installation level; however, a USAF-wide bat survey was conducted in 2018 on NAFB but not the NTTR. Results showed that NAFB had average bat activity compared to other installations included within the study (Schwab 2018). During those surveys, a total of 22 species were documented, including 14 special status species.

Bats are an important constituent of the desert ecosystem as they are significant pollinators, maintain ecosystem integrity, and help control pest populations. However, bats as a group have been in significant decline over the recent past (Boyles et al. 2011). Continued monitoring of bats is critically important given the recent country-wide declines in bat populations. Monitoring of currently stable bat populations now may become critically important if those same species decline in the future.

The spotted bat (*Euderma maculatum*) is the only bat listed as threatened under NAC 503. It is also BLM Sensitive and Nevada SGCN. It is a long-eared vesper bat with striking white spots on its dark body. The spotted bat prefers arid areas ranging from lowland deserts to ponderosa pine habitat at around 9,000 feet in elevation. It primarily eats large moths. The only tentative detection of this species has been through acoustic monitoring in 2014, 2016, and 2019, although these acoustic records do not provide certainty. Locations can be found in Figure 2-72.

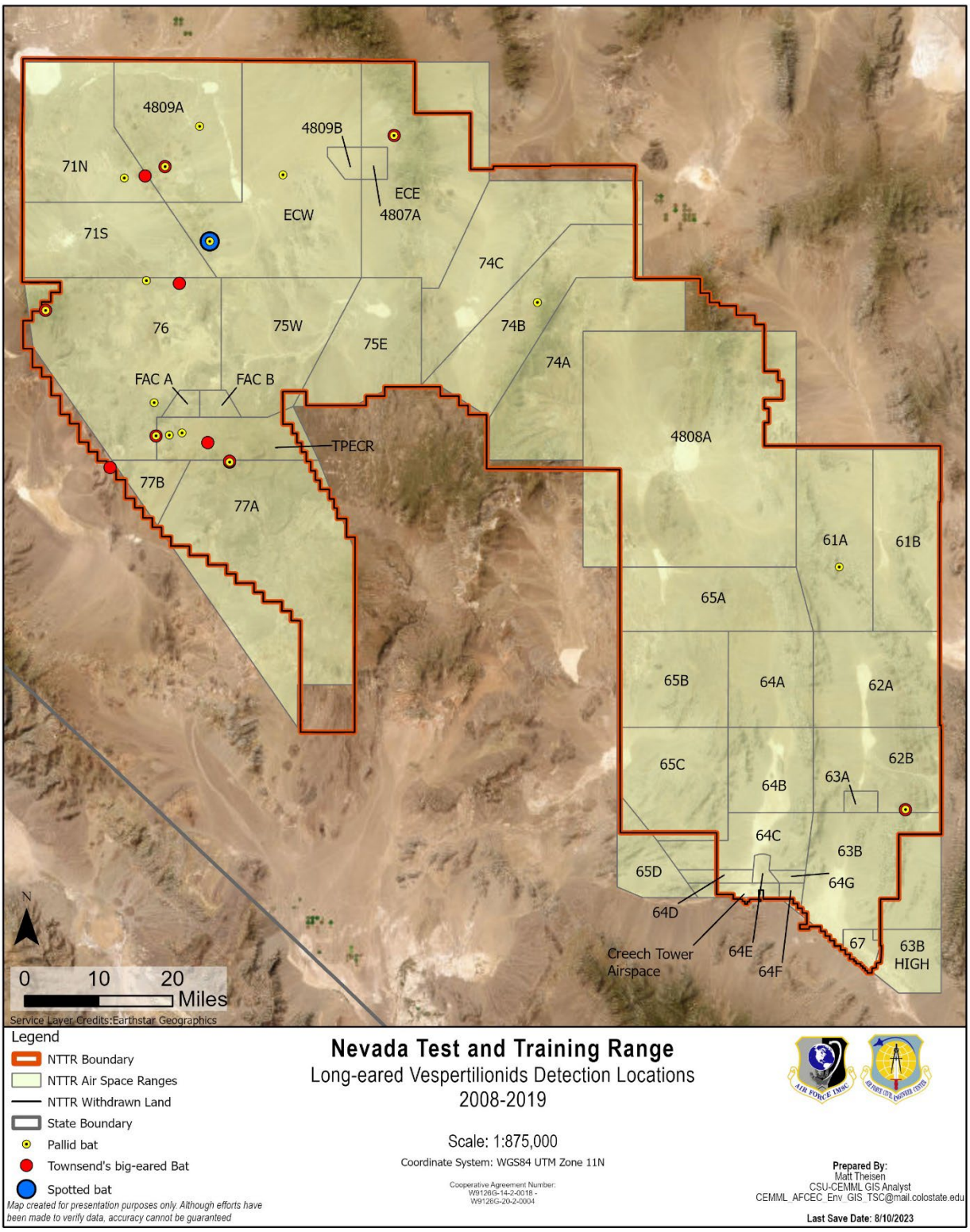

Figure 2-72. Locations of sensitive long-eared vespertilionids detected by captures and acoustic monitoring on the North Range, 2008-2019.

The pallid bat, Allen's big-eared bat (*Idionycteris pyllotis*), and Townsend's big-eared bat also members of the long-eared vesper bat group Figure 2-72. Both the pallid bat and Townsend's big-eared bat have been captured in mist nets on the NTTR. The pallid bat is classified as BLM Sensitive and Nevada Protected. Its diet consists of large insects, scorpions, and small vertebrates, and it hunts using noises the prey makes rather than through echolocation (Reid 2006). Up to 2021, the pallid bat had been captured 61 times and recorded eight years out of 12 of acoustic monitoring (NAFB 2022*a*). Allen's big-eared bat is classified as BLM Sensitive, Nevada Protected and SGCN. It has not been captured or documented on NAFB or the NTTR. Allen's big-eared bat primarily occurs in woodlands. Most of the survey effort for bats have not been in woodlands; thus the opportunity for detecting Allen's big-eared bat has been low. Townsend's big-eared bat is classified as BLM Sensitive, Nevada SGCN and Sensitive. It has been captured 15 times and has been documented seven of the last 11 years by acoustic surveys, including the last seven consecutive years (NAFB 2022*a*). Like other big-eared bats, it prefers moths and other flying insects. Habitat preferences includes arid scrub, pine forests, and wooded canyons (Reid 2006). In Nevada, all known roosts sites have been in abandoned mines (WAPT 2012). Observed locations of the Townsend's big-eared bat are shown in Figure 2-72.

The California leaf-nosed bat (*Macrotus californicus*) is classified as BLM Sensitive, Nevada Protected and SGCN. It was first documented on the installation via 24 acoustic records in 2008–2009 on NAFB and the North Range. Since those initial detections, it has been recorded ten of the last 12 years, including the last eight consecutive years. Its preferred habitat is lowland desert scrub and it feeds on moths, butterflies, and katydids (Reid 2006). The Mexican free-tailed bat is classified as BLM Sensitive and Nevada Protected. Found throughout the southern U.S. and into South America, this bat frequents a large variety of habitats including towns, deserts, and scrub. Mexican free-tailed bats feed on a variety of flying insects, including many agricultural pests (Reid 2006). Observed locations of the California leaf-nosed and Mexican free-tailed bats are shown in Figure 2-73 and Figure 2-74.

The western mastiff bat (*Eumops perotis*) is classified as BLM Sensitive and Nevada Sensitive. It has been documented in 2014, 2017, and 2019–2021 at both NAFB and the NTTR (Figure 2-73). It prefers to roost in rock crevices on cliff faces, and it will use buildings in deserts. It is a large bat (4.5 inches) and will travel 15 miles or more to forage (Reid 2006).

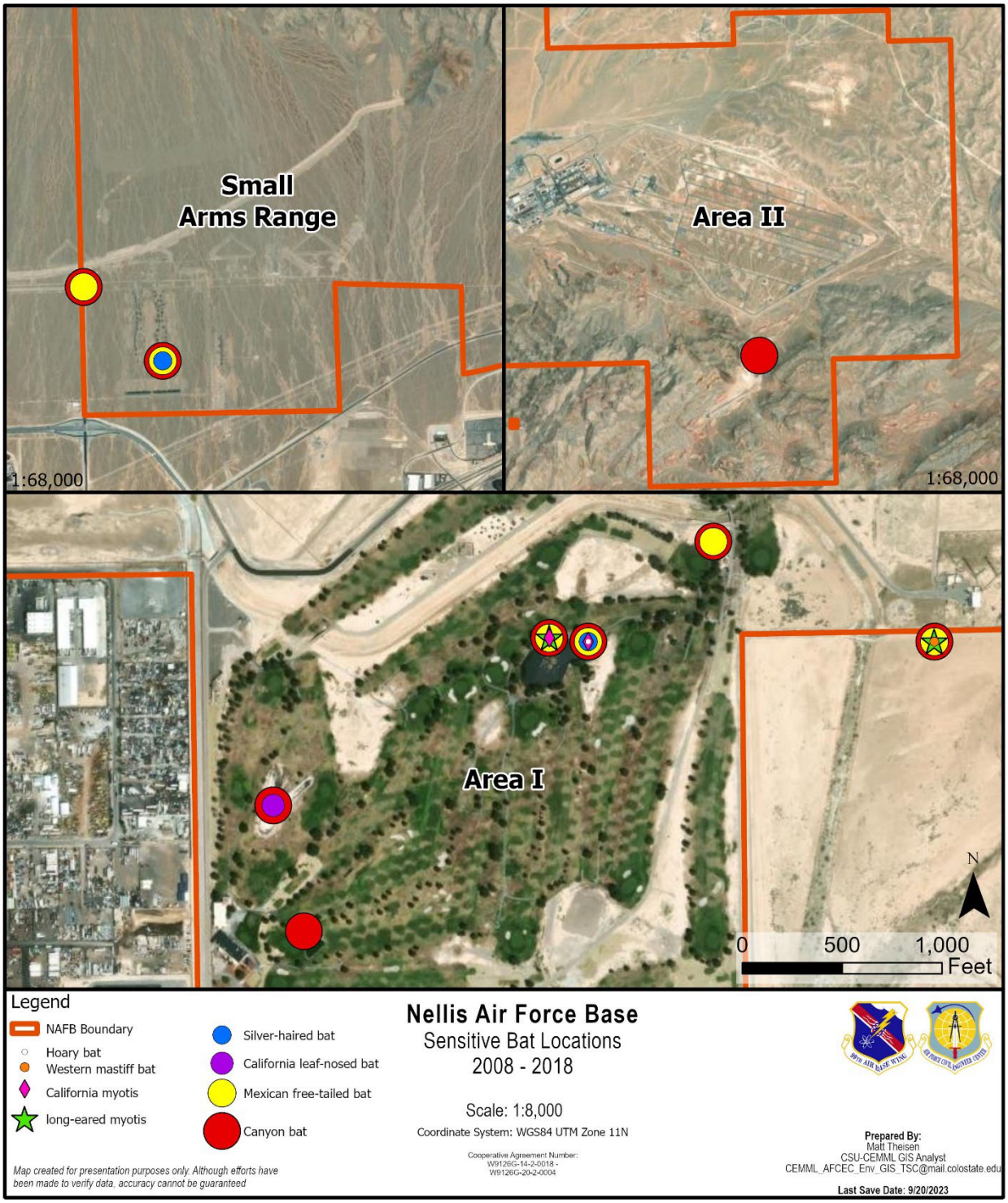

Figure 2-73. Locations of sensitive bat species detected by captures and acoustic monitoring on Nellis Air Force Base, 2008-2018.

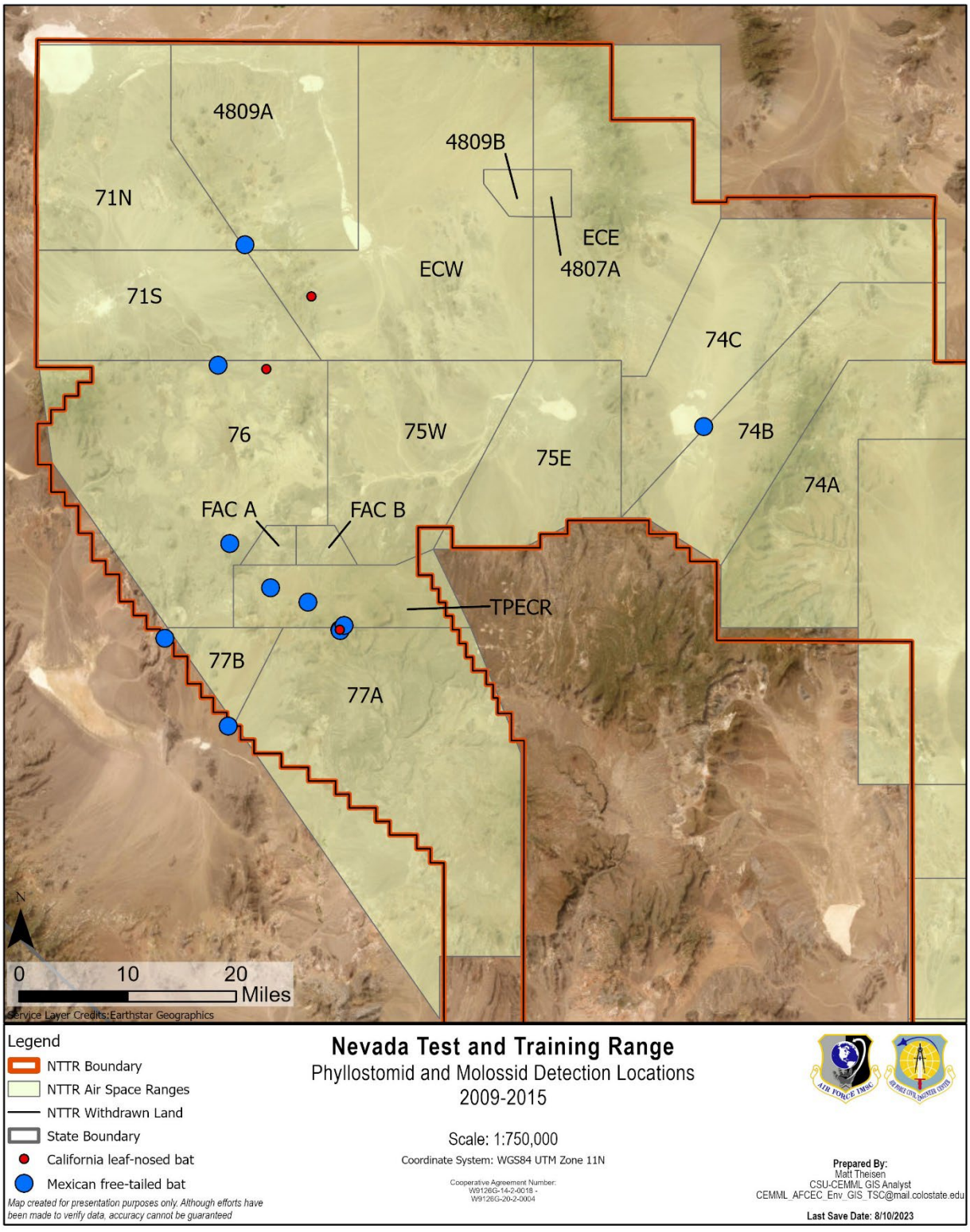

Figure 2-74. Locations of sensitive phyllostomids and molossids detected by captures and acoustic monitoring on the North Range, 2009-2015.

Three tree bats with special status have been documented on NAFB and the NTTR. All three bats prefer forested habitats or riparian zones and roost in loose bark or leaves, or on the ends of tree branches (Reid 2006). All three have been documented only from acoustic recordings. The western red bat (*Lasiurus blossevillii*) is classified as BLM Sensitive, Nevada Sensitive and SGCN. It has been detected in the North Range from acoustic recordings six of the last 12 years (NAFB 2022*a*). The hoary bat (*Lasiurus cinereus* is classified as BLM Sensitive and is Nevada Protected and an SGCN. It has been recorded eight of the last 12 years on NAFB and the NTTR from acoustic monitors. Finally, the silver-haired bat (*Lasioncycteris noctivagans*) is classified as BLM Sensitive and is Nevada Protected and an SGCN. It has been recorded seven of the last 12 years by acoustic monitor on NAFB and the NTTR (NAFB 2022*a*). Observed locations of these bats are shown in Figure 2-75.

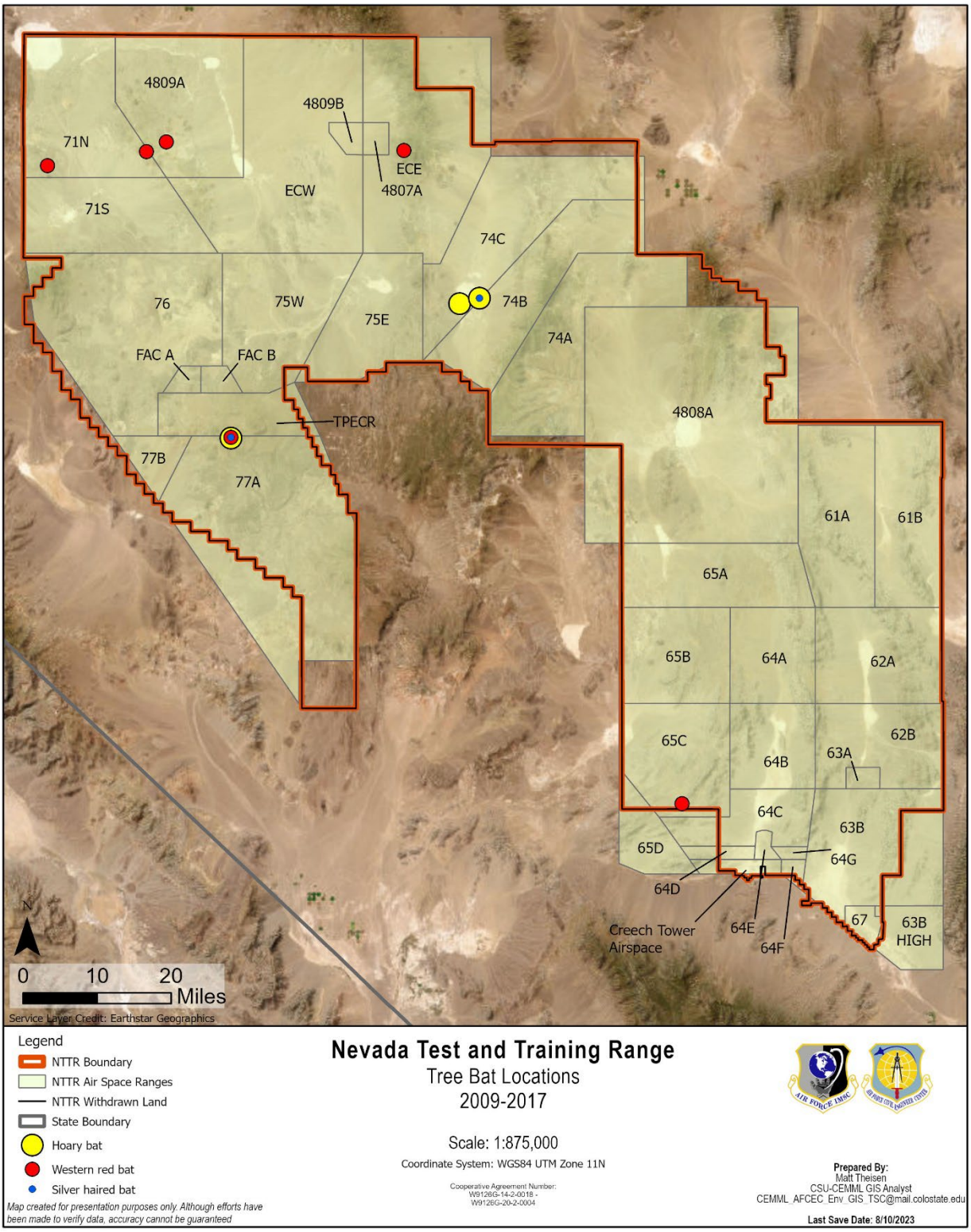

Figure 2-75. Locations of sensitive tree bat species detected by captures and acoustic monitoring on the North Range, 2009-2017.

Western vesper bats are small- to medium-sized, plain-nosed bats that occur throughout the western U.S. Their tails are enclosed in a membrane, which is used as a scoop to capture flying insects (Reid 2006). Five western vesper bats are considered special-status species and have been documented on NAFB and the NTTR. The California myotis is classified as BLM Sensitive and is Nevada Protected and an SGCN. It has been documented on both NAFB and the NTTR 11 of the last 12 consecutive years from acoustic monitoring and captured 106 times in mist nets (NAFB 2022*a*). It can be found in desert scrub, riparian woodlands, canyons, and forests (Reid 2006). The long-eared myotis (*Myotis evotis*, Figure 2-76) is classified as BLM Sensitive, Nevada Protected and SGCN. It has been documented on both NAFB and the NTTR during six of 12 years of acoustic monitoring and captured 13 times in mist-nets (NAFB 2022*a*). It pulls moths and beetles from vegetation and may rely on its hearing rather than echolocation to capture prey. The long-eared myotis is mainly found in forested areas up to 10,000 feet in elevation (Reid 2006). The reproductive rate of this species is quite low, with up to just one pup born per year (WAPT 2012). Observed locations of these bats are shown in Figure 2-77.

Figure 2-76. Long-eared myotis (*Myotis evotis*) captured on the North Range in 2019. Nellis Air Force Base Photo Library.

The fringed myotis (*Myotis thysanodes*) is classified as BLM Sensitive, Nevada Protected and SGCN. It has been documented on the North Range. This species has been captured 46 times in mist nets, and detected nine of the last 12 years during acoustic monitoring (NAFB 2022*a*). The fringed myotis gets its name due to the presence of short, pale hair on the edge of its tail membrane. It can be found in both desert scrub and forested habitats from elevations of 4,000 to 9,000 feet (Reid 2006). The southwestern cave myotis (*Myotis velifer brevis*) is classified as BLM Sensitive and Nevada SGCN. It has been documented from acoustic surveys at one site in 2009 on the North Range (NAFB 2022*a*). It has a single known roosting site in all of Nevada, documented near Lake Mead. As the name suggests, it prefers caves and mines for roosting, although it has been known to use buildings. Also, the cave myotis is always found within a few miles of a water source (WAPT 2012). The fifth western vesper bat is the canyon bat, formerly known as the western pipistrelle. It is classified as BLM Sensitive and is Nevada Protected and an SGCN. It has been documented 127 times by mist nets, and detected 11 of the last 12 years during acoustic monitoring. This species is the smallest bat in the U.S. at only about 1.5 inches. It often becomes active before sunset, and its flight pattern looks similar to that of a large moth (Reid 2006). Observed locations of these bats are shown in Figure 2-77.

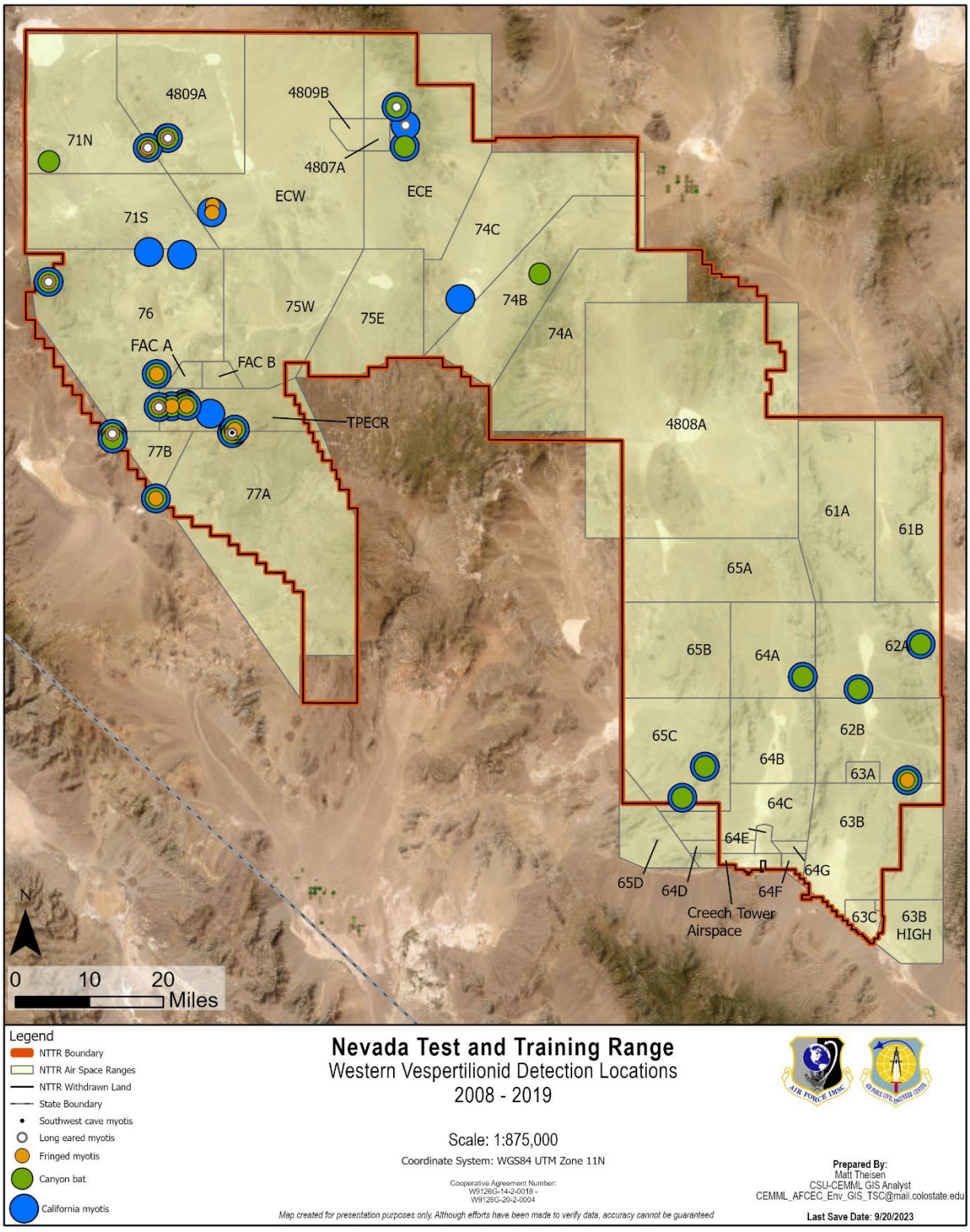

Figure 2-77. Locations of western vespertilionids detected by captures and acoustic monitoring on the Nevada Test and Training Range, 2008-2019.

2.3.4.5 Pollinators

Pollinators play an integral role in maintaining native habitats, and compliance with existing laws, regulations, and policies related to pollinators is essential for sustaining the USAF mission. The pollinators with the highest level of protection are those listed under the ESA, the MBTA, and/or state laws; however, all pollinators are afforded consideration under Presidential Memorandum 14946 "Creating a Federal Strategy to Promote the Health of Honey Bees and Other Pollinators".

The Mojave poppy bee (*Perdita meconis*) is classified as BLM Sensitive and has a Critically Imperiled State Rank in Nevada. It was detected on the installation in 2023 (T. Griswold, entomologist, personal communication 2023). The species forages only on poppies in the *Arctomecon* and *Argemone* genera (Portman et al. 2019). The Las Vegas bearpoppy relies on visits from the Mojave poppy bee for successful sexual reproduction. The bee is a candidate species for listing under ESA (USFWS 2020*a*) and is protected under Nevada state law. Reference the 2021 Candidate Species Report for further information (NAFB 2022*b*).

The monarch butterfly (*Danaus plexippus*) is a federal candidate species. It is likely to occur on the installation. The western population of this species can be found in Nevada during summer months. Monarch caterpillars rely on milkweed (*Asclepias* spp.) as their only food, and therefore populations of native Nevada milkweeds are essential for supporting local breeding populations (Burls and Newton 2017). Adult monarchs visit a diversity of native flowering plants and trees/shrubs for nectaring and roosting, so these floral resources are important for individuals moving through migration corridors. As such, efforts to support general pollinator habitat and connectivity among pollinator habitat patches can also benefit this species. More information on monarchs and their conservation can be found in the "U.S. Air Force Pollinator Conservation Strategy" (USFWS 2017) and in "Monarch Conservation on Department of Defense Lands in the West: Best Management Practices" (McNight et al. 2021). Additional information on pollinator conservation efforts on the installation can be found in Sections 7.4 and 8.0.

2.3.4.6 Rare Plants

Rare plants and their habitats are essential for maintaining ecosystem integrity, heterogeneity, and pollinators. Due to the undisturbed nature of the NTTR and portions of NAFB, there are many rare plant observation records. NAFB and the NTTR have conducted rare plant surveys since at least the 1990s and have generated large amounts of data. Historical records also indicate many rare species occurred on the installation before military tenure; these are listed in Appendix E, or the most recent 2021 Rare Plants Report (NAFB 2022*i*). Observed rare plant locations for the NTTR are shown in Figure 2-78 and Figure 2-79.

The Las Vegas bearpoppy and Las Vegas buckwheat are two species of management focus on the installation. Las Vegas bearpoppy is Nevada Critically Endangered and BLM Sensitive. The Las Vegas buckwheat is BLM Sensitive and has a state-imperiled ranking in Nevada. Locations of these plants on NAFB are shown in Figure 2-14.

The Las Vegas bearpoppy and Las Vegas buckwheat have been observed in three different locations on NAFB. Neither of these two rare plants exist on the NTTR. The genetically unique Las Vegas bearpoppy populations in the Las Vegas Valley are under threat of fluctuating interannual rainfall and increased development in the Las Vegas Valley, and so are of concern to the USFWS, Nevada Division of Forestry (NDF), Clark County, and the USAF (Stosich et al. 2022). USFWS considers this plant to be among its highest priorities for protection in the state. To avoid federal listing, the existing populations on public lands

2938 are protected, which includes populations found on NAFB (TNC 2007). Currently, the state of Nevada lists
2939 it as critically endangered, and The Nature Conservancy describes the plant as globally rare and state
2940 imperiled. This plant species is known to occur only in Clark County, Nevada and Mohave County, Arizona
2941 (TNC 2007). The short-lived species is found exclusively on gypsiferous soils (de Queiroz and Meyer 2023)
2942 and projects proposed on other soil types are not likely to affect the Las Vegas bearpoppy. Reference the
2943 2021 Rare Plants Report (NAFB 2022*i*) for further information.

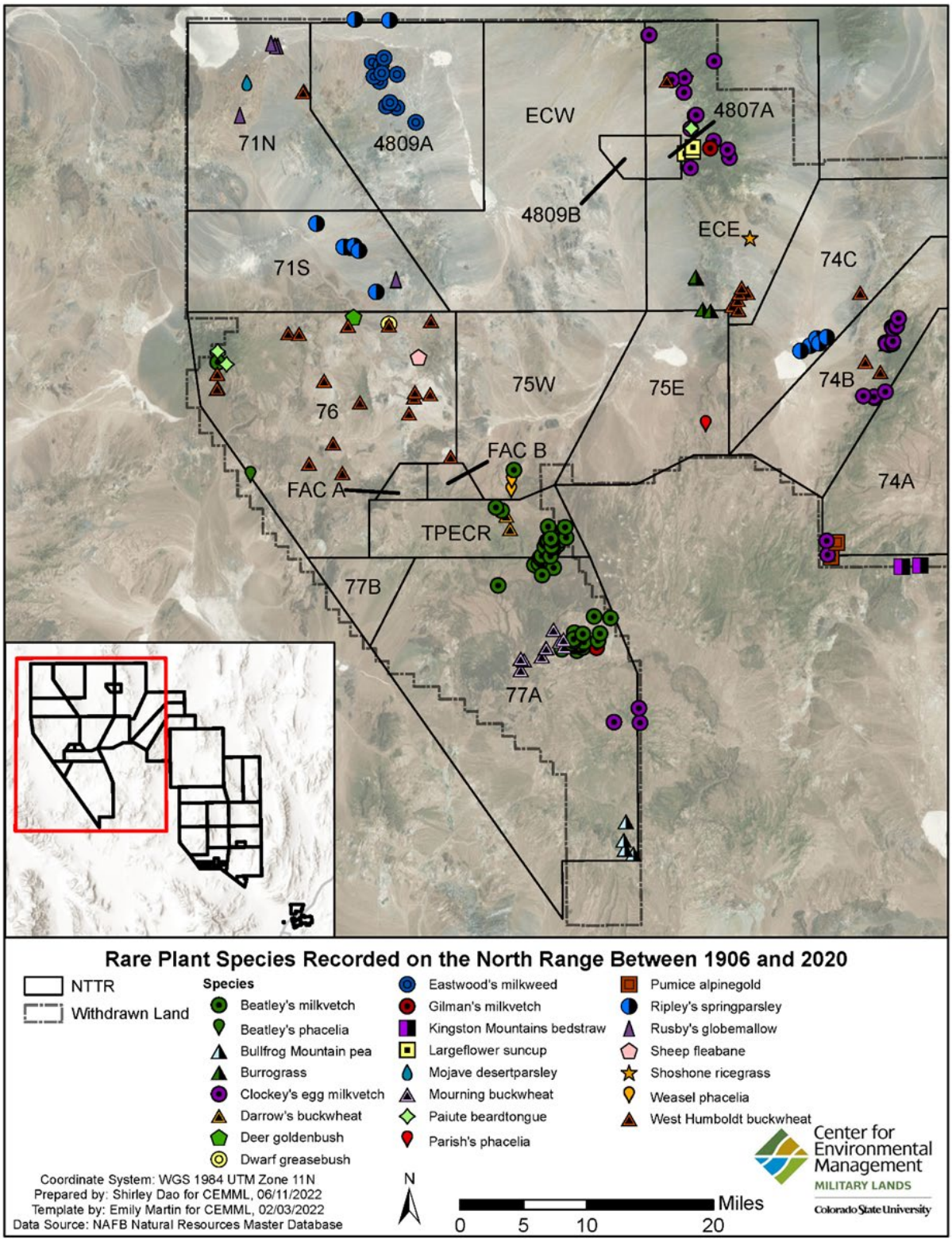

Figure 2-78. Rare plant species recorded on the North Range, 1906–2020.

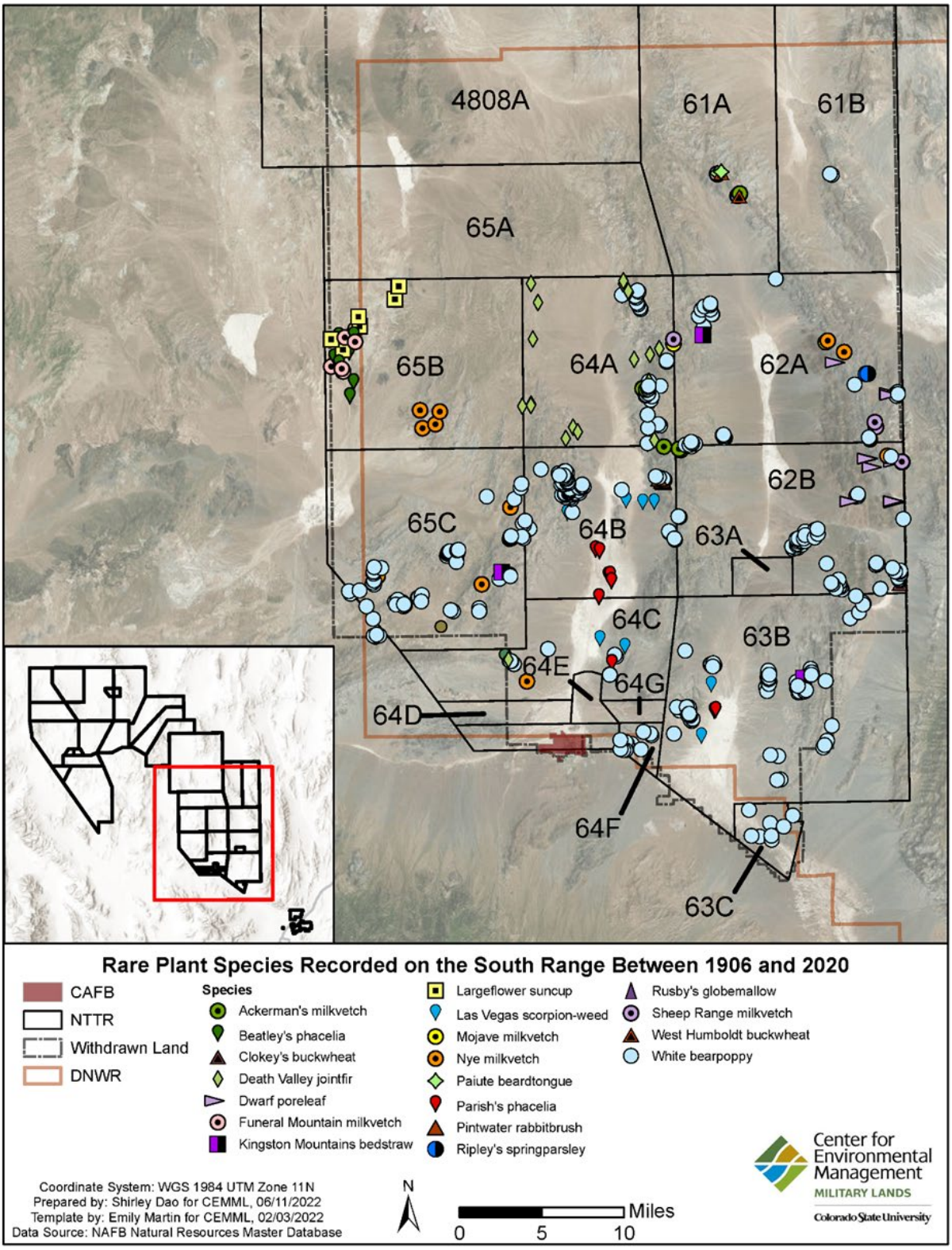

Figure 2-79. Rare plant species recorded on the South Range, 1906–2020.

2.3.4.7 Climate Impacts on Threatened and Endangered Species and Species of Concern

Habitat change and disruption to food availability are two major climate-related threats to all species at NAFB and the NTTR. Prey populations or forage abundance may be affected by the projected changes in temperature and precipitation under different climate scenarios. Seasonal cues for prey or forage emergence may change, resulting in a mismatch between food availability and food needs of threatened and endangered species. Populations of some threatened and endangered species are further imperiled by life stages that are sensitive to temperature and precipitation changes projected in the climate scenarios. Habitat requirements may change for some species as they adapt their behavior. Increased fire potential from cheatgrass invasion may degrade habitat. The potential of increased frequency and severity of drought may impact habitats and food availability.

The desert tortoise, Gila monster, and the prey base of ground-nesting birds and small mammals could be adversely affected by the expansion of brome-dominated landscapes resulting from a changing climate. CEMML developed population-level climate change vulnerability assessments (CCVA) for 36 special status species with potential to occur on the installation, such as the above listed. CEMML summarized the climate change-related factors affecting each species, species' vulnerabilities to those factors (i.e., vulnerability risk), and an overall level of confidence associated with that risk, based on literature review and other available information. Results from these CCVAs are discussed in Section 7.4. Reference the CEMML Climate Assessment (CEMML 2023) for further details about the methods and results.

2.3.5 Wetlands and Floodplains

Wetlands and floodplains are special categories within the broader group of water resources. Water resources can include streams, natural lakes, wetlands, floodplains, and groundwater, among other features and are protected under numerous federal laws and policies. Regulatory guidance for waters, wetlands, and floodplains include the CWA, Rivers and Harbors Act of 1899, EO 11990 Protection of Wetlands, EO 11988 Floodplain Management. Nevada lacks state-level protections for wetlands. The CWA primarily protects WOTUS from illicit discharges of pollutants. WOTUS is used as a threshold definition of waters and wetlands that establishes the scope of legal jurisdiction under the Act. Legally protected waters and wetlands are considered "jurisdictional". The definition of WOTUS has varied during the last few presidential administrations; a current and accurate definition of WOTUS can be found at: https://www.epa.gov/wotus/current-implementation-waters-united-states. The Rivers and Harbors Act of 1899 regulates the development of navigable waters of the US; as such, it is not applicable to NAFB or the NTTR.

Currently the installation has no WOTUS. This is primarily due to the ephemeral nature of waters on the installation and the lack of connectivity with Navigable Waters, as many of the wetlands are within internally drained watersheds. Although the installation has recorded positive USACE wetlands determinations on the NTTR, jurisdictional status has not yet been determined. NAFB and the NTTR will conduct further investigations to determine protection of these wetlands under the CWA if mission-related impacts may affect them.

Wetlands warrant protection from EO 11990, regardless of jurisdictional status. EO 11990 requires that federal agencies seek to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands. The USAF will fully disclose the location of wetlands, and any land-use restrictions imposed by regulatory authority, on lands that are transferred or sold to non-federal entities. The NTTR contains alluvial floodplains adjacent to ephemeral wetlands, which

are regulated IAW EO 11988. EO 11988 requires federal agencies to minimize the risks of floods to human welfare and infrastructure, while restoring and preserving the natural and beneficial values of floodplains.

2.3.5.1 Wetlands

Nellis Air Force Base

Field surveys and National Wetlands Inventory maps have been used to assess wetland occurrence at NAFB. NAFB has two potential wetlands. One is the golf course ponds (NAFB 2002), which are not protected under CWA 404 because they are artificial impoundments and their water source is treated groundwater. The other is Las Vegas Wash, which is ephemeral and connects to Lake Mead. The Wash has been previously determined to be non-jurisdictional, but jurisdictional delineations expire and a new delineation will be necessary each time there are planned potential impacts to the Wash.

The remainder of NAFB is arid scrubland or urban with no wetlands.

Nevada Test and Training Range

Surface waters are more abundant on the NTTR than NAFB. Water resources on the North Range are more extensive than on the South Range, where they are extremely limited. Numerous surveys have been conducted on the NTTR to determine the presence of water resources and associated protection status. The 2021 Final Habitat Wetlands Report can be referenced for further information regarding the purpose and results of historical surveys.

The NTTR has 360 historically recorded wetland sites. However, current surveys document far fewer. Water resources on the NTTR can be categorized by defining features, including developed, historical, intermittent, mesic plant community, perennial, possible, surface water, and unspecified. Figure 2-8 depicts the location and category of all known confirmed water resources on the NTTR.

Some water resources on the NTTR are ephemeral, present only during peak rainfall periods with sufficient runoff. Artificial water sources are present on the North Range, including water guzzlers, four constructed water ponds, and numerous smaller dugouts constructed in the past by ranchers. Perennial surface waters constitute a small percentage of water sources on the NTTR, but are vitally important to wildlife and may require protection pending further investigations. Significant perennial water sources on the NTTR include George's Water, Log Spring, Sumner Spring, and East Kawich Springs.

Floodplains

In general, the NTTR landscape consists of three broad categories of stormwater runoff conveyance: mountains, piedmont plains, and base-level plains or alluvial valleys. Floodplains have been mapped by the Clark County Emergency Management Department for NAFB and the SAR and are available in shape files. Floodplains must be managed in accordance with EO 11988.

Mountain area runoff usually follows steep, scoured, rocky channels with narrow or nonexistent floodplains. Runoff from mountain areas is relatively rapid and usually enters piedmont plains, which serve as a transitional area between the mountains and base-level plains. The slope of piedmont plains is much less than that of mountain areas and runoff is somewhat slower. Runoff on piedmont plains is usually conveyed by piedmonts (erosional surface cut on rock, usually covered with a thin layer of alluvium), alluvial fans, or old fan remnants.

Base-level plains, or alluvial valleys, have very shallow slope and usually end in a low topographic area or playa. Stormwater passes through the base-level plains or alluvial valleys in defined channels that have floodplains that are generally wide and flat. These well-defined channels with adjacent floodplains are defined as valley collectors. The topographical low areas or playas ultimately impound storm water runoff. On the NTTR, most stormwater runoff is confined in closed basins and does not flow beyond playas. Floodplains play an important role in natural resource management. Knowledge of their location is important when siting targets, roads, and structures. Floodplains also provide temporary food and habitat for birds and other transient wildlife populations. In addition, many of the floodplain areas provide vernal pools, which are habitat for various invertebrates.

Rainstorms can cause flooding, especially when combined with snowmelt in the spring. Localized thunderstorms produce high-intensity, short-duration rainfall events that can result in flash flooding an average of 13 times per year at the NTTR. Following a storm, surface runoff occurs for a short period, and the resulting water usually collects in the low-permeability playas. Some channel flow from snowmelt and precipitation may also occur.

2.4 Mission and Natural Resources

2.4.1 Natural Resource Constraints to Mission and Mission Planning

Natural resource constraints to the mission include any natural feature causing restrictions to current mission needs or future mission planning. Constraints at NAFB and the NTTR include the need to not disturb high-quality habitats, and legal requirements to sustain sensitive flora, fauna, wetlands, and floodplains.

Mission constraints can be avoided by planning with updated information, considering potential issues in advance, and allowing adequate planning time. Planning for mission changes requires knowledge of both the natural systems on NAFB and the NTTR and the required manmade infrastructure. To facilitate effective planning, the NNRP surveys natural resources to establish a baseline of best available information for project reviews.

Examples of planning considerations are described below.

- Landscaping at new construction areas and some existing facilities should use xeric, native species where possible, especially where development interfaces with native habitat.
- Sensitive species, such as the federally listed Mojave desert tortoise and the state-listed Las Vegas bearpoppy and Las Vegas buckwheat, must be considered during planning, site selection, and decision-making processes.
- Avoidance of high-quality undisturbed habitats, wetland, and floodplain areas during the planning process.
- Proactive management of the BASH issue.
- Integration of new resource information with sensitive biological area maps will improve the decision-making process.
- Ecosystem integrity enhanced by implementing centralized access to available databases, especially via GIS.

2.4.2 Land Use

NAFB maintains accountability records for a total of 2,980,013 acres, including fee-owned, public domain withdrawn land for military use, and ingrant. These include NAFB proper, the NTTR, the SAR, Sunrise Obstruction Lights Annex, Nellis Wells Water System Annex, and Nellis Communications Annex.

NAFB and the NTTR lands are classified and managed under three land-use categories: improved land, semi-improved land, and unimproved land.

- **Improved lands**—Areas that have been developed for administration, housing, other building projects, and organized recreation (golf courses, ball fields, etc.). Vegetation on improved lands requires constant maintenance to ensure survival in the local arid climate. On NAFB, the major turf grass is a combination of Kentucky bluegrass, ryegrass, and fescue. Improved lands are regularly mowed and irrigated throughout the year and aerated twice a year. Weeds and brush are controlled with herbicides, as required. Trees and shrubs are pruned regularly. Insecticides are applied in and around buildings as needed. Appropriate chemicals or traps are used for rodent control if rodents become a nuisance or impede the military mission.
- **Semi-improved lands**—Semi-improved lands on NAFB and the NTTR include areas located in proximity to runways, airfields, fence lines, or parking ramps; and minimally developed spaces such as open storage areas. Most semi-improved lands are not grass-seeded. Mowing controls weeds and brush along airfield when needed, which is important for reducing fire hazard. Trees and shrubs are pruned when needed. Rodents are controlled near runways and open storage areas. Semi-improved lands are not aerated or scheduled for insect control.
- **Unimproved land**s—Most land within NAFB and the NTTR is unimproved. Because these areas are not scheduled for development or building sites, they are not included in the NAFB Land Management Plan. These lands do not receive mowing, irrigation, aeration, pruning, or insect control.

Of the total area managed by NAFB, and the NTTR, over 99% is unimproved land. Semi-improved lands account for about 0.1% of the total, and improved land accounts for about 0.03%. Land usage details are in Table 2-16.

Table 2-16. Land usage details for Nellis Air Force Base and the Nevada Test and Training Range.

Installation	Land Definition	Acres	Natural Resource Priorities
NAFB	Area I, II, III	14,856	DT; RP; SOC
NAFB	Small Arms Range	10,985	DT; RP; SOC
NAFB	Nellis Water System Annex	80	None
NTTR	Nevada Test and Training Range	2,949,603	DT; RP; SOC; WH; RH
	TOTAL	**2,975,524**	

Abbreviations: DT (Desert tortoise); SOC (Species of Concern); RP (Rare Plant); WH (Wild Horses); RH (Riparian Habitat) Source:

2.4.3 Current Major Mission Impacts on Natural Resources

A summary of major mission impacts on natural resources is below.

2.4.3.1 Noise

Noise impacts on NAFB have been evaluated, and the results were presented in an AICUZ study under the direction of the Base Civil Engineer. Decibel contours were defined around the airfield as part of that study. Aircraft noise may be heard most weekdays on NAFB and the NTTR. Extensive noise modeling and studies were conducted to determine baseline noise levels at NAFB and the NTTR and whether mission-related noises could have a significant impact on the environment. Sources of noise studied at the NTTR included subsonic noise, sonic booms, and noise from high explosives. It was concluded that mission activities did not significantly increase noise levels above baseline determinations. Additionally, none of the noise levels projected for the NTTR were sufficiently loud to impact wildlife and other natural resources (NAFB 1993*b*).

2.4.3.2 Hazardous and Toxic Materials and Installation Restoration Program Sites

Hazardous and Toxic Materials and Wastes

NAFB and the NTTR personnel routinely use hazardous and toxic materials in their operations. These materials include paints, solvents, thinners, adhesives, aircraft fuel, diesel, gasoline, lubricants and oils, hydraulic fluids, cleaners, batteries, acids, refrigerants, herbicides, insecticides, rodenticides, and compressed gases. The mission also produces non-hazardous solid waste that is collected and disposed of properly, causing little or no impact to natural resources. NAFB and NTTR transports recycling receptacles to a permitted recycling facility and municipal solid waste to a permitted disposal facility, both off-base. The disposal of municipal stormwater from NAFB and NTTR will meet the criteria of 40 CFR 246, 257, 258, DoD Directive (DoDD) 4715.23, and AFMAN 32-7002 Chapter 6, Solid and Hazardous Waste Compliance. There is no active landfill on NAFB. Installation Restoration Program (IRP) Sites

In support of the military mission, petroleum products, solvents, and protective coatings have been used on NAFB and the NTTR, resulting in waste chemicals. Some of these materials are hazardous or toxic. Underground storage tanks are present on NAFB and the NTTR. The USAF established the Installation Restoration Program (IRP) to mitigate the effects of these materials. The IRP sites are described in the Management Action Plan (NAFB 1997) for NAFB and the NTTR, and are also discussed in the 2017 Legislative Environmental Impact Statement (LEIS). The types of sites addressed by the IRP include ordnance trenches, disposal pits, landfills, surface spills, storage terminals, fire training sites, waste ponds, and storm drains.

Since 1982, 144 IRP sites have been identified: 46 on NAFB and 98 on the NTTR (NAFB 1997, NAFB 2017*d*). The sites on the NTTR did not require remediation. On NAFB, 12 sites required remediation, and nine of those are still being monitored or under remediation. No issues have been identified at the landfills; site cap and groundwater monitoring will continue. No issues have been reported at any of the spill sites; data shows a reduction in contamination and there is no off-site mitigation of contamination plumes. Groundwater monitoring will continue at these spill locations. Initial studies of potential NTTR target threats to environmental health are in the Range Contamination Report. The IRP sites are not expected to pose human health risks (NAFB 1997).

2.4.3.3 Infrastructure and Ground Disturbance

Mission activities that involve infrastructure and ground disturbance may result in a range of impacts on soils, water resources, vegetation, and wildlife. The use of ordnance and vehicles on the NTTR results in ground disturbance, which exposes soil to wind erosion. Impacts to soil can be minimized by following Best Management Practices (BMPs).

Mission activities are not expected to impact groundwater or surface waters associated with intermittent and perennial seeps and springs. However, many mission-related activities may impact ephemeral streams found throughout NAFB and the NTTR. Activities that may impact floodplains or ephemeral streams include road construction, pipeline and utility installation, target construction, and construction of buildings or other facilities. However, most impacts can be minimized with proper planning and procedures.

Activities causing potential impacts to vegetation include maintenance and placement of targets and threat simulators, ground training, and the use and maintenance of roads and utility lines. These activities occur primarily in areas that have already been disturbed. Most of this disturbance occurs at the NTTR, concentrated on playas where biological resource values are low and thus environmental impacts are minimal. A 2023 review of mission activities on the NTTR determined that only approximately 5% of the total land area of the NTTR is disturbed.

Impacts to wildlife on NAFB and the NTTR mostly result from on-the-ground activities, including continued use of range targets, ground facilities, training areas, and roads. The mission may cause significant impacts in isolated areas such as roads or target sites, and loss of some habitat resulting from mission activities is expected to continue with the continuing mission.

Environmental impacts caused by the construction and operation of facilities must be assessed prior to initiation of any work, according to NEPA regulations IAW 40 CFR 246, 257, 258, DoDD 4715.23 and AFMAN 32-7002 Chapter 6, Solid and Hazardous Waste Compliance. Cooperative environmental development planning is conducted to minimize impacts on natural resources.

2.4.3.4 Ordnance

Because of the nature of the military mission of NAFB and the NTTR, ordnance delivered on the NTTR has localized impacts to the environment. Because the majority of targets are located in playas, impacts to wildlife and plants are considered minimal. The ordnance may cause disturbance to soils and result in erosion. Impact and detonation ordnance may injure, damage, reduce, and/or eliminate both vegetation and animals, with indirect effects being changes in succession and associated reduced use of the site by animals until the habitat restores itself. Damaged target areas are cleaned up and restored, which in turn impacts the environment with excavation and clearing activities as well as disturbance caused by personnel, vehicles, and equipment. There is minimal human exposure to contaminants from explosives. Plant uptake of contaminants is not known and the impact to animals ingesting plants cannot be determined at this time. Animals are potentially affected when dry lakebeds containing targets fill after rain.

Certain military activities, such as ordnance detonation, aircraft crashes, and use of flares, can result in brush fires, which in turn may affect natural resources. Under PL 106-65, the USAF must take necessary precautions to suppress wildfires caused by military operations. Military munitions or ordnance will follow policies of AFMAN 32-7002, paragraph sections and sub- sections of 5.3.7. The 2021 WFMP prepared for NAFB and the NTTR has procedures for minimizing fire potential. Section 7.9 provides more information about wildland fire management on NAFB and the NTTR.

Wastes from ordnance explosions may be found on the surface, underground due to the force of the original delivery or from the physical actions of wind and water, or in burial pits where quantities of ordnance-related wastes were collected. All ordnance burial pits are presently IRP sites. These sites were closed in accordance with the environmental regulations of the state of Nevada in the mid-1980s.

Surficial soil contaminants are not expected to move off the NTTR. Sampling programs at representative target complexes indicate that explosive and metal residues from expended ordnance appear to be restricted to locations immediately around the target areas. These findings may need to be updated if further research indicates that ecological risks are associated with NTTR ordnance.

AF EOD personnel actively clear ordnance on the NTTR as part of the Coronet Clean program. Waste ordnance has little potential for spontaneous combustion or detonation from wildlife activities. Ordnance items do represent a safety hazard for personnel, and specific safety courses are required for persons working on the NTTR.

2.4.4 Potential Future Impacts

It is unlikely that future mission impacts to natural resources impacts will be different or reduced on NAFB or the NTTR.

2.4.4.1 Noise

Noise will likely cause minimal future impacts to the natural resources at the NTTR, unless there are major changes in mission.

2.4.4.2 Hazardous Wastes and Installation Restoration Program Sites

Current policies regarding pollution, and the active involvement of the Environmental Management Directorate and other USAF organizations in these issues, have reduced the volume of wastes. Efforts to remediate contaminated areas are extensive and ongoing. New technological measures, such as absorbent pads and booms, are used to contain leaked or spilled petroleum products and solvents.

Improper management of hazardous wastes may cause future impacts to natural resources. However, trained personnel following standard operating procedures and the SWPPP should reduce that risk. IRP sites that are managed or currently being restored pose minimal future impacts. However, any future IRP sites may impact natural resources and the environment until they are restored.

2.4.4.3 Infrastructure and Ground Disturbance

New infrastructure may cause future impacts to natural resources. Infrastructure construction causes direct losses of ground cover and disturbance to adjacent areas, an effect seen most directly on NAFB. Roads and utility corridors fragment habitats and accelerate impacts to previously undisturbed areas. Habitat fragmentation and disturbance of remote areas are important considerations in natural resource management (Noss and Cooperrider 1994), particularly of the NTTR.

2.4.4.4 Ordnance

Future ordnance activities will likely cause minimal impacts to natural resources at NTTR. Major changes in ordnance activity or location may have more serious natural resource impacts.

2.4.4.5 Climate Impacts on Mission Planning

The CEMML Climate Assessment (CEMML 2019) identified several ways that climate change could directly or indirectly affect the mission, mission-critical infrastructure, and natural resources. The mission relies heavily on the natural environment and may be impacted indirectly by stressed or shifting ecosystems, loss of ecosystem services, and regulatory burden. See Section 7.16 for a more detailed discussion of vulnerabilities to the mission and operations at NAFB and the NTTR.

3.0 ENVIRONMENTAL MANAGEMENT SYSTEM

The USAF environmental program adheres to the Environmental Management System (EMS) framework and its Plan, Do, Check, Act cycle for ensuring mission success. EO 13834, *Efficient Federal Operations*; DoDI 4715.17, *Environmental Management Systems*; AFI 32-7001, *Environmental Management*; and International Organization for Standardization (ISO) 14001 standard, *Environmental Management Systems—Requirements with guidance for use*, provide guidance on how environmental programs should be established, implemented, and maintained to operate under the EMS framework.

The natural resources program employs EMS-based processes to achieve compliance with all legal obligations and current policy drivers, effectively manage associated risks, and instill a culture of continual improvement. The INRMP serves as an administrative operational control that defines compliance-related activities and processes.

4.0 GENERAL ROLES AND RESPONSIBILITIES

General roles and responsibilities necessary to implement and support the NNRP are listed in Table 4-1. Specific natural resources management-related roles and responsibilities are described in appropriate sections of this plan.

The roles and responsibilities of various agencies over the management of withdrawn lands and established wildlife ranges on the NTTR are complex. 99 CES/CEIEA is ultimately responsible for natural resource management and works to ensure that natural resources are managed properly. NAFB, the NTTR, the BLM, NDOW, and USFWS share the responsibility for the management of natural resources on the NTTR in accordance with Public Law 106-65, the Sikes Act, the National Wildlife Refuge Act, the ESA, the MBTA, and the BGEPA. 99 CES coordinates its responsibilities with state and federal stakeholders to ensure fulfillment of their obligations. Review and approval authority for the INRMP Component Management Plans and proposed actions rests with the 99 ABW. Any federal actions impacting the environment are subject to NEPA and may require consultation with federal, state, and local regulatory agencies as well as the general public. Federal agencies, state agencies and other organizations must be consulted when plans potentially impact lands or resources jointly managed by the USAF and those agencies or organizations.

Table 4-1. General roles and responsibilities.

Office/Organization/Job Title (Listing is not in order of hierarchical responsibility)	Base	Range	Installation Role/Responsibility Description
99 CES/CEIEA	Yes	Yes	Overall responsibility for development and implementation of INRMP, Component Plans and related EA. Updates and revises the INRMP and Component Management Plans. Coordinates draft plans and projects with the NTTR prior to execution. Integrates the INRMP with Base Comprehensive Plan and Comprehensive NTTR Plan, BASH Plan, ICRMP, and NAFB IPMP. Develops and implements measurement and monitoring procedures. Coordinates consultation with other agencies and stakeholders. Ensures that NAFB and the NTTR adhere to state and federal regulations pertaining to natural resources. Coordinates natural resource management with USFWS, BLM, NDOW, Nellis EIAP, Nellis Environment, Safety, and Occupational Health Council (ESOHC), NTTR, 99 CES/CEIEA, 99th Air Base Wing/Combat Commander (99 ABW/CC), Headquarters (HQ) ACC Environmental Analysis Branch, 99th Security Forces Squadron.
Nellis Public Affairs	Yes	Yes	Reviews EA associated with the INRMP. Conducts required NEPA public notifications and public meetings. Provides information about the INRMP to news media,

Table 4-1. General roles and responsibilities.

Office/Organization/Job Title (Listing is not in order of hierarchical responsibility)	Base	Range	Installation Role/Responsibility Description
			elected officials, environmental groups, and interested members of the public.
Nellis EIAP	Yes	Yes	Provide procedures for environmental impact analysis of Air Force actions, including the INRMP.
Nellis Environment Safety and Occupational Health Council (ESOHC)	Yes	Yes	ESOHC reviews policies and programs, establishes goals, monitors progress, and advises leadership to ensure that the Air Force 1) provides a safe and healthful workplace, 2) ensures operations minimize risk to mission accomplishment, 3) preserve resources and protect the environment, and 4) safeguards military and civilian personnel and the public.
NTTR	Yes	Yes	Coordinate with 99 CES and facilitate Range-specific aspects of INRMP implementation. Schedule and coordinate logistics for any natural resource management activities on the NTTR. Review and coordinate with 99 CES on proposed INRMP projects (to ensure the military mission).
99 ABW/CC	Yes	Yes	Final approval authority for the INRMP.
HQ ACC	Air Field Only	Yes	The single focal point for all issues dealing with airfield management, air traffic control, terminal instrument procedure, and the establishment, maintenance, modification, and disestablishment of airspace and ranges for air-to-air and air-to- ground operations in the continental U.S. Includes the environmental, legal, public relations, and operational aspects of range and airspace management, plus development of policy, planning, programming, requirement, and guidance. Reviews and concurs with all range-related documents. Final approval authority for the Range Comprehensive Plan.
USFWS	Yes	Yes	Review and concur with Component Management Plans and actions relating to DNWR lands within the NTTR. Provide data and management input regarding desert bighorn sheep, migratory birds, and species of concern to DNWR mission. Provide consultation with respect to federally listed threatened or endangered species. Management of desert bighorn sheep. Coordinates the desert bighorn sheep hunt on the South Range under the direction of the NTTR and in coordination with NDOW.

Table 4-1. General roles and responsibilities.

Office/Organization/Job Title (Listing is not in order of hierarchical responsibility)	Base	Range	Installation Role/Responsibility Description
NDOW	Yes	Yes	Provide data and management input regarding wildlife management. Assist NAFB and the NTTR in conservation of state-listed species of concern. Conserve and manage desert bighorn sheep. Manages the desert bighorn sheep hunt in coordination with the DNWR. Coordinate the desert bighorn sheep hunt on the North Range.
BLM	No	Yes	On the NTTR only: • review INRMP and Component Management Plans; • rangeland management; • fire suppression and management; • wild horse management; and • coordinate RMPs with 99 CES/CEIEA and the NTTR.

In summary, each of the federal and state agencies with natural resource responsibilities within the boundaries of the NTTR continues to have those responsibilities, but only through the final approval of the NTTR to ensure that the military mission is not impacted and that the safety and security of the NTTR is not jeopardized. Responsibilities of regulatory agencies and stakeholders are further defined and discussed below.

4.1 Bureau of Land Management Responsibilities

The BLM's land management responsibilities on the NTTR are derived from the Military Lands Withdrawal Act (MLWA) of 1999, and the 2004 BLM NTTR RMP.

According to the MLWA of 1999 (PL 106-65), the BLM is responsible for the protection of wildlife and wildlife habitat, control of predatory and other animals, and prevention and appropriate suppression of brush and range fires resulting from non-military activities. Additionally, the MLWA of 1999 (PL 106-65) states the following with respect to the Secretary of the Interior's responsibility for non-military use of withdrawn land:

> *". . . shall be subject to such conditions and restrictions as may be necessary to permit military use of such lands for the purposes specified in or authorized pursuant to this subtitle. The Secretary of the Interior may issue a lease, easement, right-of-way, or other authorization with respect to non-military use of the lands, only with the concurrence of the Secretary of the military department concerned."*

The 2004 Record of Decision for the Approved BLM's NTTR RMP and Final EIS clearly states the role of the BLM at the NTTR:

> *"The emphasis of the NTTR RMP is management of the wild horse, while protecting unique habitats for threatened, endangered, and special status species, unique military training opportunities, limited recreation, as well as other resource uses. Even though habitat is limited, the BLM is committed to provide the desert tortoise with the highest possible quality of habitat. However, it must be noted that management of specified natural resources is secondary to the military mission."* (BLM 2004a).

In summary, the responsibilities of the BLM on the NTTR are as follows.

- Manage wild horses according to the BLM RMP Record of Decision.
- Protect unique habitats for threatened and endangered species, as well as the military mission.
- Protect the desert tortoise.
- Control any wildfires on the NTTR.
- All responsibilities are secondary to the military mission.

4.2 United States Fish and Wildlife Service Responsibilities

The MLWA of 1999 (PL 106-65) defines USFWS responsibilities as follows.

> "*DoI.-- Notwithstanding the Desert National Wildlife Refuge withdrawal and reservation made by Executive Order No. 7373, dated May 20, 1936, as amended by Public Land Order Number 4079, dated August 26, 1966, and Public Land Order Number 7070, dated August 4, 1994* [extended for an additional 25-year period in 2021 through 2046 by H.R. 639-25 National Defense Authorization Act of 2021 Title XXVII Subtitle E Section 2843]*, the lands depicted as impact areas on the map referred to in paragraph (4) are, upon completion of the transfers authorized in paragraph (5)(F)(ii), transferred to the primary jurisdiction of the Secretary of the Air Force, who shall manage the lands in accordance with the memorandum of understanding referred to in paragraph (5)(E). The Secretary of the Interior shall retain secondary jurisdiction over the lands for wildlife conservation purposes*"

The MOU between the USAF and USFWS defines the responsibilities of the USFWS on withdrawn lands in DNWR, as follows.

> *"The Service is the federal agency primarily responsible for the welfare and management of the land, wildlife habitat and other natural resources, and for protection of cultural and archeological resources, and for research thereon in the refuge. The Service is also the federal agency with specific responsibilities for protection of threatened and endangered species and management of desert bighorn sheep, desert tortoises and migratory birds."* (USAF and USFWS 1997).

Thus, responsibilities of the USFWS with respect to the NTTR are as follows.

- Manage natural, cultural, and archeological resources on the DNWR.
- Conserve wildlife resources within the DNWR, including the desert bighorn sheep.
- Protect federally listed threatened and endangered species and their habitats according to the ESA.
- Coordinate the desert bighorn sheep hunt under the direction of the NTTR and in cooperation with NDOW.

- Under the provisions of the Sikes Act, assist NAFB and the NTTR in managing natural resources by providing expertise on issues related to endangered species, invasive species, migratory birds, law enforcement, wetlands, and environmental contaminants.

4.3 Nevada Department of Wildlife Responsibilities

NDOW has responsibilities for management of various natural resources within NAFB and the NTTR. These responsibilities include the following.

- Control predatory animals.
- Manage wildlife.
- Preserve the desert bighorn sheep.
- Manage the desert bighorn sheep hunt in coordination with the USFWS and the NTTR.

5.0 TRAINING

USAF installation NRMs/POCs and other natural resources support personnel require specific education, training, and work experience to adequately perform their jobs. Section 107 of the Sikes Act requires that professionally trained personnel perform the tasks necessary to update and carry out certain actions required within this INRMP. Specific training and certification may be necessary to maintain a level of competence in relevant areas as installation needs change, or to fulfill a permitting requirement.

Natural resources management training is provided to ensure that base personnel, contractors, and visitors are aware of their role in the program and the importance of their participation to its success. Training records are maintained in agreement with the Recordkeeping and Reporting section of this plan. Listed below are key natural resources management-related training requirements and programs.

- All NRMs working on NAFB and the NTTR take the course "DoD Natural Resources Compliance", which provides policy, guidance, and oversight for management of natural resources. The three principles that guide the Natural Resources Program are stewardship, leadership, and partnership. Stewardship initiatives assist DoD in safeguarding its irreplaceable resources for future generations. By embracing a leadership role as part of the program, the DoD serves as a model for respectful use of natural and cultural resources. Through partnerships, the Natural Resources Program strives to access the knowledge and talents of organizations and individuals outside of the DoD.
- All biologists conducting desert tortoise surveys must receive training in field survey protocol implementation, as outlined in the desert tortoise field manual provided by the USFWS (USFWS 2009a). Only biologists authorized by the USFWS are to conduct desert tortoise field work.

6.0 RECORDKEEPING AND REPORTING

6.1 Recordkeeping

The installation maintains required records IAW Air Force Manual 33-363, *Management of Records*, and disposes of records IAW the Air Force Records Management System (AFRIMS) records disposition schedule (RDS). Numerous types of records must be maintained to support implementation of the natural resources program. Specific records are identified in applicable sections of this plan, in the Natural Resources Playbook, and in referenced documents.

6.2 Reporting

The installation NRM is responsible for responding to natural resources-related data calls and reporting requirements. The NRM and supporting AFCEC Natural Resources Media Manager should refer to the Environmental Reporting Playbook for guidance on execution of data gathering, quality control/quality assurance, and report development.

7.0 NATURAL RESOURCES PROGRAM MANAGEMENT

This section describes the current status of the installation's natural resources management program and program areas of interest. Current management practices, including common day-to-day management practices and ongoing special initiatives, are described for each applicable program area used to manage existing resources. Program elements in this outline that do not exist on the installation are identified as not applicable and include a justification, as necessary.

Installation Supplement—Natural Resources Program Management

Natural resource management at NAFB and the NTTR is somewhat limited by the vast acreage of the NTTR and access restrictions. Thus, ecosystem-based management is used due to its efficiency and manages the ecosystem as a whole, rather than costly resource-specific management. Highly sensitive resources do receive more management attention, such as restoration or protection, as needed.

Establishment of knowledge also constitutes a large piece of management. Continually updated survey data allows the NNRP to implement essential management where necessary, and facilitate avoidance of sensitive resources by mission activities and training. By proactively planning and concentrating mission disturbances, the NNRP avoids impacts to and conserves resources.

7.1 Fish and Wildlife Management

Applicability Statement

This section applies to all USAF installations that maintain an INRMP. The installation is required to implement this element.

Program Overview/Current Management Practices

The primary objective of USAF natural resources programs is to sustain, restore, and modernize natural infrastructure to ensure operational capability and no net loss in the capability of USAF lands to support the military mission (AFMAN 32-7003). Proper management of fish and wildlife balances environmental compliance and ecosystem viability with the military mission.

Current wildlife management at NAFB and the NTTR uses an ecosystem-based management strategy, consistent with DoDI 4715.03 and AFMAN 32-7003 3.10. The NAFB and NTTR support no fish populations, so management is solely wildlife based. Ecosystem-based management provides a top-down management approach that benefits the whole ecosystem, including wildlife, rather than species-specific management which is costly and inefficient. Ecosystem-based management prioritizes the sustainment of natural communities, ecological function, and biodiversity. This approach comprehensively supports all biota, and strengthens resiliency against disturbances such as climate change. For certain species of higher sensitivity and priority, however, NAFB and the NTTR use species-specific management.

The NNRP proactively conducts biological surveys to inform ecosystem-based management decisions. Current comprehensive knowledge of wildlife populations enables effective protection of critical habitat features and avoidance of wildlife while conducting mission activities. Data collection reveals useful population demographics such as population size, health, locations, distributions, and movements. Monitoring allows managers to evaluate the health of wildlife before, during, and after management activities or other environmental disturbances. Biological surveys and monitoring are especially important for species groups showing nation-wide signs of decline such as birds, bats, and herpetofauna. Current data

also informs the NTTR hunting program, which is discussed in Section 7.2. Continued data collection is critical to enable future protection of wildlife and habitats.

One such monitoring action for all wildlife is the use of wildlife cameras at water sources. The NNRP conducts camera surveys at water sources to track general biodiversity, wildlife usage, and behavior; estimate population sizes and trends; and inform management actions. As of February 2023, the NNRP continues to retrofit and repower cameras with solar panels to reduce helicopter maintenance costs and expand data collection capability. Additionally, the NNRP plans to install weather gauges at water sources with wildlife cameras to track changes and further understand effects of microclimate on wildlife.

Additionally, NEPA and an EIAP process are conducted for each proposed action affecting the natural environment. The EIAP often results in project alterations designed to eliminate or reduce impacts to natural resources. These alterations often change the timing or location of projects or pose project constraints based on the resource in question. Additionally, an EIAP could result in pre-project surveys, to better inform avoidance and minimization measures included within the project.

The NNRP will obtain all relevant permits or authorizations to conduct surveying and wildlife management lawfully.

Taxa-specific wildlife management is detailed below.

7.1.1 Herpetofauna and Aquatic Invertebrates

As a group, herpetofauna are experiencing significant global population declines and many are threatened with extinction (Center for Biological Diversity [CBD] 2023). Amphibians in particular are sensitive indicators of environmental change and degradation due to their exposure and vulnerability to environmental toxins (United States Geological Survey [USGS] 2023). However, herpetofauna are often the most difficult terrestrial vertebrates to inventory and monitor (WAPT 2012). Despite the success of the 2012–2021 surveys, there are several herpetofauna species, including some protected and SGCN that potentially occur in the survey areas but have not yet been documented. Numerous secretive and fossorial snakes and amphibians that spend most of their life underground or under shelter have not been documented on NAFB or the NTTR. Additional survey effort during suitable environmental conditions (cloudy, rainy, or overcast weather), or the use of long-term monitoring methods (coverboards or pitfall traps), may enable detection of these species in future field seasons.

All current survey efforts, such as visual encounter surveys, snake den surveys, pitfall traps, reptile transect surveys, Gila monster grids, road cruising surveys, artificial cover board surveys, and acoustic surveys will continue. Continued surveys will help further document long-term population trends, distribution, behaviors, and habitats, and document invasive or new species. For further information regarding herpetofauna surveys and results, reference the Final Reptile and Amphibians Survey Report (NAFB 2022*j*). Certain additions to survey methods may be warranted and would provide useful information in the context of species diversity estimates**.** Nocturnal surveys may be prioritized in the future. Additionally, further efforts may be invested into surveying amphibians, due to their rarity, sensitivity to drought and heat, and sensitivity to environmental degradation. Lastly, the NNRP may consider using the NDOW herpetofauna habitat predictive model in future survey planning efforts. Refer to Section 8.0 for objectives and specifics of projects focused on herpetofauna.

If possible, mission-related construction at NAFB and the NTTR should avoid critical habitat features of herpetofauna such as hibernacula, especially during ingress and egress periods. Signs may also be posted at rattlesnake dens near mission infrastructure for awareness of installation personnel.

The NNRP may also investigate the occurrence of fairy shrimp and spring snails on the NTTR. The NNRP would collaborate with the U.S. Geological Survey (USGS) to collect and analyze soil samples from dry playa beds on the NTTR to determine presence of fairy shrimp. The NNRP may also coordinate with Utah and Nevada Spring Snail Conservation Team to implement snail surveys at suitable locations on the NTTR.

7.1.2 Native Birds

Continued monitoring for migratory birds is especially important as they serve a complex ecological role including pest control, pollination, and food sources for other wildlife (USGS 2016). Monitoring for raptors is also important, as they typically act as indicators of environmental change or degradation (HawkWatch International 2023). Migratory birds and raptors are also important to fully understand as they have diverse phenologies and habitat, which may contribute to the difficulty of avoiding mission conflicts and complying with the MBTA. Long-term monitoring and comparison with other local datasets are especially pertinent for migratory birds due to the adverse effects of climate change, habitat loss, and other stressors. Long term monitoring is especially important given the documented collapse of Mojave Desert bird communities due to climate change (Iknayan and Beissinger 2018), as previously discussed in Section 2.3.3.2. Future studies of birds at NAFB and the NTTR may be warranted to document impacts of climate change on bird communities.

All current survey methods, including stationary point counts, Nevada bird count surveys, call playback surveys, powerline surveys, and winter raptor surveys should be continued to monitor long-term trends in the abundance, distribution, and productivity of bird species across NAFB and the NTTR. The installation's use of wildlife cameras assists in understanding avian diversity. Refer to the 2021 Migratory/Neo-Tropical Birds Survey Final Report for further information on specific survey protocols (NAFB 2022*g*).

Alterations to pre-existing survey methods within this INRMP may be considered through adaptive management. The NNRP may consider shifting winter bird counts to January to better capture winter birds. Call playback and nest surveys may be conducted at NAFB, the South Range, and the SAR to further knowledge of thrashers on these sites. Opportunistic surveys to strengthen existing data may be completed if time, funds, and personnel are available. Most importantly, future survey methods will reflect previously used methods to ensure comparability and consistency between studies.

Refer to Section 8.0 of this INRMP for objectives and projects the NNRP has established for general inventory and monitoring of migratory bird and raptor populations, as well as focused surveying and monitoring efforts for sensitive avian species.

7.1.3 Small Mammals

Small mammals fill an important ecological role in desert ecosystems, including providing a prey base for numerous predators, dispersing seeds, controlling insect populations, pollinating plants, and benefiting soils and thus plants through re-nitrification, bioturbation, and higher retention of groundwater (Salafsky et al 2007, Muñoz and Bonal 2011). Small mammal populations quickly reflect ecosystem disturbance and degradation, due to their short generation lengths (National Ecological Observatory Network [NEON] 2023). Additionally, several mammal species present on NAFB and the NTTR are protected; therefore, NDOW elevates their importance to ecosystem-wide conservation.

Monitoring and management of small mammals on NAFB and the NTTR is essential to sustain populations. Viable populations will provide the ecosystem services described above and act as immediate indicators of ecosystem change or mission disturbance. All current survey methods, including small mammal trapping and camera trapping, should continue throughout the course of this INRMP to facilitate proper management, avoid mission conflicts, and ensure compliance. Continued surveying along permanent small mammal trapping grids on the NTTR is especially important to quantify long-term changes of small mammal communities in response to climate change or other environmental stressors. Similarly, surveys should continue documenting the effects of wild horses and burros on small mammal communities through direct impacts to soils and vegetation. Refer to the 2021 Species at Risk Final Report for further information on specific survey protocols (NAFB 2022*l*).

Alterations to small mammal surveys, mutually agreed upon by the installation and stakeholders, may be implemented during this INRMP operational period. Genetic samples may be collected and analyzed in collaboration with NDOW to enhance regional knowledge. Vegetation data may be collected concurrently with small mammal trapping to quantify effects of climate change on vegetation and small mammals. Mesocarnivore trapping survey methods may be developed and implemented on the NTTR, to potentially include marking, radio collaring, and disease assessment to aid in management efforts. Lastly, scent stations may be deployed at camera trapping stations to capture more data regarding mesocarnivores.

Refer to Section 8.0 for objectives and projects focused on small mammals and mesocarnivores.

7.1.4 Bats

Most bat species documented on base are protected at the state or federal level, and therefore will be discussed further in Section 7.4.4.

7.1.5 Large Mammals

Large mammals are often considered ecosystem engineers and have significant impacts on plant communities through herbivory and soil disturbance (Boulanger et al. 2018). They also have large indirect impacts on wildlife communities through direct vegetation impacts. However, as most large mammals on the NTTR are herbivores, they are reflective of recent vegetative productivity on the NTTR. As such, keeping current estimates of large mammal populations is important because they act as indicators for overall ecosystem health.

All current monitoring and management efforts for large mammals, including helicopter surveys, wildlife cameras, Global Positioning System (GPS) collaring surveys, test-and-remove projects, and range utilization surveys will continue throughout the operational period of this INRMP. Aerial helicopter surveys for some fauna (wild horses and burros, desert bighorn sheep, and pronghorn), are used to determine herd size, composition, and location. For more secretive species (mule deer and mountain lion), motion-sensor trail cameras placed at water sources is the best way to accumulate information on their habits. Data obtained from these surveys provides the basis for planning and management of large mammals on the NTTR. Knowledge of geographic distribution, habitats, and population trends allows the NNRP to avoid mission impacts to species and initiate supportive management action. Refer to the 2021 Wild Horse and Large Mammals Final Report for further information on specific survey protocols (NAFB 2022*n*).

Desert Bighorn Sheep

Desert bighorn sheep are a management focus for the installation because of their recent declines and shared stakeholder management interests. Current surveys and management for bighorn sheep include aerial surveys, wildlife camera surveys, GPS collaring surveys, and test-and-remove projects to slow the spread of pneumonia. Continued data sharing, coordination, and collaboration with partner agencies will ensure proper management of the bighorn sheep in consideration of its decline, management interests, and value for hunting. Continuation of monitoring and management is essential for mission planning to avoid conflicts or impacts. Aerial surveys help develop population demographics, herd size, herd composition, and distribution of bighorn sheep across the NTTR. These population metrics are the best method to track population and habitat use trends over time. Knowledge of the size and location of bighorn sheep populations allows the installation to responsibly plan mission actions without impacting bighorn sheep and habitat or population management actions. Continued use of wildlife cameras is necessary to supplement the NNRP's understanding of sheep presence, population, and use of water guzzlers. Water guzzlers have become a valuable water source for bighorn sheep herds on the NTTR, due to their relative permanence in the recent history of the NTTR. The bighorn sheep's reliance on these water sources, in addition to the documented decline of natural water sources on the NTTR and climate change impacts to water availability, elevate the importance of continued guzzler presence. NAFB and the NTTR will coordinate with the USFWS and NDOW to ensure continued access to maintain and build new guzzlers on the NTTR.

Continued collaboration with external partner agencies (USFWS, NDOW) to conduct GPS collaring efforts for bighorn sheep is essential to gain valuable information regarding distribution, behavior, disease spread, and movements across the NTTR, and further develop the habitat use model. These data enhance knowledge gained from aerial surveys and better inform planning and management decisions. Collaring efforts may also provide information on viral pneumonia spread, thereby informing appropriate management action. Continued collaboration with the NDOW is critical to sustain test-and-remove management of bighorn sheep. Additionally, testing bighorn sheep for individuals chronically spreading viral pneumonia and subsequent removal may prove to be essential for long-term sustainability of populations. Recent data suggests that populations may be declining, indicated by low lamb-to-adult ratios (NAFB 2022*n*).

Wild Horses, Burros, and Pronghorn

Wild horses and burros are another important large mammal monitoring focus for the installation because of the damage they cause to native wildlife and ecosystems. All wild horse and burro management is conducted by the DOI, per the Wild Free-Roaming Horses and Burros Act of 1971. Thus, the NNRP cannot directly manage wild horses and burros, but monitoring and construction of horse exclosures may be conducted. If non-native ungulates are fenced out of a spring to protect habitat, a tank may be installed with a pipe supplying water from the spring outside the fence.

Annual monitoring will continue concurrent with pronghorn helicopter surveys to estimate population size on the North Range. Annual population size estimates are valuable for communication and coordination with the BLM regarding wild horse management. Continued coordination with the BLM regarding horse management is important to ensure actions are executed in a timely manner. Range utilization surveys will also continue to document geographic extent and severity of horse grazing on vegetative communities. Results will inform future restoration efforts and horse exclosures, and inform management of other species affected by horses and burros. Continued identification of springs and seeps in need of restoration and construction of horse exclosures is necessary to avoid permanent impacts to wetlands and associated native

species. Priority wetlands for exclusionary fences during this INRMP operational period include Log Spring, Sumner Spring, and East Kawich Spring.

7.1.6 Climate Impacts on Fish and Wildlife Management

Adaptive management on NAFB and NTTR is necessary due to climate change. Department of Defense Instruction (DoDI) 4715.03 requires that installations employ adaptive and ecosystem-based management, and therefore, many current fish and wildlife management activities are appropriate for increasing resilience or facilitating adaptation to climate change. Many of the current issues for wildlife management (e.g., drought) are likely to persist in the future but could be exacerbated by the projected changes in climate. Increased temperatures coupled with increasingly variable precipitation may drive more frequent drought followed by rainfall insufficient to cancel out the drought effects. A changing climate will likely favor newly arriving species, which often have the ability to outcompete native species that are already experiencing reduced fitness due to environmental conditions shifting away from historic standards (Hellmann et al. 2008). Though this trend is global, it is expected to be more pronounced in the southwest (Archer et al. 2008). Management plans should be flexible enough to adapt to shifting conditions and possible changes in wildlife concerns (Hellmann et al. 2008).

Managers should continue conducting wildlife surveys on a regular basis to document potential spread of invasive species as habitats transition to new forms. Continued monitoring of bat populations, game species, and other native wildlife also will be important as habitats change. Monitoring changes in the abundance and diversity of insects also will be critical, as they provide an important food source for a substantial proportion of wildlife present on the installation.

With most climate scenarios predicting large scale transition of grasslands to shrublands, herbivorous animals such as mule deer, bighorn sheep, and desert tortoises may lose important foraging grounds. Antelope however, have shown a preference for shrubland and may benefit from the change. Increasing temperatures could have a negative impact on amphibians and aquatic macroinvertebrate species. As water temperatures rise in lentic systems, dissolved oxygen content decreases, resulting in diminished habitat quality. Increasing water temperatures also will increase the chances of algal blooms, which would further deplete dissolved oxygen content and habitat suitability (Paerl et al. 2011). Maintaining and possibly establishing new wildlife guzzlers will continue to be an important aspect of wildlife management on NAFB and the NTTR, as water is already limited in this desert ecosystem and precipitation is projected to become more variable.

Erosion also could have a negative impact on water quality, particularly if fire regimes change substantially toward increased fire spread. Increased storm intensity with increases in localized heavy rainfall could lead to heavier erosion. Wildland fire management will continue to be an important wildlife management tool.

7.2 Outdoor Recreation and Public Access to Natural Resources

Applicability Statement

This section applies to all USAF installations that maintain an INRMP. The installation is required to implement this element.

Program Overview/Current Management Practices

The objective of an outdoor recreation program is to provide opportunities for the public and military personnel to use and observe natural resources. On NAFB, outdoor recreational opportunities are available

to active duty military, DoD civilian, military dependents, military retirees, DoD civilian retirees, and contractor employees. Parks, tracks, and green spaces throughout NAFB offer opportunities for outdoor walking and jogging, sports, picnicking, and birdwatching. These recreational spaces on NAFB include Sunrise Vista Golf Course, Freedom Circle Park, and the Major General Billy McCoy Environmental Grove.

On the NTTR, security and safety considerations preclude any opportunity for outdoor recreation except for the limited opportunities of bighorn sheep hunting. In accordance with the MLWA of 1999, Section 3014, Management of Lands (a)(3) NONMILITARY USES (A) IN GENERAL,

> *"All non-military use of the lands referred to in paragraph (2), other than the uses described in that paragraph, shall be subject to such conditions and restrictions as may be necessary to permit the military use of such lands for the purposes specified in or authorized pursuant to this subtitle."*

In accordance with this referenced section, the NTTR lands are closed to non-military access for the following three reasons: (1) to protect the public from injury due to ordnance hazards; (2) to ensure that national security is not compromised; and (3) to ensure that military programs can be conducted without interruption.

Access can be granted to specific personnel who have been cleared for security through proper channels. With only a few exceptions, civilians not employed by the USAF or DoD cannot access the NTTR without a military or government escort. Access for escorted civilians is limited on the NTTR by scheduling of mission operations. With proper planning, access for various surveys by state and government officials can be granted. For example, large game surveys using helicopters or fixed-wing aircraft can be scheduled but require that Range personnel are given a minimum of three weeks' notice.

7.2.1 Hunting Programs

The Nevada Board of Wildlife Commissioners manages game hunting in Nevada and determines hunting dates, bag limits, fees, and other factors pertaining to hunting. NDOW conducts most of the surveys to inform the Board's management decisions, and as such, makes recommendations for decisions. NDOW, with cooperation from the USAF, operates four Hunt Units on the NTTR. One is in the North Range in the Stonewall Mountain Area, and three are in the South Range. The three hunting units in the South Range allows access for hunters throughout most of the Range. For a few weeks in fall to early winter, areas on the North (Stonewall Mountain) and South Ranges are opened to small groups of permitted desert bighorn sheep hunters. After receiving Range Safety Training from the USAF, hunters with tags are permitted to hunt in select areas normally off limits to the public. Law enforcement for the hunts is the responsibility of NDOW. The only user fee activities on the NTTR are the desert bighorn sheep hunts; NDOW collects the fees.

7.2.2 Climate Impacts on Outdoor Recreation and Public Access to Natural Resources

Climate change is not expected to have substantial effects on outdoor recreation and public access to natural areas at NAFB and the NTTR. Because some hunting is permitted at the installation (see above), game populations will need to be monitored as environmental and habitat conditions shift, and managers may need to adjust regulations and limits accordingly. Significant increases in days over 90°F may degrade the quality of recreational activities across the installation.

If projections of decreasing precipitation materialize, golf course watering could be affected. Regional drought water restrictions may impact NAFB and the NTTR's water usage, and recreational activities that require water may be the first sacrifices to comply with restrictions.

7.3 Conservation Law Enforcement

Applicability Statement

This section applies to all USAF installations that maintain an INRMP. The installation is required to implement this element.

Program Overview/Current Management Practices

The 99th Security Forces Squadron is tasked with law enforcement responsibility on NAFB, while security on the NTTR is performed through a contract vehicle. Neither branch of Security Forces is tasked with enforcing conservation law; however, no such internal Conservation Law Enforcement program currently exists at NAFB or the NTTR. The state of Nevada has jurisdiction over resident fish and wildlife throughout the state, including NAFB and the NTTR. As such, it establishes rules, regulations, and season dates governing the taking of resident fish and wildlife species, and NDOW enforces laws governing the annual bighorn sheep hunt on the NTTR. The USFWS has jurisdiction over migratory birds as well as federally-listed threatened and endangered species. A USFWS Conservation law enforcement officer may investigate violations of relevant conservation law on NAFB and the NTTR if necessary.

NAFB and the NTTR will contact NDOW and the USFWS if any conservation law violations occur within the installation.

7.4 Management of Threatened and Endangered Species, Species of Concern, and Habitats

Applicability Statement

This section applies to USAF installations that have threatened and endangered species on USAF property. This section is applicable to this installation.

Program Overview/Current Management Practices

Threatened and endangered species management at NAFB and the NTTR is designed to ensure compliance with several laws and to maintain and improve species at risk. Proper management balances compliance with continued military use and ensures no net loss of land for mission activities. The NNRP will obtain all relevant permits or authorizations to conduct surveying and wildlife management lawfully.

7.4.1 Herpetofauna

7.4.1.1 Desert Tortoise

Biological Opinions and associated Terms and Conditions issued for ongoing USAF actions establish desert tortoise management on NAFB and the NTTR. Historical management actions based on Biological Opinions are further described in Section 2.3.4.1 and within the 2021 Final Desert Tortoise Report (NAFB 2022*c*).

Current Desert tortoise management includes surveys of relative abundance and population density surveys, along with pre-construction clearance surveys. Refer to the 2021 Final Desert Tortoise Report for further information on specific survey protocols (NAFB 2022*c*). These surveys will continue throughout the

operational period of this INRMP. Relative abundance and population density surveys are conducted at NAFB, the SAR, and the NTTR in accordance with USFWS protocols from the 2009 Recovery Plan. Relative abundance surveys provide population trend data that aid in species management. These surveys also provide a baseline for future mitigation efforts if desert tortoise habitat is impacted by mission actions or expansion. These will be especially useful for use in future consultations with the USFWS for mission expansion. Additionally, pre-construction clearance surveys are vital to ensure compliance with Biological Opinions and minimize impacts on the desert tortoise and its habitat.

Current surveys and management need to be continued and expanded throughout the INRMP operational period. In person desert tortoise awareness materials will continue to be provided to all personnel working in desert tortoise habitat, as required by Biological Opinions. Existing surveys for desert tortoise need to expand to include demographic data, tortoise clinical health measurements, telemetry using standard transmitters and/or GPS units, unique identification through shell notching/marking, and road mortality surveys. Considering tortoise conservation status and imminent future development of the region, increasing desert tortoise monitoring efforts by NAFB and the NTTR will ensure compatibility of their data collection methods and subsequent data with local conservation entities. In accordance with the Biological Opinion, tortoise-proof fencing was constructed around hazardous areas. Fencing will be inspected quarterly and repaired promptly to avoid take of tortoise.

Coordination is needed with the USFWS to establish a long-term population monitoring protocol, as included in the Conservation Measures of the Biological Opinion. Additionally, invasive species management will be coordinated with desert tortoise management to ensure continued availability of high-quality habitat. Current management projects are supported by the 2015 Desert Tortoise Management Guidelines, which has provided a viable framework for monitoring and managing the tortoise on NAFB and the NTTR (NAFB 2016*a*). The plan was designed to implement and achieve objectives and goals directed by the USFWS Biological Opinions issued on 17 June 2003 (NTTR) and 22 June 2012 (NAFB). The report provides NAFB and the NTTR mission leadership with guidelines for performing military missions while ensuring long-term sustainability of desert tortoise populations (NAFB 2016*a*). The objective of the 2015 Desert Tortoise Management Guidelines is to minimize disturbance to the desert tortoise and its habitat while maximizing USAF training flexibility.

Expanded and long-term monitoring efforts are especially pertinent given the desert tortoise's high vulnerability to climate change (CEMML 2023). Climate change is expected to negatively impact their habitat, population, and recovery. Models of moderate climate change have projected a reduction of 24% to 88% of desert tortoise habitat across its range (USFWS 2022). Increases in temperature and drought frequency will decrease available habitat, as well as the quantity and quality of food. Specifically, the desert tortoise may experience increased mortality from coyote predation caused by drought-driven declines in other coyote prey species. Additionally, extreme drought conditions may reduce reproductive effort and juvenile tortoise survival (Esque et al. 2010). Climate change is also expected to exacerbate the spread of disease among tortoise populations and the likelihood of wildfires that destroy habitat. Longer periods of drought have resulted in dramatic increases in desert tortoise mortalities from dehydration and starvation (Longshore et al. 2003). Increased predation by coyotes has also been observed during years of extreme drought (Esque et al 2010). Higher projected temperatures are likely to alter sex ratios, hatchling survival, and thermoregulation capacity, which may cause the tortoises to remain underground for longer periods to escape increasing ambient temperatures. Combined with human-induced pressures and low population growth, climate change scenarios are predicted to have significant negative effects on tortoise populations in the coming decades. Monitoring efforts will help document the localized effects of climate change on

the installation's desert tortoise population, and help inform adaptive management and planning efforts. For further information on climate impacts to the desert tortoise, reference Appendix D of the CEMML Climate Change Assessment (CEMML 2023).

Should a wildfire imperil desert tortoises or their habitat, the NNRP will coordinate with wildland fire management personnel to ensure proper protections are established for those resources. The Desert Tortoise Recovery Plan of 2011 identifies wildfires as a significant factor in habitat destruction, degradation, and fragmentation for desert tortoise populations (USFWS 2011). The increasing incidence and severity of fires in the Mojave Desert region has converted desert shrublands into ephemeral grasslands, often dominated by non-native species (Brooks and Esque 2002). The desert tortoise is poorly adapted to survive on the new, non-native vegetation. Early and thorough communication between the BLM, wildland fire, and endangered species planning teams will be necessary to avoid adverse impacts to the desert tortoise, other sensitive species, and associated habitats from wildland fire and response actions.

Current monitoring and management objectives and projects are in Section 8.0. Specific details on monitoring and management protocols for the desert tortoise are in the Biological Opinions subsection.

Current Biological Opinions

A Biological Opinion is a "*document stating the opinion of FWS or NOAA Fisheries on whether or not a Federal action is likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat*." Two active Biological Opinions apply to the installation, one for NAFB/SAR and one for NTTR.

These Biological Opinions contain Incidental Take Statements that authorize a certain amount of desert tortoise take, if all relevant mitigatory components of the Biological Opinions are followed. Incidental Take Statements contain non-discretionary Reasonable and Prudent Measures (RPMs) with Terms and Conditions that the installation must legally comply with. If incidental take exceeds the prescribed amount, or is likely to do so, the installation must reinitiate consultation with the USFWS. Thus, tracking and reporting take is critically important and requires installation-wide awareness, cooperation, and communication.

RPMs within the following Biological Opinions contain detailed guidance on measures to mitigate potential impacts to the desert tortoise from mission actions. The RPMs require pre-construction clearance surveys with specific protocols in anticipation of mission impacts, handling requirements of desert tortoise, and habitat impact prevention plans. These RPMs must be followed by the installation to ensure no impact to the desert tortoise and compliance with the ESA.

The Biological Opinions also include discretionary Conservation Recommendations, which are additional actions the installation can take to benefit the desert tortoise. These include long-term monitoring of the desert tortoise on installation lands, research and protection of critical habitat features, and proactive actions to reduce transportation-caused mortality. These actions are also taken by the installation to ensure its beneficial effect on the desert tortoise. Proposed measures that the installation will take to minimize the potential effects of the action are included within the Biological Opinions. These are actions proposed by NNRP within the Biological Assessment (BA), and concurred upon and formalized by the Biological Opinions. These include relocation of desert tortoises from harm's way, soil disturbance minimization measures, vegetation management protocols, minimization of noise and vibration, desert tortoise considerations for wildland fire management actions, dust and particulate pollution BMPs, transportation

BMPs, depredation deterrence BMPs, hazardous materials BMPs, fencing BMPs, and awareness and reporting requirements.

Programmatic Biological Opinion for Activities and Expansion of the NTTR. Number 08ENVS00-2018-F-0028, 16 August 2018 allows the USAF to continue current weapons systems testing and training on the existing NTTR and potentially acquire additional expansion areas, as described in the USAF draft EIS. This Programmatic Biological Opinion (PBO) streamlines Section 7 ESA consultation for actions affecting desert tortoise using an established framework for additional project-specific consultation that will be appended to this PBO.

Programmatic Biological Opinion for Implementation of Action Proposed on Nellis Air Force Base and the Small Arms Range. Number _____, Day Month Year. This Programmatic Biological Opinion analyses desert tortoise impacts from the following projects: development of the eastside of NAFB, additional training sites such as Rapid Airfield Damage Repair Regional Training School, the SAR remediation, utility improvements and additions, invasive species management, security, and continued mission activities.

Amendment No. 1-5-02-F-522, 30 June 2004, grants the USAF permission to implement desert tortoise monitoring and clearing on the NTTR in lieu of constructing and maintaining desert tortoise barriers. The reasoning behind this change in techniques is that desert tortoise barriers were being rendered ineffective by target range impacts. The USFWS determined that monitoring and clearing would be equally or more effective than desert tortoise barriers. The USFWS acknowledged and commended the USAF for their efforts to delineate and map all desert tortoise habitat on the NTTR and to develop desert tortoise management guidelines as part of the INRMP.

Connectivity with Nearby Desert Tortoise Habitats

Desert tortoise habitat on NAFB, the SAR, and the NTTR serves as corridors to other nearby desert tortoise habitat. The SAR, in particular, is a key component of contiguous habitat in the North Las Vegas Valley. The SAR, Tule Springs Fossil Beds NM, BLM land, and the DNWR serve as connective habitat north of Las Vegas, and south of non-suitable mountainous terrain.

Area II of NAFB borders the Nellis Dunes conservation area to the north, which serves as desert tortoise habitat. Desert tortoise habitat is present within the BLM Rainbow Gardens Area of Critical Environmental Concern (ACEC) south of Area II and is severed to the west by Highway 15.

7.4.1.2 Banded Gila Monster

Current systematic Gila monster grid surveys will continue throughout the course of this INRMP operational period. These surveys provide a valuable baseline of habitat and potential presence data for habitat in Area II. Refer to the 2021 Final Reptile and Amphibian Report for further information on specific survey protocols (NAFB 2022*j*). All habitat in Area II may be fully surveyed within the course of this INRMP operational period. Future surveys can be planned accordingly after finalizing Area II surveys. All Gila monsters captured during surveys will be sampled for DNA and samples will be sent to NDOW for storage and processing. NAFB and the NTTR will coordinate and collaborate with NDOW for future surveying efforts and genetic sampling of Gila monsters.

Continued monitoring for the Gila monster is beneficial due to its moderate vulnerability to climate change (CEMML 2023). Climate change is expected to have negative effects on the species. The Gila monster relies on monsoonal rains to offset costs associated with surviving the hot, dry summer and under projected

climate scenarios there will be increased drought throughout its range. If the timing and magnitude of monsoon events are altered, it could have significant negative effects on populations (Stahlschmidt et al. 2011). Although little is known about the abundance of banded Gila monsters, their populations have declined in recent decades and increasing temperatures and drought frequencies will likely harm them further. Continued monitoring may document the localized effects of climate change on the installation's population, and help inform management and planning efforts. For further information on climate impacts to the Gila monster, please reference Appendix D of the CEMML Climate Change Assessment (CEMML 2023).

The NNRP will follow NDOW (2020) protocol to report any encountered or observed Gila monster at NAFB or the NTTR. If a Gila monster is documented, the observation should be followed up with focused searches of the area for additional lizards. The area should be documented in a GIS database and management actions taken to minimize impact to the habitat, if possible. Given the species' preference for rocky hillsides and canyons, it is unlikely that valley floors or other high use areas will harbor Gila monsters. Additionally, NAFB conducts education awareness of Gila monsters and other wildlife, and follows all NDOW permit conditions when Gila monsters and other sensitive species are encountered.

7.4.1.3 Mojave Fringe-toed Lizard

Continued monitoring of the MFTL, which was recently discovered on the base, will be necessary to obtain information essential for its management and avoidance of mission conflicts. Monitoring will provide data on installation population size, distribution, demographics, and critical habitat features to inform future management and planning. Current monitoring efforts include the use of line distance transect surveys, mark recapture studies, individual marking with PIT tags and elastomer, and collecting genetic samples. Refer to the 2021 Candidate Species Final Report for further information on specific survey protocols (NAFB 2022*b*).

Multiple survey improvement recommendations resulted from the 2021 Candidate Species Final Report and the 2023 stakeholder meeting for INRMP revision, and may be implemented if funding and staffing allows. Line distance transect survey efforts may be expanded to further address low detection and capture rates. Expanded survey efforts may support more accurate population estimates and opportunities to obtain genetic samples from lizards. Genetic analyses of collected samples may be conducted in collaboration with USGS. Results from these surveys will likely be useful in determining whether the Nellis Dunes OHRVA populations is genetically unique, and whether it warrants state level protection. Thus, communication of the results of future management efforts or genetic studies with NDOW is essential. Lastly, invasive species management efforts may be planned with consideration of known MFTL habitat and populations, as invasive species are a potential threat to MFTL habitat.

7.4.1.4 Other Protected or Sensitive Species

Other protected or sensitive herpetofauna, including numerous Nevada SGCN, are managed through periodic surveying and monitoring of known populations. Specific species of management concern to NAFB and the NTTR are the western red-tailed skink, rattlesnakes, and SGCN.

Current surveys for the western red-tailed skink include coverboard and mark recapture surveys. These surveys will continue throughout the operational period of the INRMP to help further document long-term population trends, distribution, behaviors, and critical habitat features of the skink.

Rattlesnake surveys are being conducted through den monitoring, as it provides information essential to understand snake behavior and activity windows. These surveys will continue throughout the operational

period of the INRMP. Currently, den monitoring efforts are facilitated through mark recapture of snakes, PIT tag implantation and monitoring. Understanding behavior and activity windows of snakes allows NAFB and the NTTR to more effectively plan mission actions and minimize conflicts.

Lastly, all other SGCN are monitored through surveys summarized in Section 7.1.1. Further information on herpetofauna surveys and monitoring efforts can be found in the 2021 Final Reptile and Amphibian Surveys Report (NAFB 2022*j*).

7.4.1.5 Undetected Herpetofauna

The Sonoran Mountain kingsnake (*Lampropeltis pyromelana*) and the rosy boa (*Lichanura orcutti*) have not been detected on NAFB or the NTTR. If the Sonoran mountain kingsnake is eventually documented on the NTTR, it will probably be in remote, higher-elevation, rocky habitats in the Belted or Kawich Ranges. The rosy boa could potentially be found in the North Range of the NTTR in areas east and north of Beatty. The Oasis Wash/Fleur de Lis Canyon area appears to have suitable habitat. If either species is eventually documented through the course of normal herpetological surveys, the site will be recorded in a GIS database, and management actions may be taken to minimize impact to the known location, if possible.

The Amargosa toad (*Anaxyrus nelsoni*) and the northern leopard frog (*Lithobates pipiens*) have not been detected on NAFB or the NTTR. Both could potentially be present on the North Range of the NTTR. Given the northern leopard frog's complex habitat requirements, including permanent water sources with rooted aquatic vegetation combined with upland habitats, it is unlikely that the species will be found on the NTTR. Water-course diversions and alterations in the Kawich Range for the wild horse program have likely removed the most suitable habitat.

If the Amargosa toad is documented, the USAF may consider joining the Amargosa Toad Working Group and the Cooperative Agreement and Strategies groups to continue monitoring such a population and participate in conservation efforts with local partners. If a toad is determined to be dispersing from a known breeding site south/downstream from the NTTR, contact with NDOW may be considered to determine how to proceed (e.g., should the animal be left alone, or detained and transferred to the NDOW to return it to a known breeding site).

If the Amargosa toad or northern leopard frog are documented on the NTTR in Oasis Wash, the NNRP may consider further survey efforts to determine where there are extant breeding populations. Additionally, the location will be recorded in the GIS database and management actions taken to avoid impacts to the water source the population relies upon.

7.4.2 Native Birds

7.4.2.1 Golden Eagle

NAFB and the NTTR have been conducting golden eagle surveys since 2011. For further information on historic survey efforts, reference the 2021 Final Golden Eagle Report (NAFB 2022*d*). Current surveys for the golden eagle include nest occupancy and productivity surveys, prey-base surveys, new nest and cliff habitat surveys, and powerline surveys. Continuation of surveys is necessary to help inform eagle management and planning to avoid mission conflicts and impacts to eagles. Specific survey protocols are given in the most recent golden eagle report from 2021 (NAFB 2022*d*). However, multiple survey improvement recommendations resulted from the last survey and the stakeholder meetings for INRMP revision. These recommendations are described below.

Nesting surveys during 2020–2021 have resulted in very few nesting eagle observations and may be due to drought and a reduced prey-base. Increased focus on new nesting areas may be considered by the NNRP, as it could help identify the cause of this trend. Prey-base surveys may be conducted twice in the spring and fall, and closer to golden eagle nests to better compare prey densities with eagle reproduction. Prey-base surveys may also be expanded to capture better information on black-tailed jackrabbits (*Lepus californicus*), desert cottontails (*Sylvilagus audubonii*), and Rabbit Hemorrhagic Disease Virus Type 2 (RHDV2), as leporids represent an important component of the golden eagle's prey base on the NTTR. Powerlines may be surveyed twice per year in different seasons to document and gather further data on eagle and other bird electrocutions. Powerlines potentially hazardous to eagles may be classified based on type, and retrofitted to reduce risk to eagles. Nests constructed on powerlines may be removed to reduce wildfire risk and risk of eagle electrocution.

Although the golden eagle has low vulnerability to climate change, continued monitoring may prove useful in detecting changes in its distribution and behaviors on the NTTR due to climate change. Detecting changes in distribution and behavior may help inform management efforts and mission planning. Literature describing climate change impacts on golden eagles is relatively sparse but indicates eagles will experience relatively few direct impacts from climate change. One direct impact, however, is that nestling survival is lower in nests that lack afternoon shade (Kochert et al. 2019); therefore, increasing spring temperatures are likely to reduce nestling survival, especially within unshaded nests. Therefore, continued surveys documenting nest success may prove useful for management. For further information on climate impacts to the golden eagle, please reference Appendix D of the CEMML Climate Change Assessment (CEMML 2023).

7.4.2.2 Western Burrowing Owl

Current burrowing owl surveys will be continued throughout the operational period of this INRMP to support conservation of the species and BASH management. Current surveying for the burrowing owl includes call-playback surveys, nest monitoring on NAFB, trapping and banding, and occupancy surveys. The use of wildlife cameras to monitor active burrows will continue, as it can provide high-resolution data on occupancy, reproductive success, and behavioral patterns than in-person monitoring efforts. The use of different trap types is used to facilitate banding, to raise trapping success based on the variability of burrow locations. Banding additional individuals will provide better information on annual reproductive success, site fidelity, and some population demographics. These surveys provide valuable data describing habitat population trends and reproductive success, which informs mission planning and species management efforts. Continued comprehensive surveying efforts are especially important, considering recent declines on the installation and across its range. It will also allow the installation to more accurately estimate reproductive success and juvenile survival. Genetic samples of owls captured for banding may be taken and provided to the USFWS to obtain further information on the distinct subspecies that is present on the installation. Continuation of existing surveys will aid in understanding of the species on the installation and guide future management efforts. Detailed descriptions of historical and current survey methods are in the 2021 Final Candidate Species Report (NAFB 2022*b*).

Burrowing owl habitat on NAFB has declined in recent years due to increased development, and this is likely to continue in the future with ongoing base expansion. Burrowing owls are protected by the Migratory Bird Treaty Act and are considered a Bird of Conservation Concern by the USFWS. They are also a DoD PIF MSS; therefore, if listed by the ESA, they have a high likelihood of impacting the military mission. Proactive conservation efforts will decrease the likelihood of listing under the ESA.

Burrowing owl habitat on NAFB has declined in recent years due to increased development, and this is likely to continue in the future with ongoing base expansion. Burrowing owls are protected by the Migratory Bird Treaty Act and are considered a Bird of Conservation Concern by the USFWS (USFWS 2021). They are also a DoD PIF MSS; therefore, if listed by the ESA, they have a high likelihood of impacting the military mission (DoD 2021*b*). Proactive conservation efforts will decrease the likelihood of listing under the ESA.

In order to focus conservation efforts for the species, the installation may develop a burrowing owl management plan. Additionally, burrowing owls are protected from direct take and burrows near construction sites are carefully monitored and protected according to the Arizona Burrowing Owl Working Group Project Clearance Guidance for Landowners (2009) supported by the USFWS and NDOW. Pre-project clearance surveys help minimize construction impacts.

Continued monitoring and management of the burrowing owl will be necessary considering their moderate vulnerability to climate change (CEMML 2023). Increasing temperatures and decreasing precipitation can severely inhibit the persistence of this subspecies and its available prey (Cruz-McDonnell and Wolf 2016). Other population-inhibiting effects of climate change include reduced home ranges and available habitats. Lastly, rodent control programs are also known to reduce prey and habitat availability (Desmond et al. 2000, Sheffield 2021). Overall, these factors can lead to delayed nest initiation, reduced individual health and fitness, and reduced recruitment of breeding individuals (Stevens et al. 2011, Porro et al. 2020). Continued monitoring will help document the localized effects of climate change on the installation's population, and help inform management and planning efforts. For further information on climate impacts to the burrowing owl, reference Appendix D of the CEMML Climate Change Assessment (CEMML 2023).

7.4.2.3 Greater Sage-Grouse

There are no current surveys for the greater sage-grouse because it is thought to be a transient species on the NTTR, based on suitable minimal habitat. If any future resident populations or leks are discovered, further management actions may be considered.

7.4.2.4 Other Protected Resident and Migrant Birds

Current surveys focused on migrant and resident birds are listed and defined in Section 7.1.2. These surveys also support management and monitoring efforts for protected species, such as the pinyon jay, loggerhead shrike, sage thrasher, Bendire's thrasher, LeConte's thrasher, Brewer's sparrow, and others. The methods of these surveys are described in the most recent 2021 Migratory/Neo-tropical Birds Final Report. Continuation of surveys is necessary as they provide valuable data describing population trends and reproductive success, which informs mission planning and species management efforts (NAFB 2022*g*).

Multiple survey improvement recommendations resulted from the 2021 Migratory/Neo-tropical Birds Final Report and the 2023 stakeholder meeting for INRMP revision, and may be implemented if funding and staffing allow. These recommendations are described below. The NNRP may work with the PIF Pinyon Jay Working Group to ensure consistent survey methods and data compatibility with the working group and the Avian Knowledge Network (AKN). Surveys may be done in advance of ground-disturbing projects to identify nesting birds and avoid impacts to nests, eggs, and young. Lastly, a banding program for LeConte's and potentially Bendire's thrashers may be explored to obtain further information on population demographics.

Continued monitoring for protected bird species will be necessary considering their moderate to high vulnerability to climate change. Climate change impacts to these species include loss of habitat, competition

with other invading species, loss of food or prey sources and invasive species (CEMML 2023). For further information on climate impacts to the protected bird species, reference Appendix D of the CEMML Climate Change Assessment (CEMML 2023). Continued monitoring will help document the localized effects of climate change on the installation's populations, and help inform management and planning efforts. Considering these climate-driven effects, the NNRP may survey pinyon pine to increase understanding of food and habitat resources for pinyon-dependent wildlife species, including pinyon jay, as temperatures increase and precipitation becomes more variable in the Great Basin.

7.4.3 Small Mammals

Current surveys for the pale kangaroo mouse and dark kangaroo mouse are solely composed of small mammal trapping. Small mammal trapping surveys will continue on NAFB, as these surveys will help minimize mission impacts to sensitive species and inform future management actions. Specific protocols for historic and current survey methods are included within the 2021 Final Species at Risk Report (NAFB 2022*l*).

Several monitoring and management alterations resulted from the last survey report and 2023 INRMP revision stakeholder meeting, and are described below. The alterations will be incorporated into current management protocols when and if funding and staffing allows. Genetic samples may be collected from selected SGCN species captured during small mammal trapping, with emphasis on pale and dark kangaroo mice or other species as indicated by NDOW. If samples are collected, they will be provided to NDOW to aid in regional understanding of sensitive small mammals. Additionally, the feasibility and utility of PIT tagging sensitive species will be assessed for current and future management of the species.

Continued surveying and monitoring of kangaroo mouse species and other small mammal SGCN will be useful, considering their moderate vulnerability to climate change (CEMML 2023). Both species will likely be impacted by habitat conversion and loss due to climate change, and both are vulnerable to cheatgrass invasion. Continued monitoring will help document the localized effects of climate change on the installation's populations, and help inform management and planning efforts. It should be noted that the dark kangaroo mouse faces similar climate-change threats as greater sage grouse and management actions for one species could benefit both (Hafner et al. 2011, Runge et al. 2019). For further information on climate impacts to small mammals, reference Appendix D of the CEMML Climate Change Assessment (CEMML 2023).

7.4.4 Bats

Current bat monitoring methods will continue throughout the operational period of this INRMP. Current monitoring of bats is comprised of stationary bat recorders, roost loggers, mist netting, and wing banding. Surveys will support the North American Bat Monitoring Protocol (NABat) monitoring grids for up to two weeks on the NTTR, and resultant data will be submitted to the NABat database. Surveys will continue to support wing banding on SGCN bat species. Low-frequency acoustic monitors will continue to be used to detect the spotted bat in additional locations. Detailed descriptions of historic and current survey protocols are given in the 2021 Bats Final Report (NAFB 2022*a*). Continued bat surveys provide valuable information regarding long-term population trends, critical habitat features, and behaviors on the NTTR, and will provide the basis for mission planning, legal compliance, avoidance of adverse impacts to bats, and future management actions. Mist netting provides valuable data to detect population fluctuations, disease, body condition, and other metrics (NAFB 2022*a*). Continued monitoring is especially important considering the recent significant declines in bat populations, and the ecological significance of bats. Bats provide a multitude of important ecosystem services, including insect predation, plant pollination, and seed dispersal

(Bat Conservation International [BCI] 2022, Smithsonian Institution 2022). They are exceptionally sensitive to climate change and serve as bioindicators of large-scale ecological effects from regional warming and drying trends (Jones et al. 2009, Adams 2010, Sherwin et al. 2013, CBD and Defenders of Wildlife 2016, Hayes and Adams 2017). Thus, continued monitoring of bats aids an understanding of ecological health and change on the installation. Several monitoring and management alterations resulted from the last survey report and 2023 INRMP revision stakeholder meeting are described below. The alterations may be incorporated into current management protocols when and if funding and staffing allows.

A mark-recapture study on sensitive bat species may be implemented, to provide valuable information on population estimates and trends. If implemented, NAFB will comply with existing permits for mist netting and wing banding. Future surveys may be repeated at dedicated sites within the NTTR. This would yield better information on population trends and species diversity. These surveys may be paired with mist-net surveys to further spotted bat or other unidentified bat species information. Additionally, future mist-netting on NAFB may yield valuable information on potentially occurring southern bat species such as the western yellow (*Lasiurus xanthinus*) or California leaf-nosed bats. Further emphasis may be given to conducting surveys seasonally, as it would yield valuable information on migration behaviors of bats on base. If implemented, these surveys may include cave and mine locations to gather better information on bat roosting and hibernacula behavior.

Additionally, continued monitoring of bats will be necessary considering the moderate to high vulnerability of certain species on the installation to climate change (CEMML 2023). The fringed myotis, little brown bat, hoary bat, and silver-haired bat were all determined to have moderate or higher climate change vulnerability by CEMML. As noted above, bats are exceptionally sensitive to climate change (CEMML 2023), and climate change could shift bat species' ranges, change behavioral patterns, and cause loss of food and water resources (NAFB 2022*a*). Climate change may affect the timing of insect emergence, which could reduce bat foraging success in the spring (Sherwin et al. 2013). Although warming temperatures and temporary periods of increased precipitation could benefit bats if they promote greater food availability and faster juvenile development, disruption of hibernation, extreme weather events, and spread of disease could cause significant mortality (Sherwin et al. 2013). Continued monitoring will help document the localized effects of climate change on the installation's populations, and help inform management and planning efforts. For further information on climate impacts to specific bat species, reference Appendix D of the CEMML Climate Change Assessment (CEMML 2023).

7.4.5 Pollinators

As discussed in Section 2.3.4.5, pollinators play an integral role in maintaining native habitats and ecosystem function (Breeze et al. 2021). Although pollinators are generally protected as a group, several species occur or have potential to occur on the installation that warrant additional management. These include the Mojave poppy bee, monarch butterfly, and the western bumble bee.

The Mojave poppy bee, which is under review for federal listing and protected within the state of Nevada, was detected on NAFB in April 2023 (T. Griswold, entomologist, personal communication 2023). As such, the natural resources program may coordinate with USFWS moving forward to develop additional conservation activities on the installation to protect this species. Key actions to protect the species' habitat may include:

- Reducing foot and vehicle traffic in any area with Las Vegas bearpoppy, including the Conservation Areas. Because the poppy bee nests in gypsum soil near this host species (CBD

2018), walking or driving anywhere near the flowers should be as limited as possible within the constraints of the mission.

- Preventing the use of pesticides in areas containing Las Vegas bearpoppy, and ensuring that any pest control on NAFB is compatible with pollinator conservation, as described in the Pollinator Conservation Reference Guide, Section 3 (USFWS 2017).
- Supporting a robust pollinator community on the installation by conserving other native, flowering plant species in the Las Vegas bearpoppy habitat. Although the Mojave poppy bee is a specialist on the Las Vegas bearpoppy, other bee species visit and help pollinate the flower to some degree (CBD 2019). As such, increasing the overall health of the pollinator community has potential to support the Las Vegas bearpoppy, thereby increasing Mojave poppy bee habitat (Borchardt et al. 2021)

Current management efforts for the Mojave poppy bee include visual surveys of the Las Vegas bearpoppy for floral visitors. These surveys will continue throughout the operational period of the INRMP, and are described in the 2023 Candidate Species Report (NAFB 2022*b*). The Mojave poppy bee was observed in the Conservation Area, Area III of NAFB on May 2023. Specific data will be described in the 2023 Candidate Species Report. Continuation of these surveys is especially important considering the potential federal listing of the species. Continued surveys, especially in areas where the bee has been recently observed, will benefit the installation by informing management actions and mission planning, thereby potentially avoiding further regulatory burden and mission restrictions. The Las Vegas bearpoppy (the host species to the bee) is also under review for federal listing; the conservation of the Mojave poppy bee is a key component in preserving the Las Vegas bearpoppy, and the Las Vegas bearpoppy is a crucial component of Mojave poppy bee habitat. Thus, continued monitoring and conservation of both species will be mutually beneficial.

Monarch butterflies are also likely to occur on the installation. Although no management or monitoring for the monarch has been completed through spring 2023, this revised INRMP includes several projects based on the monarch BMPs recommended for DoD lands (McNight et al. 2021). These actions include identifying locations for planting native milkweed and developing public outreach. Additionally, NAFB plans to survey for monarchs and milkweed during the course of vegetation and rare plant surveys to determine the extent and connectivity of existing habitat on the installation. Monarch monitoring on the installation will help inform management actions and mission planning and may help the installation avoid potential future regulatory burden and mission restrictions if the species is listed under the ESA.

Lastly, the western bumble bee is another species under review for federal listing that could potentially occur on the installation. Although no management or monitoring for the western bumble bee has been completed through Spring 2023, this revised INRMP includes a project for western bumble bee surveys.

One opportunity for pollinator-related public education and outreach is an annual bioblitz, which is a short period of intensive surveying made accessible for public participants. These events can leverage local expertise to demonstrate the diversity of species on the installation to the public while gathering valuable data. Groups such as iNaturalist and the National Recreation and Parks Association have designed toolkits for developing these events.

Initial and continued monitoring for these pollinators is increasingly important considering their specialized ecology and moderate to high vulnerability to climate change (CEMML 2023). Recent population declines in addition to impending impacts from climate change heighten the need for conservation action. Specific climate change impacts to these pollinators include increases in temperature and changes in precipitation

that may negatively impact habitat availability and availability and timing of floral resources, and changes in timing and magnitude of weather events that may cause shifts in population dynamics and habitat loss (CEMML 2023). Continued monitoring will help document localized effects of climate change on populations and help inform management and planning efforts. For further information on climate impacts to these pollinators, reference Appendix D of the CEMML Climate Change Assessment (CEMML 2023).

7.4.6 Vegetation

Current rare plant survey methods include monitoring on NAFB and the NTTR. Detailed descriptions of historical and current survey protocols are in the 2021 Final Rare Plants Report (NAFB 2022*i*). Continuation of these surveys is essential as they provide a basis for mission planning, species management, and for documenting impacts of climate change. They are especially important to further establish a baseline of rare plant occurrence on the installation, considering future mission development. The installation will report any observations of three-corner milk vetch, *Lewisia macguirei,* or other possibly present rare plants to the USFWS, per request.

Las Vegas bearpoppy populations in the Las Vegas Valley have been shown to be genetically unique, and so are of concern to Nevada Department of Forestry (NDOF), Clark County, USFWS, and the USAF. Currently, The Nature Conservancy describes the plant as globally rare and state imperiled, and the State of Nevada lists it as critically endangered. This plant species is known to occur only in Clark County, Nevada and Mohave County, Arizona (Sheldon 1994). USFWS considers this plant to be among its highest priorities for protection in the state. They hope to avoid federal listing of it as threatened by protecting the existing populations on public lands, which includes populations found on NAFB (Bair 1997). The species is found exclusively on gypsiferous soils (Sheldon 1994) and projects proposed on other soil types are not likely to affect the Las Vegas bearpoppy.

NAFB continues to take steps to conserve the bearpoppy, including early planning of new construction projects to avoid areas known to have bearpoppy plant communities. No development will occur within the 233 acres of undeveloped Las Vegas bearpoppy and Las Vegas buckwheat habitat located in Area III without required consultation with NDOF and USFWS. Consultation will occur at the pre-planning/internal review stage of development, when the Description of the Proposed Action and Alternatives is received, to discuss impacts, alternative actions, and future management of the Area III habitat. NAFB will refrain from development in areas populated by the Las Vegas bearpoppy and Las Vegas buckwheat, although a permanent area cannot be set aside for conservation (U.S. Government Accountability Office Opinion, 16 October 1998).

An environmental awareness park may be developed in the proximity of bearpoppy colonies and habitat if deemed appropriate. This park would educate installation personnel about the species and their conservation significance, while permanently protecting it from destruction or adverse impacts of mission development.

Several monitoring and management alterations resulted from the last survey report and 2023 INRMP revision stakeholder meeting and are described below. The alterations may be incorporated into current management protocols when and if funding and staffing allow. The installation may assess the feasibility of developing habitat models for rare plant species to inform and prioritize surveying efforts. If implemented, significant survey effort would be saved by focusing survey efforts in locations with highly suitable habitat. Survey timing may be reassessed annually based on precipitation and other factors to focus on overlap with blooming periods.

7.4.7 Habitats of Concern

NAFB and the NTTR annually monitor Nevada Key Habitats for occurrence, trends, and health. Health of these habitats and specific monitoring strategies are given in the most recent 2021 Final Unique Habitats Report (NAFB 2022*m*). Wildlife surveys and habitat utilization surveys are performed concurrent to vegetation surveys. Species diversity and habitat utilization surveys provide data that allows the NNRP to maintain habitats on the installation while also identifying areas in need of habitat management to enable the military mission.

NAFB manages sensitive habitats under its Unique Habitat Guidelines document, which was developed in conjunction with NDOW for effective management. The Unique Habitat Guidelines is a valuable resource for managing and conserving natural resources to minimize impacts and provide a sustainable training environment for USAF (NAFB 2015*b*).

7.4.8 Climate Impacts on Management of Threatened and Endangered Species and Species of Concern

Management actions needed to protect threatened and endangered species will depend on the speed at which the climate changes, the nature of the changes, and the ability of the species to respond to those changes. Our understanding of species' responses to changing climate is not yet sufficient for predicting how individual species will respond. Moreover, sub-populations of a given species may exhibit unique responses to environmental conditions. Genetic variation within a species helps populations adapt to environmental conditions, but populations may not be able to undergo selection for preferred traits if environmental conditions change too rapidly (Hoffmann and Sgrò 2011). Behavioral changes, such as switching host plants or food sources, have already been observed in some cases (Iwamura et al. 2013, Ozgul et al. 2010).

Many current management activities for threatened or endangered species are appropriate for increasing species' resilience or facilitating adaptation to climate change. An ecosystem approach that prioritizes functional diversity and maintenance of habitats, habitat variability, and habitat connectivity will potentially help species adapt to changing conditions or migrate to more favorable habitats; however, given the uncertainty inherent in managing species under changing environmental conditions, additional analysis and planning may be required.

Basing management decisions on historical patterns is likely to be insufficient for future management challenges (Bierbaum et al. 2013). Proactive approaches that account for change can help to extend the period over which species may adapt to changing climate and avoid catastrophic declines associated with stochastic events acting on an already stressed ecosystem (CEMML 2019).

7.5 Water Resource Protection

Applicability Statement

This section applies to USAF installations that have water resources. This section is applicable to this installation.

Program Overview/Current Management Practices

Surface- and groundwater-specific discussions are included below.

7.5.1 Surface Water

Due to the scarcity of water on the NTTR, its presence is extremely important to support healthy plant and animal populations. Extensive surveys to identify and map springs and seeps have been conducted on the

NTTR. A subset are sampled for surface water quality parameters on an annual basis. These surveys help monitor changes to habitat for sensitive and protected species, and ensure inform planning efforts to conduct jurisdictional delineations where needed to comply with the CWA, especially in areas potentially impacted by mission operations. The data will be maintained and updated as necessary in the natural resources database. More information on ongoing seep and spring surveys is in the 2021 Final Habitat Wetlands Report (NAFB 2022*e*).

The USAF coordinated range access for the NDOW, USFWS, and the Fraternity of the Desert Bighorn Sheep to install water-retention basins and guzzlers (wildlife drinkers) on the South Range, where water resources are scarce for wildlife (NAFB 2014*a*). Cement retention ponds, water troughs, water-storage containers, and drinkers with plastic sheeting to collect rainwater were constructed to create more surface water features.

An investigation of surface soils after bombing of targets was conducted to determine whether practice-bombing activities cause surficial soil contamination (NAFB 1996). The results of this study indicated that some contamination occurred at target sites, but the concentration of contaminants was relatively low, and posed little or no risk to people and the environment. However, the internally drained basins of the NTTR may present a contamination concern. Under normal circumstances, precipitation would help naturally attenuate soil contaminants. But since most target areas are within internally drained basins, any contamination moved by surface waters would concentrate within playa lakes and valley bottoms. At these locations, though, most contaminants would be immobilized by the high level of clay found in playa lakes (NAFB 1999). Based on these findings, future studies to determine the effects of long-term buildup or increased concentrations of contaminants in playas on plants and animals and surface water quality appear unwarranted.

As part of the Legislative Environmental Impact Statement (LEIS) in support of continuing the land withdrawal for the NTTR, another contamination analysis was completed in 2017 (NAFB 2017*d*). The report assessed documentation of operations and maintenance materials (O&M materials), ordnance, and radiological materials but did not assess sites on the ground. The report found the following regarding these categories:

- O&M materials and their associated waste streams are handled under management plans that are prepared in response to Federal, State, and Local laws as well as USAF regulations as applicable.
- Ordnance represents the majority of contamination within the NTTR. Target sites on the NTTR are routinely swept and made safe under the Coronet Clean policy. The munitions waste from clean-up activities is managed in accordance with existing management programs.
- Radiological materials include Depleted Uranium (DU) munitions that are managed by the USAF and licensed by the Nuclear Regulatory Commission (NRC) and legacy nuclear testing sites that are managed by the Department of Energy. DU targets on the NTTR are regularly cleaned in accordance with established management plans. Per the most recent studies available, DU particles and oxides do not appear to be migrating off the licensed area by soil or surface water transport but remain in surface soils radially from target areas. The DOE manages their contaminated sites as Corrective Action Sites (CAS) grouped into Corrective Actions Units (CAU). CASs may consist of a variety of sites (landfills, mud pits, leach fields, etc.) with or without radiological contamination. The DOE is responsible for assessing and remediating contamination resulting from DOE operations through an MOU and under a Federal Facility Agreement Consent Order issued by the state of Nevada.

Two areas within the installation fall under the requirements for National Pollutant Discharge Elimination System permitting. This includes the NTTR and allows for discharge of stormwater in accordance with general permit number GNV00022233.

An assessment of Point Bravo (a small facility that serves as a field office, staging area, and entry point into the South Range), and Creech Air Force Base (CAFB) was conducted to address the potential for and impact of an aboveground storage tank release on drinking water intakes and sensitive wildlife habitats. CAFB and the NTTR required this assessment for compliance with the 01 July 1994 Final Rule that amended 40 CFR, Parts 9 and 112 of the Oil Pollution Act of 1990. Upon review of possible affected sensitive wildlife areas, drinking water intakes, planning calculations, and current spill contingency plans, a Facility Response Plan was deemed unnecessary. A Certification of Substantial Harm Criteria will be completed and maintained with each of the facility Environmental Coordinators and with 99 CES. This certification is reviewed annually with the Base Facility Response Plan.

Water Resource Protection Measures

During construction projects and any other activities that would result in removal of vegetation or disturbance to the soil surface, the following actions should be taken to conserve surface waters.

- Follow guidance within the Stormwater Pollution Prevention Plan.
- Where practical, BMPs, such as placement of hay bales and silt fences, should be used to minimize soil erosion and deposition of sediments in ephemeral streams, collection valleys, and playa lakes.
- The NRM should be consulted before any action is taken that may impact streams, washes, or playas.
- The action may require consultation with the USACE if it places fill material in ephemeral streams, wetlands, or other surface waters connected to navigable waters of the U.S. Ephemeral streams include any natural drain that has a defined channel or shows characteristics of flowing water. Streams flowing into playa lakes and other isolated basins are not considered jurisdictional because they are not connected to navigable waters of the U.S. Thus, activities affecting them would not require consultation with the USACE, but the NRM should be consulted to make the final determination of whether or not the USACE should be contacted.
- Actions that impact vegetation along streams, washes, or springs should be modified where possible to avoid or minimize impacts.
- Whenever possible, roads, pipelines, and any other linear construction projects located within 50 feet of any stream channel or drain should not be oriented parallel to the stream channel because of the potential for erosion and damage to the pipeline or road.
- Roads and pipelines crossing over streams should be oriented perpendicular to the stream channel.

Mission maintenance and operation activities should consider the following prior to initiation.

- Direct or indirect impacts to springs and associated wetlands or vegetation communities are avoided whenever possible.
- Impacts to streams and drains are minimized.
- Identify any sensitive recharge features potentially impacted by the action. Avoid or minimize impacts to these features.
- All efforts are made to prevent any contamination to groundwater in the area.

Water resources will be protected from wildland fire and associated management actions to the extent practicable. Protection of water resources is also especially important considering their recent decline on

the NTTR, and potential impacts from climate change. The NRM will coordinate with the BLM and wildland fire response personnel to determine a comprehensive list of wetlands and habitats to appropriately protect from fire and associated response actions. At the minimum, wildland fire management operations should follow the water resource protection measures above.

NAFB and the NTTR personnel that may come in contact with hazardous wastes are given specific training for avoiding, handling, and disposing of such materials. Aircraft hangars are equipped with oil-water separators, which capture and collect generated waste petroleum products and solvents. An Initial Accumulation Point course is provided for managers, consistent with the federal Resource Conservation and Recovery Act (RCRA). Introductory courses for technicians, focusing on materials used on the flight line, and refresher courses for more senior personnel are also provided. These courses direct personnel to limit handling of hazardous wastes, to gather the wastes in proper storage, and to assemble larger than 55-gallon quantities at designated accumulation points. A review of hazardous materials handling on the NTTR was conducted and a final report was issued in April 1996 (NAFB 1996).

In addition, a Storm Water Pollution Prevention Plan has been prepared by 99 CES personnel. This plan provides methods to eliminate or reduce pollution in local surface and groundwater sources, should any hazardous materials be inadvertently released. This plan will be followed where applicable and pertinent.

7.5.2 Groundwater

Sixty-two underground water sources have been identified on the NTTR. Precautions should be taken to ensure that groundwater originating from NTTR recharge or located in aquifers located below the NTTR is protected from impacts of USAF activities. Geologic studies should identify sensitive recharge structures that could provide conduits for potential contamination by various USAF activities at the NTTR. The natural resource database is to be updated with any new information on the location of recharge zones. Mission actions involving functioning ordnance or potentially hazardous materials should not occur within 200 feet of any production well, monitoring well, or natural spring.

The NNRP may conduct a study of groundwater sources during the operation period of this INRMP to quantify availability and trends of groundwater on the NTTR. This study will help quantify how changes in groundwater availability are related to seasonal weather and climate change. Results will also help describe potential impacts to wildlife.

7.6 Wetland Protection

Applicability Statement

This section applies to USAF installations that have existing wetlands on USAF property. This section is applicable to this installation.

Program Overview/Current Management Practices

Wetlands and other water source areas are scarce in arid regions. They are critical habitat for many wildlife species and often support unique floral communities. Current wetland surveys are conducted in tandem with the seep and springs surveys, but are focused on determining continued presence and legal wetland status. Wetlands delineations will continue throughout the course of this INRMP to establish a new baseline of wetlands on the NTTR. For further information on current wetland surveys, reference the 2021 Final Habitat Wetlands Report (NAFB 2022*e*).

Recent surveys have shown wetland decline on the NTTR when compared to historical records, which warrants additional monitoring. A large number of historically recorded wetlands currently show less or no sign of water, and encroachment of upland vegetation in certain cases (NAFB 2022*e*). Further investigation into the context of these wetland declines is necessary, as they may significantly impact wildlife. Long-term monitoring of wetland sites could quantify the rate of wetland loss occurring on the NTTR and response to drought cycles and climate change. Wetlands and water features with more permanence, such as Breen Creek, will be monitored on an annual basis due to their significance and value to native species. Additionally, continued monitoring is critically important to document ongoing damage from wild horses and burros.

Because most of the wetlands occurring in the Great Basin ecoregion are in internally contained watersheds and do not connect to navigable waters, they are unlikely to fall under jurisdictional wetland definitions. However, certain water resource features support some WOTUS determination criteria and should be formally delineated before potential mission impacts occur. Wetlands with future, positive jurisdictional determinations should be monitored periodically for significant changes to the water regime. However, it should be noted that negative WOTUS determination would not affect NAFB responsibilities under EO 11990, NEPA, and the EIAP.

All wetland delineations and associated data should continue to be documented and maintained in the NNRP database for future planning and monitoring.

7.6.1 Impact Prevention

During the early planning and design phases of any mission project or action, the following steps should be taken to ensure the conservation of wetland areas.

- Project managers should review the natural resource database to determine whether any wetlands have been identified in the area of the proposed action.
- If wetlands are found to be impacted by the action, an alternative site should be selected for the project that avoids impacts to wetlands. If impacts cannot be avoided, methods of modifying the project to minimize impacts to wetlands should be considered.

For projects that directly or indirectly impact wetlands, the following should be accomplished.

- The boundaries of the wetlands should be delineated to obtain an accurate estimate of the area of wetlands that will be filled by the project.
- The NNRP should determine whether the wetland is potentially jurisdictional. If the wetland is found to be potentially jurisdictional, the NRM should coordinate permit preparation with the USACE.
- Depending on the level of impact, permit approval may require from 30 days to one year. Project planning efforts should accommodate the time required for permit preparation and approval.
- The NNRP should be prepared to compensate for any loss of wetlands by creating new wetlands in another location or on the site.

Wild Horses, Burros, and the Water Resources Program

The extensive damage wild horses and burros cause to wetlands is described in Section 2.3.3.5. The Water Resources Program was initiated in partnership with the BLM to include funding and personnel to install fencing around sensitive springs and wetlands habitat to exclude horses and burros. Wetland exclosures should be monitored on a regular and ongoing basis to prevent access and damage from these animals. The

program provides for alternative water sources for horses and burros at selected locations. Alternative water sources should be physically separated from water in the wetlands to prevent vegetation trampling, sediment accumulation, and contamination by animal waste, and to prevent direct competition for the water with native wildlife.

If future damage to wetlands occurs from wild horses or burros, 99 CES/CEIEA should coordinate with the BLM to determine a solution. Any modifications in management must include methods of conserving wetlands on the NTTR.

7.6.2 Climate Impacts on Wetland Protection

As of the most recent 2021 Final Habitat Wetlands Report (NAFB 2022*e*), none of the seeps, springs, or ponds on NTTR are considered jurisdictional wetlands, but the water resources on the installation provide valuable habitat for wildlife. Climate change considerations for wetland protection at NTTR should focus on continued monitoring of these areas and maintaining and adding fencing to exclude horses and burros where needed to protect these habitats. More general protection methods aside from exclusion fencing include restoring wetlands that have been invaded by non-native plant species and mitigating wetland losses associated with construction or military activities.

7.7 Grounds Maintenance

Applicability Statement

This section applies to USAF installations that perform ground maintenance activities that could impact natural resources. This section is applicable to this installation.

Program Overview/Current Management Practices

NAFB is in the arid southwest where water conservation is a high priority. In the past, nonnative drought-tolerant trees and shrubs, evergreen trees and shrubs, perennials, ground covers, vines, and grasses have been planted throughout the base. NAFB utilizes a suitable planting list that is modified from the Southern Nevada Water Authority's Water Smart Landscapes Program Plant List. The modification reflects NAFB's needs for resilient, low maintenance, low water use, and low bird-attractance vegetation. The list is considered a working list to ensure adaptive management in a changing environment. Projects listed in the base Capital Improvements Program EA include xeriscaping, or drought-tolerant landscaping, along with upgrades to the water system and use of water saving devices (NAFB 2013).

Tree planting and care is guided by the Nevada Division of Forestry’s Cleaner Air, Tree by Tree: A Best Management Practices Guide for Urban Trees in Southern Nevada. This guide includes recommendations for species selections and proper locations. It also includes best management practices for tree care including establishment, soil health maintenance, tree maintenance, tree protection, and risk management. In the Mojave Desert, trees are unable to survive without supplemental irrigation; therefore, NAFB trees are provided with long term irrigation. Additionally, NAFB discourages removal of nuisance trees (e.g. causing litter). Trees should only be removed when they are risking public safety, in poor condition, or when necessary to enable the military mission. When trees are removed, they are to be either relocated or replaced in a suitable location. Replacement trees are 1) not to create a future hazard for aircraft and flight operations (e.g. BASH concerns), 2) require a functioning irrigation system to the vegetation at the time of planting, 3) require low to medium water use, and 4) be a species recommended by the Southern Nevada Water Authority. NAFB utilizes a computerized system for tracking tree inventory, planting spaces, and management activities conducted.

NAFB is currently recognized by Tree City USA, for being good stewards of the urban forest community. The Tree City USA program is administered by the state forestry program, and requirements to maintain Tree City USA status include annual investments in trees, an installation tree board, an annual Arbor Day observance, and efforts to maintain trees and tree health.

To enable consistent vegetation and tree planting guidance and protocols, an urban forest management plan may be developed during the course of this INRMP. The plan will support the INRMP by encouraging conservation concepts and supporting a resilient ecosystem on base. Multiple new Nevada laws will be discussed in the urban forest management plan, if developed, and directly impact grounds maintenance at NAFB. Nevada Assembly Bill (AB) 356 prohibits the use of local municipal water for grass irrigation, and restricts the installation of new nonfunctional turf on most property types. The definition of nonfunctional turf applies to the vast majority of grass at NAFB and the NTTR.

Turf disease and unwanted invasives are controlled through proper methods and management. The base housing office is responsible for monitoring housing to ensure that proper turf-management practices are followed, including the Nevada AB 356. Weed control in improved areas is handled by a contractor.

7.8 Forest Management

Applicability Statement

This section applies to USAF installations that maintain forested land on USAF property. This section is applicable to this installation.

Program Overview/Current Management Practices

Some of the higher elevations on the NTTR have pinyon-juniper habitat, and up to seven conifer species have been documented in the mountains to the west of Groom Lake. Most of the documented species of conifer are in higher elevations in ranges 74A and 74B, and are unlikely to have foreseeable anthropogenic impacts. However, climate change may impact these forests and is further discussed in Section 2.3.2.3. See Section 7.9 for information regarding wildland fire management.

No commercially viable forests are present on the NTTR so this issue will not be addressed further in this document.

7.9 Wildland Fire Management

Applicability Statement

This section applies to USAF installations with unimproved lands that present a wildfire hazard and/or installations that use prescribed burns as a land management tool. This section is applicable to this installation.

Program Overview/Current Management Practices

The mission of the Air Force Wildland Fire Program is to ensure mission capability and readiness through a strategic, cost-effective, wildland fire organizational structure that provides ecosystem management, promotes long-term range sustainment, leverages partnerships, and provides key fire-related information to decision makers (AFMAN 3.79.2). All installations with burnable acreage, those that use prescribed fire, or those with potential for wildfires are required to develop and implement a WFMP (AFMAN 3.80). As such, wildland fire management is likely only applicable to the NTTR due to the presence of burnable land. The current WFMP (Tab 1) provides guidance, responsibilities, and procedures for the prevention and

suppression of wildland fires on all NAFB and the NTTR lands. It is used to implement ecosystem management and fuels reduction goals using fuel treatments and prescribed fire in support of the INRMP.

In 2019, NAFB began the process of standing up a USAF Wildland Fire Module. A module is a permanent team of wildland fire qualified personnel that conducts USAF wildland fire operations within a designated area of responsibility. Having this module allows the USAF to stage firefighting-related equipment on the NTTR. Primarily the equipment will be used for fire mitigation to reduce the risk of catastrophic wildfires where sensitive or high-value equipment exists.

Current wildland fire management is focused on fuels reduction and management of invasive species and the grass-fire cycle (GFC). Prescribed burning has only been conducted once on the NTTR because the rapid rates of fire spread preclude safe prescribed burning under most conditions. Instead, techniques that include mechanical treatments, non-mechanical treatments, and herbicide applications are used. These methods are designed to remove or rearrange fuels to mitigate wildfires, and allow for efficient and safe management response to wildfire ignitions. Prescribed fire will only be conducted when deemed necessary to reduce accumulated or piled fuels, as completed for the Cedar Peak burn. Both fire and non-fire treatments will be coordinated and jointly executed with BLM and should follow all environmental requirements. Fuels reductions are proposed for the Cedar Peak, Black Mountain, Stonewall, and Belted Peak areas. Roadsides will be treated with herbicides to widen them and create effective firebreaks. However, treatment of brome grasses (*Bromus* spp.) is a high priority for the NNRP because of its role in the GFC, further described below. Wildland fire and invasive species initiatives are coordinated to ensure benefit to natural resources and decreased wildfire risk. Lastly, all data regarding wildland fire management activities are recorded and maintained in GIS.

7.9.1 Wildfire Impacts, Origin, History, and Return Interval

Wildland Fire Impacts and Origin

Wildland fire poses a significant threat to the mission and personnel safety. Wildfires may impact the training mission, weapons testing, mission infrastructure, and natural and cultural resources on the NTTR. Specific impacts to natural resources may include damage to vegetation and soils, erosion, water resources, and native species and habitats. In addition, wildfires that start on the NTTR could reach private and public lands nearby, threatening homes in the wildland-urban interface and damaging natural and cultural resources. Potential impacts are further discussed in Section 1.3 of the WFMP (NAFB 2021*a*).

The WFMP provides a record of wildfires back to 1984, occurring on varying scales and with regularity (NAFB 2021*a*). Wildfires on the NTTR are primarily ignited by lightning, but also by human causes such as military training. A significant portion of wildfires on the NTTR have unknown ignition sources. Although most wildfires on the NTTR are small and less than ten acres, numerous large and damaging wildfires have occurred including several over 1,000 acres and two above 20,000 acres. Helicopter surveys in 2008 supported this, finding evidence of many unreported, lightning-caused fires in remote areas of the NTTR. Military testing and training includes activities with high ignition potential, such as bombing, aerial flares, and ground forces training. To reduce fire risk, these activities are performed on/over unvegetated or lightly vegetated playas where the potential for wildfires is low. Public access is highly controlled on the NTTR; hence, the potential for public-caused fires is very low. The greatest threat for a public-caused fire is the potential for a wildfire to start on neighboring land and spread onto the NTTR.

Wildfire History and Return Interval

Natural wildfire history and return interval specific to the NTTR are not known, but can be approximated using studies estimating fire return intervals of the Great Basin and Mojave Deserts. Literature that describes fire history within the Great Basin Desert includes Mensing et al. (2006) and Miller and Tausch (2001). These studies generally suggest that the natural fire return interval for Great Basin sagebrush communities is based on precipitation and aridity cycles; the return interval increases as arid climates decrease fuel loads and continuity, whereas the opposite occurs for wetter climate cycles. Return intervals are estimated to vary from approximately 20–200 years based on sagebrush species dominance (Miller and Tausch 2001). Cold desert scrub and salt-desert shrublands burned very infrequently, due to low fuel loads and low productivity (Chambers et al. 2009). Within the Mojave Desert, fires in scrub and blackbrush ecosystem types are infrequent, and return intervals are typically 50–100 years (Anjozian 2009, Brooks et al. 2013 Fenstermaker 2012). Similar to the Great Basin Desert, return intervals have been documented to depend on climate cycles, particularly precipitation and aridity (Brooks et al. 2013). Additionally, fire size in the Mojave Desert is also dependent on precipitation and aridity cycles.

The patterns discussed above cannot be applied to all vegetative communities on the NTTR, as some communities support more frequent fire. Communities more prone to frequent fire warrant attention from the INRMP and WFMP, as they can significantly affect the mission or natural resources. Fire is more common in high elevation and desert montane ecological zones (Brooks and Matchett 2006), or within wetland ecosystem types (Brooks et al. 2013) due to higher fuel load and continuity. Brooks and Machett (2006) also noted that Mojave Desert mid-elevation shrubland and high elevation woodlands support fuel loads and continuity to carry fires. Mensing et al. (2006) also suggested that fires in the sagebrush-woodland ecotone are large and frequent, and help minimize woodland encroachment into sagebrush communities. Fires within high elevation woodland zones can be particularly damaging, leading to lengthy natural recovery times or permanent vegetative profile changes (Brooks and Machett 2006).

The Great Basin and Mojave Deserts are experiencing dramatic reductions in fire return intervals due to the invasion of cheatgrass, a non-native grass that increases fuel continuity and creates a positive feedback loop, the GFC. The GFC is well described in scientific literature and well documented within both deserts (D'Antonio and Vitousek 1992, Balch et al. 2013, Klinger et al. 2021). Pyrophytic invasive grasses, like cheatgrass, extirpate native species by encouraging fire spread through the flammability of their growth form, and then aggressively colonizing the disturbed area post-fire. The expanded invasive community then promotes ever more fire and continues to increase its dominance on the landscape. The GFC has the potential to significantly affect native ecosystems (D'Antonio and Vitousek 1992). The presence and effect of cheatgrass is apparent on the NTTR, as cheatgrass is increasingly invading the range. If cheatgrass invasion continues on the NTTR, ecosystems and resources will be permanently altered, with increasing dominance of low-diversity non-native grasslands that do not support the same biodiversity as the native vegetation..

7.9.2 Roles, Responsibilities, and Current Wildland Fire Management

Responsibility for the withdrawn lands is jointly shared by the BLM, USFWS, and AFWC (BLM 2004b). The MLWA of 1999 (PL 106-65) delineates the responsibilities of NAFB, BLM, and the USFWS in control and management of brush and range fires on withdrawn lands. The law mandates that the USAF will take necessary precautions to prevent and suppress brush and range fires occurring due to military activities within and outside the withdrawn lands. The USAF may seek BLM assistance for suppressing a fire and will compensate the BLM for its actions. BLM and USFWS have responsibility for nonmilitary-caused

fires. If the source of the fire is unknown, the 99 ABW and BLM will integrate fire suppression operations and incident management using National Interagency Incident Management System and Unified Incident Command System. The AFWC has an established agreement with DoE that allows each agency to share personnel and assets in fighting brush and range fires. While this agreement is positive, it must be understood that both agencies have severe limitations on the type and amount of support they can provide at any time.

Management of the NTTR is the responsibility of the 99 ABW and the NTTR working through the AFWC, neither of which has trained or qualified personnel to protect the NTTR from damage or loss by wildfires. This means all wildfire suppression requires assistance from other federal and state agencies. If a wildfire occurs on the NTTR, fire suppression will be requested from the BLM in accordance with the MLWA of 1999 and the MOU between NAFB and BLM. Currently there are no fire-suppression capabilities on the NTTR for first-response activities.

When a wildfire is reported, an Incident Commander (IC) will be assigned by the responsible agency through the execution of a written delegation of authority. The IC is responsible for implementing the agency's strategic direction for management of the incident. During larger wildfire incidents, a written delegation of authority is given to the IC. The agency that issues the written delegation is the agency that is responsible for the wildfire. The written delegation includes objectives, priorities, expectations, environmental constraints, public information directions, safety considerations, and other considerations or guidelines, as needed. A sample written delegation of authority is in Attachment 3 of the WFMP.

7.9.3 Coordination with Additional Program Areas

Wildland fire and associated management have significant potential to affect sensitive resources. Wildland fire management must be mutually supportive and coordinated with other program areas to avoid adverse impacts. Specific resources or locations that must be considered and avoided during wildland fire operations are discussed in Section 7 of this INRMP. Examples of resources that must be considered during wildland fire operations are threatened and endangered species, wetlands and unique habitats, cultural resources, and invasive species.

7.9.4 Climate Impacts on Wildland Fire Management

Overall, climate projections indicate increasing probability of ignitions leading to wildland fires. Climate projections indicate that average annual temperatures are expected to rise and average annual precipitation is projected to drop under all climate scenarios except RCP 4.5 2030. For a given ignition source, the likelihood of wildfire ignition largely depends on receptivity of the fuel bed. The fuel bed is a function of fuel abundance, physical characteristics of the fuels (such as surface area to volume ratio and chemical composition), and weather factors (such as temperature and relative humidity). Assessment of the type, number, or location of ignition sources was beyond the scope of the CEMML Climate Assessment and these are assumed to remain constant under the projections.

In addition to the greater likelihood of ignitions starting fires based on climate projections, vegetation changes will promote increased ignition probabilities. Already, cheatgrass and red brome grasses have invaded portions of the installations. These highly fire-adapted and fire-promoting invasive grasses contribute to increased ignition probability and fire spread. Their characteristics often lead to a GFC in which highly fire-adapted grass species promote greater fire frequencies, and the GFC is likely to be accelerated by climate change in the future.

Although average annual precipitation is projected to decrease, seasonal precipitation patterns are projected to shift, and some months and seasons may receive higher precipitation amounts than the historical average. Brooks et al. (2004) found that increased fall and winter precipitation, which is projected for NAFB and the NTTR, can encourage the encroachment of cool-season invasive grasses into previously uninvaded areas. This would effectively increase the availability of fine fuels, increasing overall fire probability and spread, which further promotes a shift from native communities to invasive grasslands. Where these disturbance-adapted grass species do not invade or expand their ranges, ignitions are not likely to change noticeably because ignitions in those areas are not currently limited by climate—they are already hot and dry enough on almost any given day to ignite a wildfire.

Generally, ignitions on military installations are highly localized to where live-fire exercises are conducted. If those ignitions occur in locales where ignition probabilities are likely to increase or decrease, overall ignition loads will increase or decrease, respectively. The net gain or loss in ignition load will depend on how much of the cover is converted to invasive grassland. If invaded areas overlap areas where training activities tend to promote fire, then the ignition loads will rise.

Traditionally, fire behavior has been dependent on fuels, weather, and topography. Of these factors, only topography will remain constant under current projections of climate change. Given the assumptions about invasive grasses discussed above, fuel continuity can be expected to increase in invaded locations. This can create a cycle of ever-increasing fire size because these grasses easily invade and thrive in areas disturbed by fire, although more broad-scale invasions not preceded by fire are likely to occur as well. Where non-native grasses invade new ground, fire activity is likely to increase and spread more rapidly in the contiguous fuel beds they create.

Despite the possible invasion scenarios, large portions of the NTTR are likely to remain uninvaded. As a result, these areas will lack the fuel continuity necessary for carrying fire except during the occasional years of high precipitation that produce a flush of herbaceous vegetation that can fill gaps in fuel continuity. Other areas of NTTR could burn under current conditions. Where invasions of nonnative grasses occur after fire in shrubland or grassland/shrubland, fire also eliminates the existing shrub component and converts it to nonnative grassland. In those cases, fire intensity will be lower relative to the fire intensity where shrubs remain. Where invasions occur without fire disturbance, the increase in biomass from invasive grasses will lead to increases in fire intensity and rates of fire spread. Given the projections for reduced precipitation and higher temperatures (which diminish the relative humidity), fire intensity in areas not converted to invasive grassland can be expected to increase even more.

Climate change will drive most biomes upward in elevation. Presumably, this will lead to expansions in vegetation types currently occupying the lowest elevations, including barren areas, and contractions of vegetation types currently occupying the highest elevations. Although losses of vegetation are expected at lower elevations, this may not be manifested until after 2050. If vegetation cover does decline, the proportion of uninvaded, burnable landscape will diminish commensurate with losses in fuel continuity.

Given the considerations discussed above, two diverging fire regimes are likely to occur at NAFB and the NTTR. One is defined by those portions of the installation where invasive grasses become heavily entrenched. In these locations, fire ignition probabilities are likely to increase. Where shrubs remain in these invaded landscapes, fire intensity will increase, but where shrubs are generally extirpated via the GFC, fire intensity will decrease. It is highly unlikely, however, that the entirety of these installations will be occupied by invasive grasslands in 30 years. Where invasions do not occur, the decreasing fuel continuity at low elevations will reduce the proportion of the landscape where fires are able to burn. This is likely to be most

apparent at NAFB and at the lowest elevations of NTTR South; however, this shift may not occur until well after 2050.

7.10 Agricultural Outleasing

Applicability Statement

This section applies to USAF installations that lease eligible USAF land for agricultural purposes. This section is not applicable to this installation.

Program Overview/Current Management Practices

No agricultural outleasing programs are currently being administered on NAFB or the NTTR.

The current grazing operation, which is administered by the BLM, does not interfere with the NTTR mission and day-to-day operations. The USAF and the grazing lease holder have an MOU for access, fencing, and scheduling. The rancher has an NTTR access badge and follows normal range access procedures.

7.11 Integrated Pest Management Program

Applicability Statement

This section applies to USAF installations that perform pest management activities in support of natural resources management (e.g., invasive species, forest pests, etc.). This section is applicable to this installation.

Program Overview/Current Management Practices

Invasive species management at NAFB and the NTTR is driven by the National Invasive Species Council (NISC) Annual Work Plan (NISC 2016), Federal Noxious Weed Act (7 U.S.C. 2814), EO 13112, Nevada Control of Insects, Pests, and Noxious Weeds (Nevada Revised Statute [NRS] 555.005 to 555.201), and the NAFB IPMP. The current NAFB IPMP (2018) ensures compliance with the above listed federal and state regulatory drivers, as well as DoDI 4150.07 2.10.Q. Additionally, AFMAN 32-7003 3.58.4 requires the NAFB IPMP to be mutually supportive and not in conflict with the INRMP. For further guidance on federal and state regulatory drivers, refer to the NAFB IPMP (2018).

The INRMP supports the NAFB IPMP by planning and implementing invasive species control efforts. Additionally, the NNRP supports the NAFB IPMP through their continued collaboration with government agencies and their incorporation of new methods for the fulfillment of the INRMP goals. The NAFB IPMP supports the INRMP by providing the legal, logistical, and procedural foundations for managing invasive species. Thus, continued coordination between the pest management and natural resources programs is essential. Management of non-native invasive species is essential for effective natural resources management. Non-native invasive species are defined as any species that is not indigenous to a given ecosystem, and whose introduction causes or is likely to cause economic or environmental harm or harm to human health (EO 13112). Non-native invasive species can impact the function of an ecological system by altering nutrient cycling, soil and water dynamics, and fire regimes. Invasive species have the capability to alter a natural ecosystem by diminishing the abundance of native species. Invasive plant infestation can impact both plant and animal communities (Olson 1999). As many as 42% of the species listed under the ESA are at risk primarily due to non-native invasive species (Pimentel et.al 2005). Thus, continuation of invasive species management is essential for the continued success of the military mission and natural resources management.

The NNRP works with BLM, USFWS, NDF, and NDOW to establish pest management goals and to implement projects to help fulfill these goals. These efforts also coincide with the goals of the NAFB IPMP and the approaches set forth by the National Invasive Species Management Plan. The goals that have been established are listed in Chapter 8 of this plan. Continued collaboration with the BLM, USFWS, NDF, and NDOW will help to ensure coordination of research projects and exchange of knowledge to better understand treatments of invasive species within the Mojave and Great Basin Desert landscapes. BMPs will continue to be researched and applied to fulfill the goals of this plan. The NNRP will specifically coordinate with the BLM and USFWS before initiating any invasive species control projects on the North and South Ranges.

On NAFB, the Pest Management personnel are responsible for controlling pests in and around facilities, except in NAFB family housing, which uses a private contractor for pest control. The Pest Management Office uses five control strategies to control pest species: education, cultural, mechanical/physical, biological, and chemical. In the NAFB IPMP, each control strategy is specified in detail for the control of each pest. Pest species that are found around facilities include mosquitoes, ticks, fleas, bees, wasps, scorpions, spiders, venomous snakes, lice, mites, chiggers, ants, cockroaches, flies, termites, rodents, and powder post beetles. Continued coordination between the NNRP and pest management office will be necessary to increase communication and support mutually beneficial pest management actions on base.

Invasive species, especially annual grasses, have been widely documented to impact the frequency and severity of wildfire in the western U.S. (Balch et al. 2013). Effective management of annual grasses will be indispensable to avoid significant impacts to natural resources and the mission. The NRM and IPM will communicate and coordinate regularly with BLM and wildland fire personnel to execute mutually beneficial and non-conflicting management.

Noxious Weeds

As of the 2021 report, no federally listed noxious weeds have been found on any of the installations addressed in this INRMP; however, three state-listed weeds, known as non-native invasive species (NNIS) have been found on NAFB and the NTTR. These include tamarisk, Sahara mustard (*Brassica tournefortii*), and malta starthistle (*Centaurea melitensis*). Tamarisk is the only state-listed species that has been found on NAFB and the NTTR. Sahara mustard and malta starthistle have been recorded on NAFB. For many years of invasive species surveys, starthistle on NAFB was assumed to be yellow starthistle (*Centaurea solstitialis*). However, during a survey in 2018, a sample of flowering starthistle was determined to be malta starthistle. During subsequent visits to starthistle populations on NAFB, botanists have only observed and recorded observations of malta starthistle; however, it is presumed that both species may occur on NAFB. Other invasive species that are not federally or state-listed but have been detected on NAFB and the NTTR include cheatgrass, compact brome, salt lover, and species of Russian thistle (*Salsola* spp.). These species have become well established; thus, attempts to eradicate them may now be impractical.

Nuisance Animals

On NAFB and the NTTR, animal species that can be considered a nuisance are listed in Table 7-1. Nuisance species are not considered invasive but do have the ability to increase in number to the point where they can become a management problem.

The NAFB IPMP also describes management procedures for feral and domesticated animals. The contact for issues with these animals is the Pest Management Section, Security Forces, and the requestor. Clark County Animal Control may also be contacted. Feeding and harboring feral animals in USAF installations

is prohibited. It is important to note that NAFB properties do not hold cropland and grazing outgrants; therefore, invasive species control plans for agricultural outgrants are not required. There is one grazing allotment on the North Range of the NTTR that is managed by the BLM.

Table 7-1. Current and potential nuisance species on Nellis Air Force Base and the Nevada Test and Training Range.

Common Name	Scientific Name	Species Status
Brown-headed Cowbird	*Molothrus ater*	Native, parasitic species
European Starling	*Sturnus vulgaris*	Non-native, nuisance species
House Sparrow	*Passer domesticus*	Non-native, nuisance species
Horned Lark	*Eremophila alpestris*	Native, nuisance species
Canada Goose	*Branta canadensis*	Native, nuisance species
Cliff Swallow	*Petrochelidon pyrrhonota*	Native, nuisance species
Coyote	*Canis latrans*	Native, nuisance species
Wild Horse	*Equus ferus*	Non-native, nuisance species
Wild Burro	*Equus asinus*	Non-native, nuisance species
Feral Dog	*Canis familiaris*	Non-native, nuisance species
Feral Cat	*Felis catus*	Non-native, nuisance species
Mediterranean House Gecko	*Hemidactylus turcicus*	Non-native, nuisance species
Rough-tailed Bowfoot Gecko	*Cytropodian scabrum*	Non-native, nuisance species

Many projects have long been underway at NAFB and the NTTR to fulfill the goals of the INRMP regarding invasive and nuisance species. These projects are coordinated with the BLM, USFWS, NDOF, NDOW, and the Tribes. Table 7-2 lists current projects to help fulfill goals of the NNRP.

Table 7-2. Current projects supporting invasive species management goals.

Project Name	Description	Project Status
NAFB Invasives Treatment	Treat Sahara mustard, tamarisk, or other species on NAFB.	Ongoing
Cheatgrass/Annual Grasses Treatment	Application of pre-emergent herbicide on *Bromus* species on the NTTR. Explore use of carbon source as cheatgrass treatment.	Ongoing
Annual surveys	Annual survey of NAFB and the NTTR for Invasive Plant Species. Prioritize treatment of species present.	Ongoing
High-Resolution Imagery Analysis	Use satellite imagery to help identify large areas of invasive species, and then ground-truth areas to measure accuracy of analysis.	2014–present
Tamarisk Detection and Removal NAFB	Map, treat, and monitor tamarisk on NAFB.	2009–present
Malta Starthistle Detection and Removal NAFB	Map, treat, and monitor malta star thistle on NAFB	2009–present
Nuisance Animals		
Annual monitoring	Monitor for non-native herpetofauna, incidental to other herpetological work. Collaborate with regional partners to determine if control work is necessary.	Ongoing
Horse Impact Mitigation	Work with BLM to document horse-caused environmental damage, and determine mitigation strategies.	Ongoing

7.12 Bird/Wildlife Aircraft Strike Hazard

Applicability Statement

This section applies to USAF installations that maintain a BASH program to prevent and reduce wildlife-related hazards to aircraft operations. This section is applicable to this installation.

Program Overview/Current Management Practices

The mission of the Air Force BASH program is to prevent wildlife-related aircraft mishaps and reduce the potential for wildlife hazards to aircraft operations (AFMAN 32-7003 3.64). A BASH plan must be implemented on the installation (DAFI 91-212 1.3.5.1), and the installation BASH plan must be mutually

supportive and not in conflict with the INRMP (AFMAN 32-7003 3.64.1). The NAFB and the NTTR BASH Plan 17, effective 01 May 2022, provides guidance and procedures for BASH reduction in areas of the installation in which flight operations are conducted.

Wildlife, particularly migratory birds and raptors, can present serious strike hazards to aircraft. These hazards exist because daily and seasonal movements of birds and bats can take them within flight paths of aircraft. Large mammals on the installation, such as coyotes, cross runways and can also pose significant strike risks for landing aircraft (NAFB 2016*b*). On NAFB, one source of potential BASH issues is Sunrise Vista Golf Course. The facility is situated within the Wildlife Exclusion Zone at the south end of the NAFB runway and encompasses ponds, watered turf, and trees that attract many bird species. The proximity of this golf course and its bird-friendly habitat to the runway ensures continued potential of collisions between aircraft and birds. In addition, runways across the installation are not surrounded by full exclusionary fences, so animals such as foxes, black-tailed jackrabbits, and desert cottontails are not excluded. These species attract large raptors, which cause yet another BASH concern (NAFB 2016*b*).

The INRMP supports the BASH plan in numerous ways. The NNRP coordinates with the 57th Wing Flight Safety by conducting avian point-count surveys around the flight line and maintains state and federal wildlife depredation permits. The NNRP conducts bird surveys at locations around the flight lines at NAFB in an effort to quantify seasonal trends in bird density and abundance in areas within and adjacent to the flight path. The NNRP has also conducted small mammal trapping around the flight lines at NAFB to quantify the prey base for animals such as raptors and coyotes that could pose BASH issues. Additionally, the NNRP supports the removal of vegetation along the flightline and coordinates with Flight Safety on the NAFB Suitable Plant List. The INRMP also helps mitigate BASH management actions that impact or undermine management priorities elsewhere in the INRMP. An example of this is the development of a burrowing owl management plan in response to increased mission development and BASH impacts.

In support of the BASH program, the USFWS annually issues a Depredation at Airports Permit for Migratory Birds to NAFB. Additionally, NDOW issues five separate permits to NAFB: Depredation of foxes, cottontails, quail, migratory birds, and for trapping coyote. These permits are reviewed by the issuing agencies on an annual basis and must be applied for each year. Once granted, these permits allow for lawful take of designated wildlife to reduce safety risks to personnel and damage to aircraft. Continued data sharing and coordination with the USFWS and NDOW is essential to ensure successful BASH mitigation efforts.

7.13 Coastal Zone and Marine Resources Management

Applicability Statement

This section applies to USAF installations that are located along coasts and/or within coastal management zones. This section is not applicable to this installation.

Neither NAFB nor the NTTR contain any coastal or marine areas.

7.14 Cultural Resources Protection

Applicability Statement

This section applies to USAF installations that have cultural resources that may be impacted by natural resource management activities. This section is applicable to this installation.

Program Overview/Current Management Practices

NAFB and the NTTR contain significant cultural resources, many of which have legal protection status. Subsequently, the management of cultural resources is covered by an ICRMP (AFMAN 32-7003 2.17.1). The INRMP and ICRMP are required to be mutually supportive and not in conflict (AFMAN 32-7003 3.12). Further information regarding cultural resources can be found in the 2017 ICRMP.

Continued coordination and collaboration between the natural and cultural resources programs are essential to avoid management conflicts. Natural resources management often involves ground-disturbing activities that could adversely affect historic properties and other cultural resources (AFMAN 32-7003 2.18); conversely, ethnobotanical cultural resources may impact natural resources management. Early and thorough communication between the two programs will ensure efficient management.

Of particular importance is the protection of cultural resources from wildfire and associated management actions and responses. Fire and fuels-management activities must be consistent and comply with the NAFB ICRMP. The areas covered under the WFMP contain significant prehistorical and historical cultural resources. Thus, the NRM will work in coordination with the BLM and wildland fire response personnel to ensure cultural resources are appropriately protected from fire and response actions.

7.15 Public Outreach

Applicability Statement

This section applies to all USAF installations that maintain an INRMP. The installation is required to implement this element.

Program Overview/Current Management Practices

The NNRP holds public outreach events and works with the NAFB Public Affairs office to publish posters and pamphlets for public outreach and personnel training. For example, NAFB participates in the Arbor Day Foundation's Tree City USA program and hosts Arbor Day and Earth Day celebrations each year. Education on the protection of sensitive species is another focus of the outreach program. The NNRP has produced several posters and pamphlets educating staff on avoiding negative impacts on desert tortoises and burrowing owls while conducting mission activities. Other examples of NNRP outreach products include a printed field guide for the area's reptiles and amphibians and a public webpage on the environmental program, accessible at:

https://www.nellis.af.mil/Public-Affairs/Community-Engagement/Partnerships/Environment/

Additional outreach and awareness efforts during the operational period of this INRMP include Mojave desert tortoise awareness materials, and development of a public pollinator bioblitz program. The NNRP may develop an environmental appreciation park within the vicinity of the Area III Conservation Area to provide awareness regarding rare plants and the desert ecosystem if support and funding are provided.

7.16 Climate Change Vulnerabilities

Applicability Statement

This section applies to USAF installations that have identified climate change risks, vulnerabilities, and adaptation strategies using authoritative region-specific climate science, climate projections, and existing tools. This section is applicable to this installation.

Program Overview/Current Management Practices

Climate vulnerability in this case refers to the degree to which an installation and its natural resources are susceptible to the impacts of climate change. Under this definition, installations and their natural resources that are more vulnerable will experience greater harm, while those less vulnerable will be less affected or even benefit from changes. Mission-related vulnerabilities were assessed based on both literature review and spatial and temporal overlap between projected exposures, associated effects such as flooding or drought, and mission requirements. This section will primarily cover natural resource-related impacts, with particular attention to impacts to operations and any potential future impacts from mission expansion. NAFB and the NTTR may be susceptible to the following climate-related issues:

- Significant increases in daily average, maximum, and minimum temperatures, including the number of days with maximum temperatures above 90 °F and the increasingly common occurrence of heat waves.
- In high elevation areas, the contraction of the winter season and the earlier occurrence of spring temperatures and increased unpredictability relating to winter storm formation.
- Reductions in effective water availability for people and ecosystems as a result of higher temperatures and a continuation of the highly variable desert precipitation regime predominant in the area.
- Changes in vegetation, including reduced cover of native vegetation and expansion of invasive grasses (Section 2.3.2.3).
- Greater erosion due to loss of vegetative cover and changing precipitation patterns (Section 2.3.2.3).
- Threats to native wildlife populations that may occur directly through loss of water availability or indirectly via bottom-up losses in the food chain (Section 2.3.3.6).
- Increased stress on threatened and endangered species due to habitat change and reduced food availability (Section 2.3.4.7).
- Threats to the mission, including a greater need for equipment maintenance due to more wind/dust and more frequent drought at the installation (Section 2.4.4.5).
- Increased dust will have a negative effect on soil cryptogamic crust conditions, which will create a feedback loop creating more dust, making ecosystems more likely to be vulnerable to invasive species (e.g., brome grasses) establishment and expansion (Section 7.9.4).
- Shifts in wildfire ignition and intensity driven by change in temperature and precipitation in combination with vegetation changes (Section 7.9.4).
- Greater need for wildlife management activities, including surveys for native and invasive species, to monitor changes driven by shifting environmental conditions (Section 7.9.4).

Climate change is widely associated with extreme weather events; those of larger magnitudes and intensities may occur more frequently under a changing climate (Trenberth 2011). Increased occurrence of extreme temperatures and increasing storm intensities could increase maintenance requirements for infrastructure (e.g., cooling buildings and electrical equipment, repairing heat and weather damage to roads and coastal structures) and strain electrical supply. High temperatures and more dangerous extreme weather events may also disrupt global supply chains and increase acquisition costs for equipment and infrastructure (Pinson et al. 2020). Warmer temperatures are likely to create additional stress on ecosystems and may reduce habitat quality across the installation through increased prevalence and persistence of invasive species.

Drought conditions are likely to increase in occurrence and intensity throughout NAFB and the NTTR region, mainly as a result of higher temperatures and a continuation of the region's highly variable low

precipitation climate regime. Drought can negatively impact military installations in numerous ways. Effects include heightened physiological stress in plants and animals, leading to increased susceptibility to pests and pathogens and increased risk of vegetation mortality and die-off events (Stein et al. 2019). Specific to military readiness, droughts combined with high temperatures can damage military infrastructure, exacerbate heat-related illnesses, increase energy consumption to provide additional cooling for facilities, and lead to cracks in the soil that can rupture utility lines and road surfaces (DoD 2019, Pinson et al. 2020).

Climate change can also impact military operations by altering how the DoD and its installations maintain readiness and provide support. Extreme weather events in regions already prone to flooding and restricted water supplies can create instability, requiring additional military resources. Training activities at NAFB and the NTTR could be impacted by localized flash flooding, especially in mountain drainage areas. Fire may also impact mission activities in the region, especially in mountain transition zones already prone to wildfire that are likely to face increasing risks as the century unfolds, due to drought episodes, long-term drying, and threats from fire-prone invasive species.

NAFB and the NTTR face significant and evolving vulnerabilities to climate change, and resources and time will be required to successfully adapt to these challenges. Adaptation will require that the installation assess current operations and procedures to identify vulnerability gaps. Once identified, considerations will need to be integrated across all organizational levels to manage associated risks. Mitigation and adaptation will also require collaboration with internal and external stakeholders to ensure the installation's mission is not compromised (DoD 2021*a*). Several resources are available to guide adaptation within the DoD (Naval Facilities Engineering Command 2017; Stein et al. 2019; Pinson et al. 2020, 2021).

7.17 Geographic Information Systems (GIS)

Applicability Statement

This section applies to all USAF installations that maintain an INRMP, since all geospatial information must be maintained within the USAF GeoBase system. The installation is required to implement this element.

Program Overview/Current Management Practices

GIS is an integral tool for natural resources management. The NNRP team uses GIS in the management of NAFB and the NTTR. GIS resources are used to generate maps for planning field survey efforts and visualizing geospatial data. Furthermore, GIS resources are used in the analysis of natural resources datasets and the development of products such as outreach posters and technical reports. Natural resources datasets managed by the NNRP team include potential habitat layers for sensitive species, species observations records from surveys, vegetation community maps, and layers showing the coverage of ground and aerial surveys.

A current effort of this INRMP will be to ensure high-resolution aerial imagery will be obtained periodically to support all natural resource planning efforts. Imagery will be shared upon request with partner agencies once internally approved.

7.17.1 Geographic Information Systems Data Standards

Maintaining quality control of GIS resources is essential. The NNRP is working as part of a USAF-wide effort to standardize GIS data and ensure that GIS resources are in compliance with USAF GeoBase programmatic guidelines. GeoBase is the Air Force Installation Geospatial Information and Services

program for GIS that was established to support management of installation infrastructure and environmental resources and maintain compliance with AFI 32-10112. GeoBase is based on the most recent Spatial Data Standards for Facilities, Infrastructure, and Environment version.

8.0 MANAGEMENT GOALS AND OBJECTIVES

The NNRP has established long-term goals, objectives, and projects for management and protection of natural resource assets integral to carrying out the military mission. The goals described are purposeful, long-term ambitions for military mission support and are the primary focus of this INRMP. Theobjectives are focused and updated management strategies set to help achieve the goals. Finally, the projects are initiatives or actions taken by managers to complete the objectives. Projects identified may be ongoing or planned. While all projects are subject to funding and logistics, greater and timely access opportunities for implementing and completing meaningful projects is required. Because the INRMP's implementation supports the overall military mission, the primary military mission takes precedence over the guidance provided by the INRMP; however, execution of the primary military mission may be modified where appropriate and possible to meet the goals and objectives of the INRMP. Detailed information regarding survey effort is provided as a guide; however, actual field effort must take into account other mission requirements, staffing and escort availability, weather conditions, and funding. The NNRP will coordinate and share data of established protocols and results of surveys with appropriate external agencies (BLM, NDOW, USFWS, and USGS) for projects related to monitoring wildlife and habitat on the NTTR. Many entities vie for time on the NTTR, but the NNRP works hard to plan ahead, create backup plans, and adjust as necessary to accomplish its own natural resource mission.

Installation Supplement—Management Goals and Objectives

GOAL 1 ENSURE LONG-TERM WILDLIFE AND ECOSYTEM VIABILITY ON NAFB AND THE NTTR IN SUPPORT OF THE MILITARY MISSION BY CONDUCTING TARGETED SURVEYS AND MONITORING FOR THREATENED, ENDANGERED, AND SENSITIVE SPECIES.

Objective 1.1 Continue to survey and monitor for Mojave desert tortoise populations using methods approved by the USFWS and existing BOs with consideration of projected increasing temperatures and changing precipitation.

Project 1.1.1 Conduct up to 40 field days of surveys for Mojave desert tortoise on NAFB and the NTTR, including up to 6 days of helicopter use for accessing remote areas that cannot be reached by road.

Project 1.1.2 In addition to the 40 field days planned in Project 1.1.1, expand existing Mojave tortoise surveys to include tortoise health assessment measurements, DNA sample collection and analysis, use of VHF radio transmitters and shell-attached GPS loggers, and application of unique identification tag, as approved by USFWS.

Objective 1.2 Conduct surveys to support management of golden eagles and inform management decisions.

Project 1.2.1 Conduct up to eight days of helicopter surveys for nesting golden eagles on the NTTR.

Project 1.2.2 Conduct up to eight days of prey-base surveys on NTTR such that each survey route is covered twice in the course of the year, once in the spring and once in the fall to fully capture the prey base availability through the year.

Project 1.2.3 Determine feasibility and utility of attaching GPS transmitters to golden eagle chicks through collaboration with USFWS to inform regional knowledge of eagle movements on and off of the NTTR.

Objective 1.3 Survey and monitor migratory birds to document biodiversity and inform management decisions

Project 1.3.1 Conduct up to 10 burrowing owl surveys on the NTTR.

Project 1.3.2 Conduct up to 30 Stationary Point Counts on NAFB and the NTTR.

Project 1.3.3 Survey up to three days for wintering raptors on the North Range of the NTTR.

Project 1.3.4 Conduct up to four days of winter powerline surveys for raptors.

Project 1.3.5 Conduct up to eight call-playback surveys for burrowing owls or other sensitive bird species.

Project 1.3.6 Collaborate with the PIF Pinyon Jay Working Group to establish a pinyon jay survey protocol to be implemented annually.

Objective 1.4 Conduct focused surveys and monitoring on state sensitive fauna and installation-defined candidate species to inform management and future listing decisions.

Project 1.4.1 Conduct 30 surveys of established transects for Mojave fringe-toed lizard and collect genetic samples from PIT or elastomer-tagged lizards.

Project 1.4.2 Collaborate with the USGS to conduct genetic analyses of the Mojave fringe-toed lizard genetic sampling.

Project 1.4.3 Monitor nesting burrowing owls on NAFB using up to 50 half days. Investigate usage of wildlife cameras to monitor nesting burrowing owls.

Project 1.4.4 Annually conduct up to four days of call playback surveys for burrowing owls on NAFB.

Project 1.4.5 Annually conduct up to four days of call playback surveys for burrowing owls on the NTTR.

Project 1.4.6 Conduct up to four days for color banding burrowing owls on NAFB. Banding will allow for identification of individual owls and year to year monitoring. Investigate different trapping techniques to increase capture rate. Collect genetic samples while banding owls and provide to the USFWS for analysis.

Project 1.4.7 Using data collected in Project 1.4.6 and previous data collection efforts, develop a burrowing owl management plan.

Project 1.4.8 Determine feasibility and utility of banding LeConte's and Bendire's thrashers to obtain further information on population demographics and aid in protection and management.

Project 1.4.9 Annually survey known populations of Las Vegas bearpoppy for Mojave poppy bee, a potential candidate species for federal listing. Share any relevant data with USFWS to inform listing decisions.

Project 1.4.10 Expand monitoring for Mojave poppy bee at mojave poppy bee locations.

Project 1.4.11 Conduct surveys for the management of the Western bumble bee.

Project 1.4.12 Survey for milkweeds on NAFB and the NTTR to monitor for monarch activity and habitat. Provide observations to the Western Monarch Milkweed Mapper (https://www.monarchmilkweedmapper.org/).

Project 1.4.13 Identify locations on the installation where milkweed could be planted, as described in the BMPs developed for the DoD (McNight et al. 2021). Consider locations where monarch activity could be used for education and outreach purposes, potentially including tagging.

Project 1.4.14 Conduct up to four sessions of small mammal live trapping, with a focus on SGCN species, where one session is a minimum of three nights/four days with 400 traps open each night, on NAFB and the NTTR. Collect genetic samples for captured individuals to be analyzed in collaboration with the NDOW. Collect vegetation data concurrently within the plots to quantify changes in response to a changing climate.

Project 1.4.15 Conduct surveys to document indirect impacts of wild horses and burros on small mammal communities, through measurements of soil and vegetation.

Objective 1.5 Survey and monitor the bat communities on NAFB and the NTTR to determine presence and abundance parameters to inform management decisions.

Project 1.5.1 Conduct up to 5 mist-netting sessions at appropriate habitats on NAFB, and band SGCNs per NDOW Scientific Collection Permit.

Project 1.5.2 Deploy and monitor up to four acoustic recording devices in appropriate habitats around NAFB and the SAR. Recorders will be left out year-round to monitor changes in bat populations, activity levels, and diversity.

Project 1.5.3 Conduct up to 10 mist-netting sessions at appropriate habitats on the NTTR, and wing-band SGCNs per NDOW Scientific Collection Permit.

Project 1.5.4 Deploy and monitor up to 16 acoustic recording devices at appropriate habitats across the NTTR. Recording devices will be deployed year-round to monitor changes in bat populations, activity levels, and diversity. Additionally, deploy acoustic monitors to support NABat monitoring grids for up to two weeks on the NTTR.

Objective 1.6 Monitor for sensitive plant species to inform future management and protection.

Project 1.6.1 Continue annually revisiting historically recorded sensitive plant locations on NAFB and the NTTR.

Project 1.6.2 Record GPS points of sensitive plant species discovered incidentally to other surveys to help focus future survey areas on NAFB and the NTTR.

Project 1.6.3 Annually assess Las Vegas buckwheat, Las Vegas bearpoppy, and other rare plants on monitoring plots and other potential locations based on species-distribution models of projected suitable habitat on NAFB.

Objective 1.7 Continue to monitor and conserve bighorn sheep on the NTTR to sustain populations and support stakeholder management efforts.

Project 1.7.1 Use photos taken by remote cameras to determine the presence or absence of bighorn sheep and inform knowledge of population size and demographics. Screen photos for disease detection.

Project 1.7.2 Conduct at least three days of helicopter surveys for bighorn sheep in the fall on the North Range of the NTTR every other year.

Project 1.7.3 Plan and implement bighorn sheep collaring projects in collaboration with NDOW to determine the basic ecology, movements, and level of connectivity between different subpopulations.

Project 1.7.4 Collaborate with NDOW and USFWS to conduct disease and health surveillance monitoring on bighorn sheep for evaluation and removal of infected sheep.

Project 1.7.5 Collaborate with outside partner agencies (USFWS, BLM, NDOW, and USGS) to collar the Desert Range bighorn sheep herd (possibly two herds

north and south) to include collar collection, refurbishment, satellite service, monthly data download and analysis, and report development.

Project 1.7.6 Collaborate with NDOW and USFWS to analyze data for all South Range collaring efforts, including movement analysis, seasonal/daily usage, health assessments, lambing areas, habitat connectivity, etc., to develop posters, presentations, and reports and inform Air Force and NDOW sheep management.

Objective 1.8 Install and maintain wildlife motion sensor cameras and weather data collection instruments at water sources to monitor and document biodiversity and use.

Project 1.8.1 Place up to 15 wildlife cameras annually at water sources throughout the NTTR, and plan for a total of eight helicopter days to collect SD cards and maintain cameras.

Project 1.8.2 Where feasible, install data logger-connected precipitation gauges and temperature sensors at wildlife camera sites to understand microclimate effects and track changes in temperature and precipitation.

Objective 1.9 Inventory and monitor populations of herpetofauna, pronghorn, mesocarnivores, invertebrates, and mollusks for population trends and biodiversity to inform management decisions.

Project 1.9.1 Conduct up to 25 days of diurnal Visual Encounter Surveys for herpetofauna, snake den checks, and cover board checks.

Project 1.9.2 Conduct up to 10 nights of nocturnal visual encounter surveys.

Project 1.9.3 Conduct up to 35 nights of road cruising for herpetofauna.

Project 1.9.4 Conduct up to five days of equipment setup/take down for cover boards, song meters, PIT tag readers, etc.

Project 1.9.5 Deploy up to six acoustic recording devices at different water sources on the NTTR to document amphibians.

Project 1.9.6 Conduct visual inspections for snake fungal disease for snakes encountered during surveys, and swab non-venomous individuals for further testing under the DoD Legacy project.

Project 1.9.7 Conduct up to four days of helicopter surveys for pronghorn in the summer on the NTTR.

Project 1.9.8 Conduct up to four sessions of live trapping mesocarnivores, where one session is three nights/four days on NAFB and the NTTR.

Project 1.9.9 Expand camera trapping efforts to include installing eight scent stations at camera trapping locations to attract mesocarnivores.

Project 1.9.10 Coordinate with Utah and Nevada Spring Snail Conservation Team to implement snail surveys at suitable locations on the NTTR.

Project 1.9.11 Conduct eDNA analyses to determine species of tadpoles observed on the west slope of the Kawich mountains.

Project 1.9.12 Initiate localized survey of insect diversity and abundance, to inform knowledge of invertebrate biodiversity and support insectivorous bats.

Project 1.9.13 Collaborate with NDOW and USGS to collect soil samples from playa beds to determine presence of fairy shrimp on the NTTR.

GOAL 2 SUSTAIN AND PROTECT SENSITIVE PLANT AND ANIMAL SPECIES AND NATURAL HABITATS TO SUPPORT THE MILITARY MISSION AND PRESERVE BIODIVERSITY IN A CHANGING CLIMATE.

Objective 2.1 Avoid impacts to threatened, endangered, and sensitive species and communities.

Project 2.1.1 Maintain comprehensive species lists depicting and describing species locations, population status, native status, regulatory status, rarity, and historical documentation to assist the USAF in identification of sensitive and protected species, habitats, and communities and directives for conforming to environmental regulations governing those resources.

Project 2.1.2 Evaluate feasibility of retrofitting powerline features dangerous to raptors on the NTTR, removing raptor nests perched on dangerous powerline features, and erect alternative replacement nest perches.

Project 2.1.3 Reduce foot and vehicle traffic in areas with known Las Vegas bearpoppy populations to protect the plant and its host, the Mojave poppy bee, which are both in review for listing under ESA.

Objective 2.2 To comply with requirements from ESA consultations, maintain Mojave desert tortoise distribution and density within NAFB and the NTTR.

Project 2.2.1 Coordinate with the USFWS to designate survey areas and establish USFWS-approved monitoring programs that encompass all accessible Mojave desert tortoise habitat on NAFB and the NTTR. Design a survey schedule capable of identifying changes in density and distribution within these areas.

Project 2.2.2 Within the scope of the Biological Assessment, quantify potential local impacts to Mojave desert tortoise populations before military activities are implemented.

Project 2.2.3 Conduct Mojave desert tortoise education for military personnel as needed or requested. Expand Mojave desert tortoise awareness materials, and disseminate an annual Mojave desert tortoise vehicle collision alert via email during high Mojave desert tortoise movement periods.

Project 2.2.4 Reseed up to 100 acres annually with native seed to restore Mojave desert tortoise habitat

Project 2.2.5 In the next 5 years, review and update the 2015 desert tortoise management guidelines.

Project 2.2.6 In the next 5 years, develop, produce, and install road signage for tortoise caution signs and speed limit signs.

Project 2.2.7 To exclude tortoises from areas with harmful military activities, install exclusionary fencing at new developments and expand the fencing at the rock quarry.

Objective 2.3 Comply with the MBTA and ESA.

Project 2.3.1 Conduct 30 days of pre-project surveys for Mojave desert tortoise and nesting birds, and conduct construction monitoring for Mojave desert tortoise on NAFB.

Project 2.3.2 Conduct 15 days for pre-project surveys to detect Mojave desert tortoise, nesting birds, and conduct construction monitoring on the NTTR.

Project 2.3.3 Inspect Mojave desert tortoise fencing in accordance with the Biological Opinion and promptly conduct repairs as needed.

Project 2.3.4 Install and maintain permanent tortoise exclusionary fencing around hazardous areas on the installation.

Objective 2.4 Conduct cleanup and remediation of areas that are critical to protected species habitat and wildlife corridors.

Project 2.4.1 Conduct habitat restoration on a case-by-case basis after events, such as wildfires, crash incidents, chemical spills, and discontinued active use of sites.

Project 2.4.2 Install, maintain, and monitor exclusionary fences around springs and seeps used by wild horses and burros to preserve access to these resources for native species.

Project 2.4.3 Develop NEPA for Project 2.4.2, if determined necessary.

Project 2.4.4 Conduct cleanup of trash and refuse within fenced Area III Conservation Area.

Objective 2.5 Monitor and maintain the protected Area III Conservation Area on NAFB to continue to protect populations of Las Vegas bearpoppy, Las Vegas buckwheat and other sensitive or rare plant species.

Project 2.5.1 Determine a conservation strategy to monitor and sustain documented occurrences of Las Vegas bearpoppy, Las Vegas buckwheat, and Las Vegas cat's eye.

Objective 2.6 Assess and mitigate impact of disturbance on vegetation communities, demonstrating mitigation effectiveness (including restoration) in short, medium, and long time periods.

Project 2.6.1 Update and refine GIS and maps, and address data gaps with sampling efforts on NDOW Key Habitats.

Project 2.6.2 Implement post-mitigation monitoring protocols that assess specific metrics of success such as proportion of native and non-native species cover, native species recruitment, non-native species infestation, usage by native animal species, and erosion. Determine appropriate monitoring intervals based on the type of disturbance, restoration or mitigation practices used, and ecological site conditions to inform management and adapt mitigation protocols.

Project 2.6.3 Identify areas of the NTTR with no further plans for active use, such as roads and two-tracks, burn scars, and areas infested with invasive species that could be restored, to Mojave desert tortoise habitat, or reduce wildfire risk.

Objective 2.7 Conduct vegetation classification and ground-truthing surveys during appropriate survey windows, according to nationally recognized standards, to improve accuracy and utility of vegetation and habitat maps and track changes in vegetation as temperatures increase and precipitation decreases.

Project 2.7.1 Delineate and classify up to 25,000 acres of vegetation to the alliance level on the NTTR, annually.

Project 2.7.2 Summarize and update NDOW Key Habitats known to occur on the NTTR.

Project 2.7.3 Conduct up to 30 days of vegetation classification on the NTTR, eight of which may require the use of a helicopter to access remote sites. The first half of the spring vegetation classification season will focus on a single range on

the South Range each year, and the second half will focus on a single range in the North Range.

Project 2.7.4 Determine the feasibility and utility of using software programs to annually delineate vegetation classifications to show annual changes caused by variable precipitation and increasing temperatures.

Project 2.7.5 Determine the feasibility and utility of incorporating BLM Assessment, Inventory, and Monitoring Strategy (AIM) long-term vegetation monitoring plots) into the NTTR vegetation monitoring program.

Project 2.7.6 Survey pinyon pine to increase understanding of food and habitat resources for pinyon-dependent wildlife species including pinyon jay.

Objective 2.8 Monitor water quality parameters of seep and spring locations on the installation to assess presence/absence of water at historical springs, document field conditions, and assess forage opportunities and water availability for native wildlife.

Project 2.8.1 Conduct eight days of surveys over a seven-year cycle to perform wetlands delineations and where possible, complete testing of water parameters (e.g., pH, temperature, conductivity, sampling depth, dissolved oxygen, salinity) at seeps and springs across the NTTR. Collaborate with NDOW to participate in surveys. Up to six days of helicopter may be needed to access remote areas.

Project 2.8.2 Conduct a study of groundwater sources on the NTTR to better describe and quantify continued water availability for native wildlife, in a changing climate.

Project 2.8.3 Install soil moisture sensors and conduct ongoing soil moisture monitoring, compiling monthly and annual trends to compare with results of ongoing vegetation classification surveys, particularly in wetland and spring/springbrook areas to better understand moisture regimes and to better track losses/impacts to these valuable habitats under a changing climate.

Objective 2.9 Monitor and control invasive plant species populations for early detection and eradication or sustained treatment efforts to comply with Executive Orders 13112 and 13751.

Project 2.9.1 Annually survey up to 400 acres, over approximately eight days, for invasive plant species on the NTTR. Monitor areas of previous invasive species treatment to plan for future removal projects in case of regrowth (~20 acres).

Project 2.9.2 Annually conduct up to four days of surveys for invasive plant species, covering approximately 200 acres on NAFB.

Project 2.9.3 Apply pre-emergent herbicide to Bromus species infestations on the NTTR.

Project 2.9.4 Apply herbicides to the road network between Tolicha Peak and Black Mountain to reduce invasive annual grass and to create a fire break to slow the or stop the movement of fire in this fire prone region.

Project 2.9.5 Annually treat invasive Sahara mustard, tamarisk, or other NNIS species on NAFB Area II, on Wells Annex, and other sites on NAFB.

Project 2.9.6 Continue pilot study of treating cheatgrass infestations with carbon source, to include the effectiveness of the method and long-term effects on vegetation and carbon cycling. If feasible conduct acres of additional treatments annually.

Project 2.9.7 Survey roadsides and borrow pits for malta star thistle on NAFB (~250 acres).

Objective 2.10 Monitor for non-native, feral, and potentially invasive animal and pest species to ensure early detection of northward or upward range shifts and new introductions.

Project 2.10.1 Continue to monitor non-native gecko populations and bullfrogs incidental to other herpetological work, and work with partners to determine if control work is necessary and feasible.

Project 2.10.2 Work with BLM partners to document damage to soils, vegetation, and water resources from wild horses and burros and determine feasible strategies to mitigate the negative effects to native species.

Objective 2.11 Improve natural resources education and quality of life by providing educational opportunities and outdoor recreation sites that also sustain biodiversity.

Project 2.11.1 Develop an environmental appreciation park in the Area III Conservation Area for base residents to benefit the long-term protection of rare plants and other species. This conservation area will provide public access by construction of an elevated boardwalk that protects soils and vegetation but provides walking/jogging and biking opportunities. This will be enhanced with railings, and shaded picnic areas.

Project 2.11.2 Develop a simple pollinator monitoring survey that can be conducted by the public in an annual "Bioblitz" to raise awareness of the DoD's commitment to supporting pollinators IAW Presidential Memorandum 14946 – Creating a Federal Strategy to Promote the Health of Honey Bees and Other Pollinators. Coordinate timing of Bioblitz with events such as monarch migration and/or key floral blooming periods, and distribute educational materials such as those found through the Pollinator Partnership.

Project 2.11.3 Maintain and enhance NAFB Tree City USA recognition by continuing urban forestry initiatives including maintenance of the tree inventory, development of an urban forestry plan, and working with Nevada Department of Forestry to acquire and plant landscaping trees along walkways and common areas.

Project 2.11.4 Perform educational outreach for community awareness of sensitive species and ecological communities through sign installation, training, posters, pamphlets, field guides, etc.

GOAL 3 MAINTAIN COMPLIANCE WITH FEDERAL, STATE, LOCAL, AND MILITARY REGULATIONS

Objective 3.1 Maintain required federal, state, and local plans and permits, such as the INRMP, WFMP, NAFB IPMP, and BASH plan, and associated permits.

Project 3.1.1 Ensure all installation development and survey/monitoring protocols follow current PBO requirements and guidance.

Project 3.1.2 Obtain and maintain state and federal permits for INRMP GOP and permits to support BASH.

Project 3.1.3 Maintain a Wildland Fire Management Plan and review MOU with cooperators for fire suppression assistance.

Project 3.1.4 Collaborate with 57th Wing Flight Safety to share avian point-count data and BASH bird fatalities information.

Project 3.1.5 Conduct NEPA for federal depredation permit implementation.

Objective 3.2 Maintain interdepartmental and interagency cooperation (planning, meeting, data sharing) to ensure protocols are followed and to avoid work redundancy.

Project 3.2.1 Collaborate with the NDOW for annual bighorn sheep surveys.

Project 3.2.2 Collaborate with external agencies (NDOW, USFWS, and USGS) for complex monitoring projects of desert bighorn sheep to verify and characterize environmental relationships interior and exterior to the NTTR regarding population and habitat connectivity, establishing and maintaining population health profiles, population trends, and finalizing a robust predictive habitat-use model, based in part on spatial and temporal habitat-use patterns.

Project 3.2.3 Collaborate with the USFWS on management activities for bighorn sheep on the South Range so that management activities are as compatible as is practical and possible with the DNWR Comprehensive Conservation Plan and the SMP.

Project 3.2.4 Collaborate with the BLM on surveys for wild horses and vegetation utilization, which may be done in conjunction with other annual surveys. Conduct rangeland utilization surveys to inform horse and burro management to protect vegetation and water/riparian resources and preserve these for native species' use.

Project 3.2.5 Consult the BLM invasive species specialist before initiating any invasive species control projects on the North Range of the NTTR. Coordinate with the USFWS before initiating any invasive species-control projects on the South Range. Any herbicides used shall be reviewed for pollinator impacts using the U.S. Air Force Pollinator Conservation Strategy and Reference Guide (USFWS 2017).

Project 3.2.6 Conduct biannual meetings between NRMs and Nellis pest management office to increase communication and support mutually beneficial pest management actions on base.

Project 3.2.7 Develop and maintain collaborative relationships with federal and state agencies, as well as non-governmental organizations such as PIF, GBBO, and Partners in Amphibian and Reptile Conservation (PARC), to standardize surveying and monitoring protocols, contribute to the greater knowledge of species occurring on the installation, and to increase the capacity for effective habitat management and good stewardship of these bird species across their ranges.

Project 3.2.8 Coordinate with seed collection organizations to collect representative seed samples of NTTR plant species to stabilize, rehabilitate, and restore degraded land.

GOAL 4 PROTECT LIFE, PROPERTY, AND RESOURCES FROM WILDFIRE AT COSTS COMMENSURATE WITH VALUES AT RISK.

Objective 4.1 Reduce hazardous fuels around infrastructure and in strategic locations to reduce the potential impact of wildfire.

Project 4.1.1 Reduce the threat of wildfire to the Cedar Peak power line infrastructure by treating up to 150 acres of hazardous fuel accumulation.

Project 4.1.2 Reduce the threat of wildfire to Black Mountain by treating up to150 acres of hazardous fuel accumulation.

Project 4.1.3 Reduce the threat of wildfire to Stonewall by treating up to 20 acres of hazardous fuel accumulation.

Project 4.1.4 Reduce the threat of wildfire to Belted Peak by treating up to 20 acres of hazardous fuel accumulation.

Project 4.1.5 Use herbicides to treat roadsides with invasive grasses to create firebreaks.

Project 4.1.6 Coordinate Wildland Fire and Invasive Species initiatives to reduce large-scale infestations of *Bromus* species to decrease wildfire risks, especially in Tolicha Peak Electronic Combat Range (TPECR) and R77.

Project 4.1.7 Collaborate with BLM to ensure that sensitive resources on NAFB and the NTTR are mapped and avoidance and minimization measures are clearly defined and readily available for incident command staff during firefighting activities.

Project 4.1.8 Review all fuels reduction activities for pollinator impacts using the U.S. Air Force Pollinator Conservation Strategy and Reference Guide (USFWS 2017).

Objective 4.2 Obtain site-specific fire weather data to inform wildland fire response operations.

Project 4.2.1 Coordinate with BLM to determine feasibility of installing up to two Remote Automatic Weather Stations (RAWS) on the NTTR.

GOAL 5 UPDATE THE NATURAL RESOURCES MANAGEMENT DATABASE AND GIS TO COMPLY WITH SDSFIE STANDARDS AND PROVIDE THE FOUNDATION FOR MANAGEMENT.

Objective 5.1 Enhance data utility and quality to provide ready access and easily inform management decisions.

Project 5.1.1 Create and compile environmental GIS layers and maps for biological and non-biological resources including, and not limited to, species occurrences, vegetative communities, soils, water, climate variables, topography, landscape, geology, etc., occurring across the installation and incorporate these into GeoBase.

Project 5.1.2 Update and acquire high-resolution aerial imagery every five years or as needed to monitor and document biological and non-biological resource expansions, reductions, and changes over time. Imagery shall be shared upon request with partner agencies once the NTTR Office has reviewed it.

Project 5.1.3 Maintain a comprehensive record of all wildfire ignition sources and report them to the Air Force Wildland Fire Center.

Project 5.1.4 Ensure data collected during surveys and monitoring are submitted for entry into federal and state supported databases, such as the AKN and NABat. Additionally, work with federal and state partners to ensure local and regional data are considered when making management decisions for bats and avian species.

Project 5.1.5 Provide data upon request to federal and state agencies, universities, and others.

Objective 5.2 Maintain quality control on data collection, data entry, and database management.

Project 5.2.1 Maintain spatial databases in compliance with USAF GeoBase Program (under AFI 32-10112) to ensure proper metadata record keeping and standardization of geographic coordinate systems and projections.

Objective 5.3 Maintain standardized protocols for data collection, quality assurance and quality control of data entry across natural resources projects.

Project 5.3.1 Coordinate and collaborate with federal and state agencies, as well as non-governmental organizations, periodically where appropriate and possible to ensure that standardized protocols for data collection and analysis are up to date with the best available science.

9.0 INRMP IMPLEMENTATION, UPDATE, AND REVISION PROCESS

9.1 Natural Resources Management Staffing and Implementation

9.1.1 Implementation

This INRMP is dynamic and has, as one objective, the integration of natural resources management with the installation's mission. For INRMP goals and objectives to be effectively implemented, guidelines provided in the INRMP should be considered early in the planning and budget processes for proposed projects and mission changes on the installation. GIS database and modeling tools recommended as part of the INRMP should be used to assist the USAF in the decision-making process.

The INRMP describes management of a living, dynamic system, and therefore will require occasional modification to reflect changes in the system. At the same time, the military mission changes with the needs of national defense, and the INRMP must be sufficiently flexible to accommodate those changes. Because the INRMP is based on guidance documents that may be periodically modified or replaced, and natural resources, which undergo constant cycling and change, periodic review and modification of the INRMP is required by AFMAN 32-7003. According to those regulations, installations, in cooperation with the USFWS and NDOW, must update the INRMP at least once every five years. Updates may also be required in shorter periods of time where changes in the military mission and changes in environmental compliance requirements significantly affect the ability of the installation to implement the INRMP. An annual review of the INRMP should be conducted by NAFB in coordination with the USFWS and NDOW to verify that:

- all “must fund” projects and activities have been budgeted for and implementation is on schedule; sufficient numbers of professionally trained natural resources management and law enforcement personnel are available and assigned responsibility to perform tasks associated with the preparation and implementation of the INRMP per the Sikes Act, Section 107;
- projects and activities for the upcoming year have been identified and included in the INRMP;
- all required coordination with the USFWS and NDOW has occurred; and
- any significant changes to the installation’s mission requirements or natural resources have been identified.

The overall function of the INRMP is to implement ecosystem management at NAFB and the NTTR by setting goals for attaining desired land conditions. According to AFMAN 32-7003, the USAF principles for ecosystem management include the following.

- Maintenance or restoration of native ecosystem types across their natural range where practical and consistent with the military mission.
- Maintenance or restoration of ecological processes, such as fire and other disturbance regimes, where practical and consistent with the military mission.
- Maintenance and restoration of the hydrological processes in streams, floodplains, and wetlands when feasible.
- Use of regional approaches to implement ecosystem management on the installation by collaboration with other DoD components, as well as other state, federal, and local agencies and adjoining property owners.
- Allowance for outdoor recreation, agricultural production, harvesting of forest products, and other practical utilization of the land and its resources if such use does not inflict long-term ecosystem damage or negatively impact the USAF mission. Because of security issues and mission goals at the NTTR, public use of land is highly restricted.

Implementation of the INRMP will be subject to NEPA requirements. An EA is prepared for INRMPs undergoing a revision. As this is an update, no new NEPA review was conducted. A new NEPA analysis will be conducted after 2021, the expiration of the current land withdrawal. All relevant environmental compliance documents and historical reports or opinions will be provided in PDF format on compact disks included with the INRMP.

USAF environmental compliance review is initiated with the submittal of Air Force Form 813, the Request for Environmental Impact Analysis. Project proponents generally submit a Description of Proposed Action and Alternatives in support of their submittal, enabling decision-makers to have sufficient information on which to base their review and conclusions. Form 813 is completed by 99 CES, which uses the conclusions to determine the documentation necessary, if any, to fully comply with NEPA. The INRMP provides information on existing conditions and potential impacts to use in support of completing Form 813.

The following resources, listed as potential issues by ACC, are not found on NAFB or the NTTR

- commercial forestry - no commercially viable forest is present,
- coastal zone management – no coastal zones are present as NAFB and the NTTR are inland installations,
- agricultural outleasing - the Bald Mountain limited grazing allotment on the Groom Range administered by the BLM is the only agricultural outleasing opportunity that exists on NAFB and the NTTR, and
- hazardous materials - these materials are contained and emergency response protocols are in place to prevent environmental damage resulting from flash floods.

9.1.2 Natural Resources Management Staffing

Currently, NAFB and the NTTR have the following positions devoted either full time or part time to natural resources management.

- NRM—Devoted full time to the management of natural resources on NAFB and the NTTR. Given the size of the installation, there are two NRMs assigned to NAFB and the NTTR. NRMs coordinate all activities at all locations (1) to ensure that natural resources are conserved without significantly impacting the goals and objectives of the military mission; (2) to coordinate mission activities with appropriate federal and state regulatory agencies when required; (3) to ensure that NAFB and the NTTR fully comply with the goals, objectives, and management guidelines stated in the INRMP.; and (4) to ensure the USAF is making informed decisions based on survey data.
- NEPA Manager—Coordinates all activities potentially impacting the environment and requiring preparation of EAs or EISs. Coordinates these activities with the NRMs, as necessary.

Presently, most of the responsibility for resource management falls on the NRMs, who spends most of their time addressing USAF activities potentially impacting natural resources and coordinating the activities of contractors and regulatory agencies involving natural resources management. Most of the surveys, reports, and monitoring being conducted at NAFB and the NTTR are accomplished on a contractual basis with independent consultants.

9.1.3 The Integrated Natural Resource Management Plan

At the direction of the ACC, 99 ABW, Base Civil Engineer (99 CES), 99 CES/CEIEA has prepared this INRMP to serve as a practical management guide for the natural resources on NAFB and the NTTR. The INRMP incorporates statutory and regulatory requirements, presidential directives and EOs, DoD and

USAF natural resources management policies, available regulatory guidance documents, and current natural resource data for NAFB and the NTTR to produce a practical guidance document that recognizes and respects the goals and objectives of the Nellis mission while conserving the natural resources of these areas. Natural resources management, as outlined by the INRMP, is intended to provide and sustain suitable landscapes for military activities without compromising ecosystem health. To meet that end, the INRMP provides base personnel with past and present natural resource information on NAFB and the NTTR through a GIS database, directs the user to additional background information, and recommends guidance to assist the user in making informed decisions that allow for proper ecosystem management.

The INRMP was prepared by 99 CES, but it involved contributions from other sources. Extensive time and effort was provided by various groups within NAFB and the NTTR. Other important contributors to the INRMP outside of the USAF include the USACE, BLM, USFWS, NDOW, NDF, The Nature Conservancy, and the general public.

9.1.3.1 Monitoring and Evaluating Attainment of Goals and Objectives

The primary ecosystem management goal of scientific data collection and ecosystem monitoring will be to develop a working understanding of the structure, composition, and health of regional and installation ecosystems. Data will be collected and evaluated to support the IC with the conservation and rehabilitation of natural resources consistent with the use of the installation and its mission.

Due to the ecological diversity encompassed by NAFB and the NTTR, which includes portions of two desert ecoregions, natural resource management initiatives require careful planning. Data collection and monitoring activities must focus on useful information for environmental managers. Data in the past have been assembled in files, reports, and maps. With this INRMP, the NNRP will begin presenting the findings in a GIS format. This allows military and environmental personnel to analyze, visualize and query the data. As more data are collected and as the military mission changes or expands, the 99 CES will continue to refine and develop GIS databases and models to use as tools to make sound management decisions.

The need for additional data regarding natural resources is evident. Natural resource management requires obtaining focused data sets to understand how components of the ecosystem interact with and affect each other and the military. Indicator species within specific plant communities can be selected and periodically monitored to assess the overall health of those communities. Existing data from previous and ongoing studies and research efforts will be augmented with carefully designed surveys that will provide the most pertinent information in the most cost-effective manner. Staff from 99 CES collects and compiles environmental management information from sources in a broad variety of disciplines to help achieve this goal. As more elements of the natural resources found on NAFB and the NTTR are described and catalogued in GIS, management decisions for the military mission will be more informed.

To achieve effective ecosystem management, other monitoring efforts will be needed. These include periodically surveying for rare or sensitive species populations and documenting shifts in the distribution of vegetation and animal communities. Monitoring allows managers to evaluate the health of an ecosystem before, during, and after management activities, thus meeting the goal of conservation of biodiversity within the constraints of NAFB and the NTTR's mission.

9.1.3.2 Management Guidelines

To meet the goals and objectives of the INRMP, natural resource management guidelines have been prepared. The guidelines section for resource management offers recommendations, suggestions, and other information that will allow resource managers and other planners to minimize or avoid impacts to natural

resources, identify environmental permitting issues, and allow for judicious management of natural resources at NAFB and the NTTR.

9.2 Monitoring INRMP Implementation

A spreadsheet will be developed as a tracking tool to follow the completion of projects proposed by the INRMP for the five years following INRMP approval. The NNRP annually prepares a report describing accomplishments of that year's projects. The annual report should also include a discussion of problems and issues encountered in the implementation of the INRMP, as well as methods to improve implementation of the INRMP. As previously discussed, the INRMP update will be approved by ABW and provided to the USFWS, BLM, and NDOW for their files. Methods to improve implementation of the INRMP to meet its goals and objectives should be discussed with these agencies.

9.3 Annual Integrated Natural Resources Management Plan Review and Update Requirements

The preliminary draft of this INRMP was reviewed by the 99 CES, the installation Environmental Safety and Occupational Health Council (ESOHC), the NTTR, the HQ ACC Asset Management Division (AMD), and other reviewers, including the USFWS, NDOW, and BLM. Recently, HQ ACC/AMD conducted a cross-functional team review of the INRMP at ACC to ascertain the review and comments from ACC range operations and planning, environmental planning, pest management, and grounds maintenance staff. The draft plan was distributed for public comment and no significant comments were received. The final plan will be presented to the ESOHC and to ACC Environmental Analysis Branch for concurrence; final approval will be obtained from the 99 ABW/CC, USFWS, and NDOW. Component Management Plans will be approved by 99 ABW/CC and will be revised every two years or as needed. The INRMP will be revised every five years, coordinated with the USFWS and NDOW.

10.0 ANNUAL WORK PLANS

The INRMP Annual Work Plans are included in this section. These projects are listed by fiscal year, including the current year and four succeeding years. For each project and activity, a specific timeframe for implementation is provided (as applicable), as well as the appropriate funding source and priority for implementation. The work plans provide all the necessary information for building a budget within the USAF framework. Priorities are defined as follows:

- High: The INRMP signatories assert that if the project is not funded, the INRMP is not being implemented and the USAF is non-compliant with the Sikes Act; or that it is specifically tied to an INRMP goal and objective and is part of a "Benefit of the Species" determination necessary for ESA Sec 4(a)(3)(B)(i) critical habitat exemption.
- Medium: Project supports a specific INRMP goal and objective and is deemed by INRMP signatories to be important for preventing non-compliance with a specific requirement within a natural resources law or by EO 13112, *Exotic and Invasive Species*. However, the INRMP signatories would not contend that the INRMP is not being implemented if not accomplished within the programmed year due to other priorities.
- Low: Project supports a specific INRMP goal and objective, enhances conservation resources or the integrity of the installation mission, and/or supports long-term compliance with specific requirements within natural resources law; but is not directly tied to specific compliance within the proposed year of execution.

Annual Work Plans—Work Plans should extend out to current year plus four additional years.

Goal	Objective	Occurrence	FY	Report Title	Priority Level	Project Number	Description
1	1.1	Recurring	All	Mojave Desert Tortoise	High	1.1.1	Conduct up to 40 field days of surveys for Mojave desert tortoise on NAFB and the NTTR, including up to 6 days of helicopter use for accessing remote areas that cannot be reached by road.
1	1.2	Recurring	All	Mojave Desert Tortoise	High	1.1.2	In addition to the 40 field days planned in Project 1.1.1, expand existing Mojave desert tortoise surveys to include tortoise health assessment measurements, DNA sample collection and analysis, use of VHF radio transmitters and shell-attached GPS loggers, and application of unique identification tag, as approved by USFWS.
1	1.2	Recurring	All	Golden Eagles	High	1.2.1	Conduct up to eight days of helicopter surveys for nesting golden eagles on the NTTR.
1	1.2	Recurring	All	Golden Eagles	Medium	1.2.2	Conduct up to eight days of prey-base surveys on NTTR such that each survey route is covered twice in the course of the year, once in the spring and once in the fall to fully capture the prey base availability through the year.
1	1.2	One-time	TBD	Golden Eagles	Low	1.2.3	Determine feasibility and utility of attaching GPS transmitters to golden eagle chicks through collaboration with USFWS to inform regional knowledge of eagle movements on and off of the NTTR.
1	1.3	Recurring	All	Candidate Species	High	1.3.1	Conduct up to 10 burrowing owl surveys on the NTTR.
1	1.3	Recurring	All	Birds	High	1.3.2	Conduct up to 30 Stationary Point Counts on NAFB and the NTTR.
1	1.3	Recurring	All	Birds	Medium	1.3.3	Survey up to three days for wintering raptors on the North Range of the NTTR.
1	1.3	Recurring	All	Birds	Medium	1.3.4	Conduct up to four days of winter powerline surveys for raptors.
1	1.3	Recurring	All	Candidate Species and Birds	Medium	1.3.5	Conduct up to eight call-playback surveys for burrowing owls or other sensitive bird species.
1	1.3	As needed	TBD	Birds	High	1.3.6	Collaborate with the PIF Pinyon Jay Working Group to establish a pinyon jay survey protocol to be implemented annually.

Annual Work Plans—Work Plans should extend out to current year plus four additional years.

Goal	Objective	Occurrence	FY	Report Title	Priority Level	Project Number	Description
1	1.4	Recurring	All	Candidate Species	High	1.4.1	Conduct 30 surveys of established transects for Mojave fringe-toed lizard and collect genetic samples from PIT or elastomer-tagged lizards.
1	1.4	One-time	FY25	Reptiles and Amphibians	High	1.4.2	Collaborate with the USGS to conduct genetic analyses of the Mojave fringe-toed lizard genetic sampling.
1	1.4	Recurring	All	Candidate Species and Birds	High	1.4.3	Monitor nesting burrowing owls on NAFB using up to 50 half days. Investigate usage of wildlife cameras to monitor nesting burrowing owls.
1	1.4	Recurring	All	Candidate Species and Birds	Medium	1.4.4	Annually conduct up to four days of call playback surveys for burrowing owls on NAFB.
1	1.4	Recurring	All	Candidate Species and Birds	Medium	1.4.5	Annually conduct up to four days of call playback surveys for burrowing owls on the NTTR.
1	1.4	Recurring	All	Candidate Species and Birds	High	1.4.6	Conduct up to four days for color banding burrowing owls on NAFB. Banding will allow for identification of individual owls and year to year monitoring. Investigate different trapping techniques to increase capture rate. Collect genetic samples while banding owls and provide to the USFWS for analysis.
1	1.4	As needed	TBD	Candidate Species and Birds	Low	1.4.7	Using data collected in Project 1.4.6 and previous data collection efforts, develop a burrowing owl management plan.
1	1.4	As needed	TBD	Birds	Low	1.4.8	Determine feasibility and utility of banding LeConte's and Bendire's thrashers to obtain further information on population demographics and aid in protection and management.
1	1.4	Recurring	All	Candidate Species	High	1.4.9	Annually survey known populations of Las Vegas bearpoppy for Mojave poppy bee, a potential candidate species for federal listing. Share any relevant data with USFWS to inform listing decisions.
1	1.4	Recurring	All	Candidate Species	High	1.4.10	Expand monitoring for Mojave poppy bee at mojave poppy bee locations.
1	1.4	TBD	TBD		Low	1.4.11	Conduct surveys for the management of the Western bumble bee.

Annual Work Plans—Work Plans should extend out to current year plus four additional years.

Goal	Objective	Occurrence	FY	Report Title	Priority Level	Project Number	Description
1	1.4	TBD	TBD		Low	1.4.12	Survey for milkweeds on NAFB and the NTTR to monitor for monarch activity and habitat. Provide observations to the Western Monarch Milkweed Mapper (https://www.monarchmilkweedmapper.org/).
1	1.4	TBD	TBD		Low	1.4.13	Identify locations on the installation where milkweed could be planted, as described in the BMPs developed for the DoD (McNight et al. 2021). Consider locations where monarch activity could be used for education and outreach purposes, potentially including tagging.
1	1.4	Recurring	All	Species at Risk	Medium	1.4.14	Conduct up to four sessions of small mammal live trapping, with a focus on SGCN species, where one session is a minimum of three nights/four days with 400 traps open each night, on NAFB and the NTTR. Collect genetic samples for captured individuals to be analyzed in collaboration with the NDOW. Collect vegetation data concurrently within the plots to quantify changes in response to a changing climate.
1	1.4	Recurring	All	Species at Risk and Vegetation	Low	1.4.15	Conduct surveys to document indirect impacts of wild horses and burros on small mammal communities, through measurements of soil and vegetation.
1	1.5	Recurring	All	Bats	High	1.5.1	Conduct up to 5 mist-netting sessions at appropriate habitats on NAFB, and band SGCNs per NDOW Scientific Collection Permit.
1	1.5	Recurring	All	Bats	High	1.5.2	Deploy and monitor up to four acoustic recording devices in appropriate habitats around NAFB and the SAR. Recorders will be left out year-round to monitor changes in bat populations, activity levels, and diversity.
1	1.5	Recurring	All	Bats	High	1.5.3	Conduct up to 10 mist-netting sessions at appropriate habitats on the NTTR, and wing-band SGCNs per NDOW Scientific Collection Permit.
1	1.5	Recurring	All	Bats	High	1.5.4	Deploy and monitor up to 16 acoustic recording devices at appropriate habitats across the NTTR. Recording devices will be deployed year-round to monitor changes in bat populations, activity levels, and diversity. Additionally, deploy acoustic monitors to support NABat monitoring grids for up to two weeks on the NTTR.

Annual Work Plans—Work Plans should extend out to current year plus four additional years.

Goal	Objective	Occurrence	FY	Report Title	Priority Level	Project Number	Description
1	1.6	Recurring	All	Rare Plants	Medium	1.6.1	Continue annually revisiting historically recorded sensitive plant locations on NAFB and the NTTR.
1	1.6	Recurring	All	Rare Plants	High	1.6.2	Record GPS points of sensitive plant species discovered incidentally to other surveys to help focus future survey areas on NAFB and the NTTR.
1	1.6	Recurring	All	Rare Plants	High	1.6.3	Annually assess Las Vegas buckwheat, Las Vegas bearpoppy, and other rare plants on monitoring plots and other potential locations based on species-distribution models of projected suitable habitat on NAFB.
1	1.7	Recurring	All	Large mammals	High	1.7.1	Use photos taken by remote cameras to determine the presence or absence of bighorn sheep and inform knowledge of population size and demographics. Screen photos for disease detection.
1	1.7	Biennial	Even years	Large mammals	High	1.7.2	Conduct at least three days of helicopter surveys for bighorn sheep in the fall on the North Range of the NTTR every other year.
1	1.7	As needed	TBD		High	1.7.3	Plan and implement bighorn sheep collaring projects in collaboration with NDOW to determine the basic ecology, movements, and level of connectivity between different subpopulations.
1	1.7	As needed	TBD	Large mammals	High	1.7.4	Collaborate with NDOW and USFWS to conduct disease and health surveillance monitoring on bighorn sheep for evaluation and removal of infected sheep.
1	1.7	As needed	TBD	Large mammals	Medium	1.7.5	Collaborate with outside partner agencies (USFWS, BLM, NDOW, and USGS) to collar the Desert Range bighorn sheep herd (possibly two herds north and south) to include collar collection, refurbishment, satellite service, monthly data download and analysis, and report development.
1	1.7	As needed	TBD	Large mammals	High	1.7.6	Collaborate with NDOW and USFWS to analyze data for all South Range collaring efforts, including movement analysis, seasonal/daily usage, health assessments, lambing

Annual Work Plans—Work Plans should extend out to current year plus four additional years.

Goal	Objective	Occurrence	FY	Report Title	Priority Level	Project Number	Description
							areas, habitat connectivity, etc., to develop posters, presentations, and reports and inform Air Force and NDOW sheep management.
1	1.8	Recurring	All	All	High	1.8.1	Place up to 15 wildlife cameras annually at water sources throughout the NTTR, and plan for a total of eight helicopter days to collect SD cards and maintain cameras.
1	1.8	As needed	TBD		Low	1.8.2	Where feasible, install data logger-connected precipitation gauges and temperature sensors at wildlife camera sites to understand microclimate effects and track changes in temperature and precipitation.
1	1.9	Recurring	All	Reptiles and Amphibians	Medium	1.9.1	Conduct up to 25 days of diurnal Visual Encounter Surveys for herpetofauna, snake den checks, and cover board checks.
1	1.9	Recurring	All	Reptiles and Amphibians	Medium	1.9.2	Conduct up to 10 nights of nocturnal visual encounter surveys
1	1.9	Recurring	All	Reptiles and Amphibians	Medium	1.9.3	Conduct up to 35 nights of road cruising for herpetofauna.
1	1.9	Recurring	All	Reptiles and Amphibians	Medium	1.9.4	Conduct up to five days of equipment setup/take down for cover boards, song meters, PIT tag readers, etc.
1	1.9	As needed	TBD	Reptiles and Amphibians	Medium	1.9.5	Deploy up to six acoustic recording devices at different water sources on the NTTR to document amphibians.
1	1.9	As needed	TBD	Reptiles and Amphibians	Low	1.9.6	Conduct visual inspections for snake fungal disease for snakes encountered during surveys, and swab non-venomous individuals for further testing under the DoD Legacy project.
1	1.9	Recurring	All	Large mammals	Medium	1.9.7	Conduct up to four days of helicopter surveys for pronghorn in the summer on the NTTR.
1	1.9	Recurring	All	Species at Risk	Medium	1.9.8	Conduct up to four sessions of live trapping mesocarnivores, where one session is three nights/four days on NAFB and the NTTR.

Annual Work Plans—Work Plans should extend out to current year plus four additional years.

Goal	Objective	Occurrence	FY	Report Title	Priority Level	Project Number	Description
1	1.9	Recurring	All	Species at Risk	Low	1.9.9	Expand camera trapping efforts to include installing eight scent stations at camera trapping locations to attract mesocarnivores.
1	1.9	As needed	TBD		Low	1.9.10	Coordinate with Utah and Nevada Spring Snail Conservation Team to implement snail surveys at suitable locations on the NTTR.
1	1.9	As needed	TBD	Reptiles and Amphibians	Low	1.9.11	Conduct eDNA analyses to determine species of tadpoles observed on the west slope of the Kawich mountains.
1	1.9	As needed	TBD		Low	1.9.12	Initiate localized survey of insect diversity and abundance, to inform knowledge of invertebrate biodiversity and support insectivorous bats.
1	1.9	As needed	TBD		Low	1.9.13	Collaborate with NDOW and USGS to collect soil samples from playa beds to determine presence of fairy shrimp on the NTTR.
2	2.1	Recurring	All	All	High	2.1.1	Maintain comprehensive species lists depicting and describing species locations, population status, native status, regulatory status, rarity, and historical documentation to assist the USAF in identification of sensitive and protected species, habitats, and communities and directives for conforming to environmental regulations governing those resources.
2	2.1	As needed	TBD	Birds	Low	2.1.2	Evaluate feasibility of retrofitting powerline features dangerous to raptors on the NTTR, removing raptor nests perched on dangerous powerline features, and erect alternative replacement nest perches.
2	2.1	As needed	TBD	Rare Plants	Low	2.1.3	Reduce foot and vehicle traffic in areas with known Las Vegas bearpoppy populations to protect the plant and its host, the Mojave poppy bee, which are both in review for listing under ESA.
2	2.2	Recurring	All	Mojave Desert Tortoise	High	2.2.1	Coordinate with the USFWS to designate survey areas and establish USFWS-approved monitoring programs that encompass all accessible Mojave desert tortoise habitat on

Annual Work Plans—Work Plans should extend out to current year plus four additional years.

Goal	Objective	Occurrence	FY	Report Title	Priority Level	Project Number	Description
							NAFB and the NTTR. Design a survey schedule capable of identifying changes in density and distribution within these areas.
2	2.2	As needed	TBD	Mojave Desert Tortoise	High	2.2.2	Within the scope of the Biological Assessment, quantify potential local impacts to Mojave desert tortoise populations before military activities are implemented.
2	2.2	Recurring	All	Mojave Desert Tortoise	High	2.2.3	Conduct Mojave desert tortoise education for military personnel As needed or requested. Expand Mojave desert tortoise awareness materials, and disseminate an annual Mojave desert tortoise vehicle collision alert via email during high Mojave desert tortoise movement periods.
2	2.2	As needed	TBD	Mojave Desert Tortoise and Vegetation	Medium	2.2.4	Reseed up to 100 acres annually with native seed to restore Mojave desert tortoise habitat.
2	2.2	One time	TBD	Mojave Desert Tortoise	Low	2.2.5	In the next 5 years, review and update the 2015 desert tortoise management guidelines.
2	2.2	One time	FY24-25	Mojave Desert Tortoise	High	2.2.6	In the next 5 years, develop, produce, and install road signage for tortoise caution signs and speed limit signs.
2	2.2	As needed	TBD	Mojave Desert Tortoise	High	2.2.7	To exclude tortoises from areas with harmful military activities, install exclusionary fencing at new developments and expand the fencing at the rock quarry.
2	2.3	As needed	TBD	Mojave Desert Tortoise and Birds	High	2.3.1	Conduct 30 days of pre-project surveys for Mojave desert tortoise and nesting birds, and conduct construction monitoring for Mojave desert tortoise on NAFB.
2	2.3	As needed	TBD	Mojave Desert Tortoise and Birds	High	2.3.2	Conduct 15 days for pre-project surveys to detect Mojave desert tortoise, nesting birds, and conduct construction monitoring on the NTTR.
2	2.3	Recurring	All	Mojave Desert Tortoise	High	2.3.3	Inspect Mojave desert tortoise fencing in accordance with the Biological Opinion and promptly conduct repairs As needed.
2	2.3	Recurring	TBD	Mojave Desert Tortoise	High	2.3.4	Install and maintain permanent tortoise exclusionary fencing around hazardous areas on the installations.

Annual Work Plans—Work Plans should extend out to current year plus four additional years.

Goal	Objective	Occurrence	FY	Report Title	Priority Level	Project Number	Description
2	2.4	As needed	TBD	Mojave Desert Tortoise	Medium	2.4.1	Conduct habitat restoration on a case-by-case basis after events, such as wildfires, crash incidents, chemical spills, and discontinued active use of sites.
2	2.4	As needed	All	Wetlands	High	2.4.2	Install, maintain, and monitor exclusionary fences around springs and seeps used by wild horses and burros to preserve access to these resources for native species.
2	2.4	One time	FY24		High	2.4.3	Develop NEPA for Project 2.4.2, if determined necessary.
2	2.4	As needed	TBD		High	2.4.4	Conduct cleanup of trash and refuse within fenced Area III Conservation Area.
2	2.5	Recurring	TBD	Rare Plants	High	2.5.1	Determine a conservation strategy to monitor and sustain documented occurrences of Las Vegas bearpoppy, Las Vegas buckwheat, and Las Vegas cat's eye.
2	2.6	Recurring	TBD	Vegetation and Unique Habitats	Medium	2.6.1	Update and refine GIS and maps, and address data gaps with sampling efforts on NDOW Key Habitats.
2	2.6	As needed	TBD	Vegetation	Medium	2.6.2	Implement post-mitigation monitoring protocols that assess specific metrics of success such as proportion of native and non-native species cover, native species recruitment, non-native species infestation, usage by native animal species, and erosion. Determine appropriate monitoring intervals based on the type of disturbance, restoration or mitigation practices used, and ecological site conditions to inform management and adapt mitigation protocols.
2	2.6	As needed	TBD	Vegetation, Mojave Desert Tortoise, and Invasives	Low	2.6.3	Identify areas of the NTTR with no further plans for active use, such as roads and two-tracks, burn scars, and areas infested with invasive species that could be restored, to Mojave desert tortoise habitat, or reduce wildfire risk.
2	2.7	Recurring	All	Vegetation	Medium	2.7.1	Delineate and classify up to 25,000 acres of vegetation to the alliance level on the NTTR, annually.
2	2.7	Recurring	TBD		Medium	2.7.2	Summarize and update NDOW Key Habitats known to occur on the NTTR.
2	2.7	Recurring	All	Vegetation	Medium	2.7.3	Conduct up to 30 days of vegetation classification on the NTTR, eight of which may require the use of a helicopter to access remote sites. The first half of the spring

Annual Work Plans—Work Plans should extend out to current year plus four additional years.

Goal	Objective	Occurrence	FY	Report Title	Priority Level	Project Number	Description
							vegetation classification season will focus on a single range on the South Range each year, and the second half will focus on a single range in the North Range.
2	2.7	As needed	TBD	Vegetation	Medium	2.7.4	Determine the feasibility and utility of using software programs to annually delineate vegetation classifications to show annual changes caused by variable precipitation and increasing temperatures.
2	2.7	As needed	TBD	Vegetation	Low	2.7.5	Determine the feasibility and utility of incorporating BLM Assessment, Inventory, and Monitoring Strategy (AIM long-term vegetation monitoring plots) into the NTTR vegetation monitoring program.
2	2.7	Recurring	TBD	Vegetation	Low	2.7.6	Survey pinyon pine to increase understanding of food and habitat resources for pinyon-dependent wildlife species including pinyon jay.
2	2.8	Recurring	All	Wetlands	High	2.8.1	Conduct eight days of surveys over a seven-year cycle to perform wetlands delineations and where possible, complete testing of water parameters (e.g., pH, temperature, conductivity, sampling depth, dissolved oxygen, salinity) at seeps and springs across the NTTR. Collaborate with NDOW to participate in surveys. Up to six days of helicopter may be needed to access remote areas.
2	2.8	One time	FY25-26	Wetlands	High	2.8.2	Conduct a study of groundwater sources on the NTTR to better describe and quantify continued water availability for native wildlife, in a changing climate.
2	2.8	Recurring	All	Wetlands	Medium	2.8.3	Install soil moisture sensors and conduct ongoing soil moisture monitoring, compiling monthly and annual trends to compare with results of ongoing vegetation classification surveys, particularly in wetland and spring/springbrook areas to better understand moisture regimes and to better track losses/impacts to these valuable habitats under a changing climate.
2	2.9	Recurring	All	Invasives	Medium	2.9.1	Annually survey up to 400 acres, over approximately eight days, for invasive plant species on the NTTR. Monitor areas of previous invasive species treatment to plan for future removal projects in case of regrowth (~20 acres).

Annual Work Plans—Work Plans should extend out to current year plus four additional years.

Goal	Objective	Occurrence	FY	Report Title	Priority Level	Project Number	Description
2	2.9	Recurring	All	Invasives	Medium	2.9.2	Annually conduct up to four days of surveys for invasive plant species, covering approximately 200 acres on NAFB.
2	2.9	Recurring	All	Invasives	High	2.9.3	Apply pre-emergent herbicide to Bromus species infestations on the NTTR.
2	2.9	Recurring	All	Invasives	High	2.9.4	Apply herbicides to the road network between Tolicha Peak and Black Mountain to reduce invasive annual grass and to create a fire break to slow the or stop the movement of fire in this fire prone region.
2	2.9	Recurring	All	Invasives	High	2.9.5	Annually treat invasive Sahara mustard, tamarisk, or other NNIS species on NAFB Area II, on Wells Annex, and other sites on NAFB.
2	2.9	Recurring	FY24-25	Invasives	Low	2.9.6	Continue pilot study of treating cheatgrass infestations with carbon source, to include the effectiveness of the method and long-term effects on vegetation and carbon cycling. If feasible conduct acres of additional treatments annually.
2	2.9	Recurring	All	Invasives	Medium	2.9.7	Survey roadsides and borrow pits for malta star thistle on NAFB (~250 acres).
2	2.10	Recurring	All	Reptiles and Amphibians	Low	2.10.1	Continue to monitor non-native gecko populations and bullfrogs incidental to other herpetological work, and work with partners to determine if control work is necessary and feasible.
2	2.10	Recurring	TBD	Large mammals	Low	2.10.2	Work with BLM partners to document damage to soils, vegetation, and water resources from wild horses and burros and determine feasible strategies to mitigate the negative effects to native species.
2	2.11	As needed	TBD	Rare Plants	Medium	2.11.1	Develop an environmental appreciation park in the Area III Conservation Area for base residents to benefit the long-term protection of rare plants and other species. This conservation area will provide public access by construction of an elevated boardwalk that protects soils and vegetation but provides walking/jogging and biking opportunities. This will be enhanced with railings, and shaded picnic areas.

Annual Work Plans—Work Plans should extend out to current year plus four additional years.

Goal	Objective	Occurrence	FY	Report Title	Priority Level	Project Number	Description
2	2.11	One-time	TBD		Low	2.11.2	Develop a simple pollinator monitoring survey that can be conducted by the public in an annual "Bioblitz" to raise awareness of the DoD's commitment to supporting pollinators IAW Presidential Memorandum 14946 – Creating a Federal Strategy to Promote the Health of Honey Bees and Other Pollinators. Coordinate timing of Bioblitz with events such as monarch migration and/or key floral blooming periods, and distribute educational materials such as those found through the Pollinator Partnership.
2	2.11	Recurring	All	Urban Forestry	Low	2.11.3	Maintain and enhance NAFB Tree City USA recognition by continuing urban forestry initiatives including maintenance of the tree inventory, development of an urban forestry plan, and working with Nevada Department of Forestry to acquire and plant landscaping trees along walkways and common areas.
2	2.11	Recurring	All		Low	2.11.4	Perform educational outreach for community awareness of sensitive species and ecological communities through sign installation, trainings, posters, pamphlets, field guides, etc.
3	3.1	As needed	As needed		High	3.1.1	Ensure all installation development and survey/monitoring protocols follow current PBO requirements and guidance.
3	3.1	Recurring	All		High	3.1.2	Obtain and maintain state and federal permits for INRMP GOP and permits to support BASH.
3	3.1	Recurring	All		High	3.1.3	Maintain a Wildland Fire Management Plan and review MOU with cooperators for fire suppression assistance.
3	3.1	Recurring			High	3.1.4	Collaborate with 57th Wing Flight Safety to share avian point-count data and BASH bird fatalities information.
3	3.2	Biennial	Even years	Large mammals	High	3.2.1	Collaborate with the NDOW for annual bighorn sheep surveys.
3	3.2	One-time	TBD	Large mammals	Low	3.2.2	Collaborate with external agencies (NDOW, USFWS, and USGS) for complex monitoring projects of desert bighorn sheep to verify and characterize environmental

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Goal	Objective	Occurrence	FY	Report Title	Priority Level	Project Number	Description
							relationships interior and exterior to the NTTR regarding population and habitat connectivity, establishing and maintaining population health profiles, population trends, and finalizing a robust predictive habitat-use model, based in part on spatial and temporal habitat-use patterns.
3	3.2	Recurring	All	Large mammals	Medium	3.2.3	Collaborate with the USFWS on management activities for bighorn sheep on the South Range so that management activities are as compatible as is practical and possible with the DNWR Comprehensive Conservation Plan and the SMP.
3	3.2	Biennial	Odd years	Large mammals	Medium	3.2.4	Collaborate with the BLM on surveys for wild horses and vegetation utilization, which may be done in conjunction with other annual surveys. Conduct rangeland utilization surveys to inform horse and burro management to protect vegetation and water/riparian resources and preserve these for native species' use.
3	3.2	Recurring	All	Invasives	High	3.2.5	Consult the BLM invasive species specialist before initiating any invasive species control projects on the North Range of the NTTR. Coordinate with the USFWS before initiating any invasive species-control projects on the South Range. Any herbicides used shall be reviewed for pollinator impacts using the U.S. Air Force Pollinator Conservation Strategy and Reference Guide (USFWS 2017).
3	3.2	Annual	All		Low	3.2.6	Conduct annual meetings between NRMs and Nellis pest management office to increase communication and support mutually beneficial pest management actions on base.
3	3.2	Recurring	All		Low	3.2.7	Develop and maintain collaborative relationships with federal and state agencies, as well as non-governmental organizations such as PIF, GBBO, and Partners in Amphibian and Reptile Conservation (PARC), to standardize surveying and monitoring protocols, contribute to the greater knowledge of species occurring on the installation, and to increase the capacity for effective habitat management and good stewardship of these bird species across their ranges.

Annual Work Plans—Work Plans should extend out to current year plus four additional years.

Goal	Objective	Occurrence	FY	Report Title	Priority Level	Project Number	Description
3	3.2	As needed	TBD		Low	3.2.8	Coordinate with seed collection organizations to collect representative seed samples of NTTR plant species to stabilize, rehabilitate, and restore degraded land.
4	4.1	Recurring	All		High	4.1.1	Reduce the threat of wildfire to the Cedar Peak power line infrastructure by treating up to 150 acres of hazardous fuel accumulation.
4	4.1	Recurring	FY23-24		High	4.1.2	Reduce the threat of wildfire to Black Mountain by treating up to150 acres of hazardous fuel accumulation.
4	4.1	TBD	TBD		Medium	4.1.3	Reduce the threat of wildfire to Stonewall by treating up to 20 acres of hazardous fuel accumulation.
4	4.1	TBD	TBD		Medium	4.1.4	Reduce the threat of wildfire to Belted Peak by treating up to 20 acres of hazardous fuel accumulation.
4	4.1	Recurring	All		High	4.1.5	Use herbicides to treat roadsides with invasive grasses to create firebreaks.
4	4.1	Recurring	All		High	4.1.6	Coordinate Wildland Fire and Invasive Species initiatives to reduce large-scale infestations of Bromus species to decrease wildfire risks, especially in Tolicha Peak Electronic Combat Range (TPECR) and R77.
4	4.1	As needed	TBD		High	4.1.7	Collaborate with BLM to ensure that sensitive resources on NAFB and the NTTR are mapped and avoidance and minimization measures are clearly defined and readily available for incident command staff during firefighting activities.
4	4.1	TBD	TBD		Low	4.1.8	Review all fuels reduction activities for pollinator impacts using the U.S. Air Force Pollinator Conservation Strategy and Reference Guide (USFWS 2017).
4	4.2	As needed	TBD		Low	4.2.1	Coordinate with BLM to determine feasibility of installing up to two Remote Automatic Weather Stations (RAWS) on the NTTR.
5	5.1	Recurring	All	All	Medium	5.1.1	Create and compile environmental GIS layers and maps for biological and non-biological resources including, and not limited to, species occurrences, vegetative communities,

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Goal	Objective	Occurrence	FY	Report Title	Priority Level	Project Number	Description
							soils, water, climate variables, topography, landscape, geology, etc., occurring across the installation and incorporate these into GeoBase.
5	5.1	As needed	TBD		Low	5.1.2	Update and acquire high-resolution aerial imagery every five years or As needed to monitor and document biological and non-biological resource expansions, reductions, and changes over time. Imagery shall be shared upon request with partner agencies once the NTTR Office has reviewed it.
5	5.1	Recurring	All		Medium	5.1.3	Maintain a comprehensive record of all wildfire ignition sources and report them to the Air Force Wildland Fire Center.
5	5.1	Recurring	TBD		High	5.1.4	Ensure data collected during surveys and monitoring are submitted for entry into federal and state supported databases, such as the AKN and NABat. Additionally, work with federal and state partners to ensure local and regional data are considered when making management decisions for bats and avian species.
5	5.1	As needed	All		High	5.1.5	Provide data upon request to federal and state agencies, universities, and others.
5	5.2	Recurring	All		High	5.2.1	Maintain spatial databases in compliance with USAF GeoBase Program (under AFI 32-10112) to ensure proper metadata record keeping and standardization of geographic coordinate systems and projections.
5	5.2	Recurring	All		High	5.2.2	Coordinate and collaborate with federal and state agencies, as well as non-governmental organizations, periodically where appropriate and possible to ensure that standardized protocols for data collection and analysis are up to date with the best available science.

5468

5469

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11.1 Standard References (Applicable to all US Air Force [AF] installations)

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- Sikes Act
- eDASH Natural Resources Program Page
- Natural Resources Playbook
- DoDI 4715.03, *Natural Resources Conservation Program*
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- AFI 32-10112, *Installation Geospatial Information and Services (IGI&S)*

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12.0 ACRONYMS

12.1 Standard Acronyms (Applicable to all USAF installations)

- eDASH Acronym Library
- Natural Resources Playbook—Acronym Section
- U.S. EPA Terms & Acronyms

12.2 Installation Acronyms

57 WFS	57th Wing Flight Safety
57 WG SE	57th Wing Safety
99 ABW	99th Air Base Wing
99 ABW/CC	99th Air Base Wing Commander
99 CES	99th Civil Engineering Squadron
99 CES/CEIEA	99th Civil Engineering Squadron, Installation Management Flight, Environmental Element, Environmental Assessments Section (previously 99th Civil Engineering Squadron, Asset Management Flight, Environmental Section, Conservation Element)
AB	Nevada Assembly Bill
ACC	Air Combat Command
ACEC	Area of Critical Environmental Concern
AFCEC	U.S. Air Force Civil Engineer Center
AFI	Air Force Instruction
AFMAN	Air Force Manual
AFPD	Air Force Policy Directive
AFRIMS	Air Force Records Management System
AFWC	Air Force Warfare Center
AICUZ	Air Installation Compatible Use Zone
AKN	Avian Knowledge Network
AMD	Asset Management Division
AML	Appropriate Management Level
BA	Biological Assessment
BASH	Bird Aircraft Strike Hazard
BCC	Bird of Conservation Concern
BEEF	Base Engineers Emergency Force
BGEPA	Bald and Golden Eagle Protection Act
BLM	Bureau of Land Management
BMP	Best Management Practice
BO	Biological Opinion
BSk	Arid-Steppe-Cold

BWh	Arid-Desert-Hot
BWk	Arid-Desert-ColdCAFB Creech Air Force Base, formerly Indian Springs Air Force Auxiliary Field
CAS	Corrective Action Site
CAU	Corrective Action Unit
CBD	Center for Biological Diversity
CCVA	Climate Change Vulnerability Assessment
CCSM4	Community Climate System Model 4
CEMML	Center for Environmental Management of Military Lands
CFR	Code of Federal Regulations
CONUS	Continental United States
CRP	Comprehensive Range Plan
CSU	Colorado State University
CWA	Clean Water Act
DAYMET	Daily Surface Weather and Climatological Summaries
DNWR	Desert National Wildlife Range
DoD	Department of Defense
DoDI	Department of Defense Instruction
DoDM	Department of Defense Manual
DoE	Department of Energy
DoI	Department of Interior
DRI	Desert Research Institute
DT	Desert tortoise
DU	Depleted Uranium
EA	Environmental Assessment
ECE	Electronic Combat East
ECS	Electronic Combat South
ECW	Electronic Combat West
EIAP	Environmental Impact Analysis Process
EIS	Environmental Impact Statement
EMS	Environmental Management System
EO	Executive Order
EOD	Explosive Ordnance Disposal
EPA	Environmental Protection Agency
ESA	Endangered Species Act of 1973
ESOHC	Environmental Safety and Occupational Health Leadership Council

6160	GBBO	Great Basin Bird Observatory
6161	GDD	Growing Degree Days
6162	GEM	Golf Course Environmental Management Plan
6163	GFC	Grass Fire Cycle
6164	GIS	Geographic Information System
6165	GP	Base General Plan
6166	GPS	Global Positioning System
6167	GSU	Geographically Separate Unit
6168	HOTDAYS	Average Number of Days Exceeding 90 °F per Year
6169	HQ	Headquarters
6170	IAW	In Accordance With
6171	IC	Incident Commander
6172	ICRMP	Installation Cultural Resources Management Plan
6173	IDP	Installation Development Plan
6174	IGI&S	Installation Geospatial Information and Services
6175	INRMP	Integrated Natural Resources Management Plan
6176	IPaC	Information for Planning and Consultation
6177	IPCC	Intergovernmental Panel on Climate Change
6178	IPMP	Installation Pest Management Plan
6179	IRP	Installation Restoration Program
6180	ISO	International Organization for Standardization
6181	IVC	International Vegetation Classification
6182	LEIS	Legislative Environmental Impact Statement
6183	LMNRA	Lake Mead National Recreation Area
6184	LOCA	Localized Constructed Analogs
6185	MAJCOM	Major Command
6186	MBTA	Migratory Bird Treaty Act of 1918
6187	MFTL	Mojave Fringe-toed Lizard
6188	MLWA	Military Lands Withdrawal Act of 1999
6189	MOU	Memorandum of Understanding
6190	MSS	Mission Sensitive Species
6191	MSL	Mean Sea Level
6192	NABat	North American Bat Monitoring Protocol
6193	NAC	Nevada Administrative Code
6194	NAFB	Nellis Air Force Base
6195	NAFB IPMP	Nellis Air Force Base Installation Pest Management Plan

6196	NBMG	Nevada Bureau of Mining and Geology
6197	NDOF	Nevada Division of Forestry
6198	NEON	National Ecological Observatory Network
6199	NDOW	Nevada Department of Wildlife
6200	NEPA	National Environmental Policy Act
6201	NISC	National Invasive Species Council
6202	NM	National Monument
6203	NDNH	Nevada Department of Natural Heritage
6204	NNIS	Non-native invasive species
6205	NNRP	Nellis Natural Resources Program
6206	NNRM	Nellis Natural Resources Management
6207	NPS	National Park Service
6208	NRC	Nuclear Regulatory Commission
6209	NRM	Natural Resources Manager
6210	NRS	Nevada Revised Statutes
6211	NTTR	Nevada Test and Training Range
6212	NTS	Nevada Test Site (now known as the Nevada National Security Site)
6213	NWAP	Nevada Wildlife Action Plan
6214	NWF	National Wildlife Federation
6215	NWHR	Nevada Wild Horse Range
6216	NWR	National Wildlife Refuge
6217	O&M	Operations and Maintenence
6218	OG	Operations Group
6219	OHRVA	Off Highway Recreational Vehicle Area
6220	OPR	Office of Primary Responsibility
6221	PARC	Partners in Amphibian and Reptile Conservation
6222	PBO	Programmatic Biological Opinion
6223	PIF	Partners in Flight
6224	PIT	Passive Integrated Transponder
6225	PL	Public Law
6226	POC	Point of Contact
6227	PRECIP	Average Annual Precipitation
6228	RAWS	Remote Automatic Weather Station
6229	RCP	Representative Concentration Pathway
6230	RCRA	Resource Conservation and Recovery Act
6231	RDS	Records Disposition Schedule

REDHORSE	Rapid Engineer Deployable Heavy Operational Repair Squadron Engineers
RHDV2	Rabbit Hemorrhagic Disease Virus Type 2
RMP	Resource Management Plan
RPM	Reasonable and Prudent Measures
RSBV2	Rabbit Hemorrhagic Disease Virus Serotype 2
SAR	Small Arms Range
SGCN	Species of Conservation Priority
SOC	Species of Concern
SWPPP	Stormwater Pollution Prevention Plan
TAVE	Average Annual Temperature
T&E	Federally Listed as Threatened or Endangered
TMAX	Annual Average Maximum Temperatures
TMIN	Annual Average Minimum Temperatures
TNC	The Nature Conservancy
TPECR	Tolicha Peak Electronic Combat Range
U.S.	United States
USACE	United States Army Corps of Engineers
USAF	United States Air Force
U.S.C.	United States Code
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
USNVC	United States National Vegetation Classification
WAPT	Wildlife Action Plan Team
WETDAYS	Days with greater than 2 inches of precipitation
WFMP	Wildland Fire Management Plan
WOTUS	Waters of the United States
WSA	Wilderness Study Area

13.0 DEFINITIONS

13.1 Standard Definitions (Applicable to all USAF installations)

- Natural Resources Playbook—Definitions Section

13.2 Installation Definitions

- *Add unique state, local, and installation-specific definitions.*

14.0 APPENDICES

14.1 Standard Appendices

14.1.1 Appendix A. Annotated Summary of Key Legislation Related to Design and Implementation of the INRMP.

Federal Public Laws and Executive Orders	
National Defense Authorization Act of 1989, Public Law (P.L.) 101-189; Volunteer Partnership Cost-Share Program	Amends two Acts and establishes volunteer and partnership programs for natural and cultural resources management on DoD lands.
H.R. 639-25 National Defense Authorization Act of 2021 Title XXVII Subtitle E Section 2843	Extended withdrawal of NAFB and NTTR lands for an additional 25-year from 2021 through 2046.
Defense Appropriations Act of 1991, P.L. 101-511; Legacy Resource Management Program	Establishes the "Legacy Resource Management Program" for natural and cultural resources. Program emphasis is on inventory and stewardship responsibilities of biological, geophysical, cultural, and historic resources on DoD lands, including restoration of degraded or altered habitats.
EO 11514, *Protection and Enhancement of Environmental Quality*	Federal agencies shall initiate measures needed to direct their policies, plans, and programs to meet national environmental goals. They shall monitor, evaluate, and control agency activities to protect and enhance the quality of the environment.
EO 11593, *Protection and Enhancement of the Cultural Environment*	All Federal agencies are required to locate, identify, and record all cultural resources. Cultural resources include sites of archaeological, historical, or architectural significance.
EO 11988, *Floodplain Management*	Provides direction regarding actions of Federal agencies in floodplains, and requires permits from state, territory and Federal review agencies for any construction within a 100-year floodplain and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities for acquiring, managing and disposing of Federal lands and facilities.
EO 11989, *Off-Road vehicles on Public Lands*	Installations permitting off-road vehicles to designate and mark specific areas/trails to minimize damage and conflicts, publish information including maps, and monitor the effects of their use. Installations may close areas if adverse effects on natural, cultural, or historic resources are observed.

EO 11990, *Protection of Wetlands*	Requires Federal agencies to avoid undertaking or providing assistance for new construction in wetlands unless there is no practicable alternative, and all practicable measures to minimize harm to wetlands have been implemented and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities for (1) acquiring, managing, and disposing of Federal lands and facilities; and (2) providing Federally undertaken, financed, or assisted construction and improvements; and (3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.
EO 12088, *Federal Compliance with Pollution Control Standards*	This EO delegates responsibility to the head of each executive agency for ensuring all necessary actions are taken for the prevention, control, and abatement of environmental pollution. This order gives the U.S. Environmental Protection Agency authority to conduct reviews and inspections to monitor federal facility compliance with pollution control standards.
EO 12898, *Environmental Justice*	This EO requires certain federal agencies, including the DoD, to the greatest extent practicable permitted by law, to make environmental justice part of their missions by identifying and addressing disproportionately high and adverse health or environmental effects on minority and low-income populations.
EO 13112, *Invasive Species*	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.
EO 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*	The USFWS has the responsibility to administer, oversee, and enforce the conservation provisions of the Migratory Bird Treaty Act, which includes responsibility for population management (e.g., monitoring), habitat protection (e.g., acquisition, enhancement, and modification), international coordination, and regulations development and enforcement.
EO 14008, *Tackling the Climate Crisis at Home and Abroad*	This EO required the Department of Defense to prioritize action on climate change in policy making and budget processes, in contracting and procurement, and in engagement with state, local, tribal, and territorial governments.
EO 14072, *Strengthening the Nation's Forests, Communities, and Local Economies*	This EO establishes policy to maintain, restore, and conserve the Nation’s forests, to include old growth and mature forests, to limit international deforestation, and to combat climate change and enhance resilience.
Public Law (PL) 93-629	Noxious weed control.
United States Code	
Animal Damage Control Act (7 U.S.C. § 426-426b, 47 Stat. 1468)	Provides authority to the Secretary of Agriculture for investigation and control of mammalian predators, rodents, and birds. DoD installations may enter into cooperative agreements to conduct animal control projects.

Bald and Golden Eagle Protection Act of 1940, as amended; 16 U.S.C. 668-668c	This law provides for the protection of the bald eagle (the national emblem) and the golden eagle by prohibiting, except under certain specified conditions, the taking, possession and commerce of such birds. The 1972 amendments increased penalties for violating provisions of the Act or regulations issued pursuant thereto and strengthened other enforcement measures. Rewards are provided for information leading to arrest and conviction for violation of the Act.
Clean Air Act, (42 U.S.C. § 7401– 7671q, July 14, 1955, as amended)	This Act, as amended, is known as the Clean Air Act of 1970. The amendments made in 1970 established the core of the clean air program. The primary objective is to establish Federal standards for air pollutants. It is designed to improve air quality in areas of the country which do not meet federal standards and to prevent significant deterioration in areas where air quality exceeds those standards.
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (Superfund) (26 U.S.C. § 4611–4682, P.L. 96-510, 94 Stat. 2797), as amended	Authorizes and administers a program to assess damage, respond to releases of hazardous substances, fund cleanup, establish clean-up standards, assign liability, and other efforts to address environmental contaminants. Installation Restoration Program guides cleanups at DoD installations.
Endangered Species Act (ESA) of 1973, as amended; P.L. 93-205, 16 U.S.C. § 1531 et seq.	Protects threatened, endangered, and candidate species of fish, wildlife, and plants and their designated critical habitats. Under this law, no federal action is allowed to jeopardize the continued existence of an endangered or threatened species. The ESA requires consultation with the USFWS and the NOAA Fisheries (National Marine Fisheries Service) and the preparation of a biological evaluation or a biological assessment may be required when such species are present in an area affected by government activities.
Federal Aid in Wildlife Restoration Act of 1937 (16 U.S.C. § 669–669i; 50 Stat. 917) (Pittman-Robertson Act)	Provides federal aid to states and territories for management and restoration of wildlife. Fund derives from sports tax on arms and ammunition. Projects include acquisition of wildlife habitat, wildlife research surveys, development of access facilities, and hunter education.
Federal Environmental Pesticide Act of 1972	Requires installations to ensure pesticides are used only in accordance with their label registrations and restricted-use pesticides are applied only by certified applicators.
Federal Land Use Policy and Management Act, 43 U.S.C. § 1701–1782	Requires management of BLM lands to protect the quality of scientific, scenic, historical, ecological, environmental, and archaeological resources and values, and to preserve and protect certain lands in their natural condition for fish and wildlife habitat. Also requires consideration of commodity production such as timbering.
Federal Noxious Weed Act of 1974, 7 U.S.C. § 2801–2814	The Act provides for the control and management of non-indigenous weeds that injure or have the potential to injure the interests of agriculture and commerce, wildlife resources, or the public health.
Federal Water Pollution Control Act (Clean Water Act [CWA]), 33 U.S.C. §1251–1387	The CWA is a comprehensive statute aimed at restoring and maintaining the chemical, physical, and biological integrity of the nation's waters. Primary authority for the implementation and enforcement rests with the US EPA.

Fish and Wildlife Conservation Act (16 U.S.C. § 2901–2911; 94 Stat. 1322, PL 96-366)	Installations encouraged to use their authority to conserve and promote conservation of nongame fish and wildlife in their habitats.
Fish and Wildlife Coordination Act (16 U.S.C. § 661 et seq.)	Directs installations to consult with the USFWS, or state or territorial agencies to ascertain means to protect fish and wildlife resources related to actions resulting in the control or structural modification of any natural stream or body of water. Includes provisions for mitigation and reporting.
Lacey Act of 1900 (16 U.S.C. § 701, 702, 32 Stat. 187, 32 Stat. 285)	Prohibits the importation of wild animals or birds or parts thereof, taken, possessed, or exported in violation of the laws of the country or territory of origin. Provides enforcement and penalties for violation of wildlife related Acts or regulations.
Leases: Non-excess Property of Military Departments, 10 U.S.C. § 2667, as amended	Authorizes DoD to lease to commercial enterprises Federal land not currently needed for public use. Covers agricultural outleasing program.
Migratory Bird Treaty Act 16 U.S.C. § 703–712	The Act implements various treaties for the protection of migratory birds. Under the Act, taking, killing, or possessing migratory birds is unlawful without a valid permit.
Military Lands Withdrawal Act (MLWA) of 1999, Public Law (PL) 106-65	Delineates responsibility of DoI and DoD for management of resources on withdrawn lands.
National Environmental Policy Act of 1969 (NEPA), as amended; P.L. 91-190, 42 U.S.C. § 4321 et seq.	Requires federal agencies to take a systematic approach when assessing environmental impacts of government activities. Establishes the use of environmental impact statements. NEPA proposes an interdisciplinary approach in a decision-making process designed to identify unacceptable or unnecessary impacts on the environment. The Council of Environmental Quality (CEQ) created Regulations for Implementing the National Environmental Policy Act [40 Code of Federal Regulations (CFR) Parts 1500– 1508], which provide regulations applicable to and binding on all Federal agencies for implementing the procedural provisions of NEPA, as amended.
National Historic Preservation Act, 16 U.S.C. § 470 et seq.	Requires federal agencies to take account of the effect of any federally assisted undertaking or licensing on any district, site, building, structure, or object included in or eligible for inclusion in the National Register of Historic Places (NRHP). Provides for the nomination, identification (through listing on the NRHP), and protection of historical and cultural properties of significance.
National Trails Systems Act (16 U.S.C. § 1241–1249)	Provides for the establishment of recreation and scenic trails.
National Wildlife Refuge Acts	Provides for establishment of National Wildlife Refuges through purchase, land transfer, donation, cooperative agreements, and other means.
National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. § 668dd–668ee)	Provides guidelines and instructions for the administration of Wildlife Refuges and other conservation areas.

Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. § 3001–13; 104 Stat. 3042), as amended	Established requirements for the treatment of Native American human remains and sacred or cultural objects found on Federal lands. Includes requirements on inventory, and notification.
Rivers and Harbors Act of 1899 (33 U.S.C. § 401 et seq.)	Makes it unlawful for the USAF to conduct any work or activity in navigable waters of the United States without a federal permit. Installations should coordinate with the U.S. Army Corps of Engineers (USACE) to obtain permits for the discharge of refuse affecting navigable waters under National Pollutant Discharge Elimination System (NPDES) and should coordinate with the USFWS to review effects on fish and wildlife of work and activities to be undertaken as permitted by the USACE.
Sale of certain interests in land, 10 U.S.C. § 2665	Authorizes sale of forest products and reimbursement of the costs of management of forest resources.
Soil and Water Conservation Act (16 U.S.C. § 2001, P.L. 95-193)	Installations shall coordinate with the Secretary of Agriculture to appraise, on a continual basis, soil/water-related resources. Installations will develop and update a program for furthering the conservation, protection, and enhancement of these resources consistent with other federal and local programs.
Sikes Act (16 U.S.C. § 670a–670l, 74 Stat. 1052), as amended	Provides for the cooperation of DoD, the Departments of the Interior, USFWS, and the State Fish and Game Department in planning, developing, and maintaining fish and wildlife resources on a military installation. Requires development of an INRMP and public access to natural resources and allows collection of nominal hunting and fishing fees. NOTE: AFMAN 32-7003 sec 3.11. INRMP Implementation. As defined in DoDI 4715.03, use professionally trained natural resources management personnel with a degree in the natural sciences to develop and implement the installation INRMP. (T-0). 3.9.1. Outsourcing Natural Resources Management. As stipulated in the Sikes Act, 16 U.S.C. § 670 et. seq., the Office of Management and Budget Circular No. A-76, Performance of Commercial Activities, August 4, 1983 (Revised May 29, 2003) does not apply to the development, implementation and enforcement of INRMPs. Activities that require the exercise of discretion in making decisions regarding the management and disposition of government owned natural resources are inherently governmental. When it is not practicable to use DoD personnel to perform inherently governmental natural resources management duties, obtain these services from federal agencies having responsibilities for the conservation and management of natural resources.
Policy Memo for Implementation of Sikes Act Improvement Amendments, HQ USAF Environmental Office (USAF/ILEV), dated 29 January 1999	Outlines the USAF interpretation and explanation of the Sikes Act and Improvement Act of 1997.

Wild Horses and Burros Act (16 U.S.C. 1331–1340; 85 Stat. 649)	Authorized the BLM to manage and control wild horses and burros.
Wild Free-Roaming Horse and Burro Act of 1971, as amended	Requires the protection, management, and control of wild free-roaming horses and burros on public lands.
National Wildlife Refuge Administration Act of 1988	Establishes a unifying mission for the refuge system, and defines a process for determining compatible uses for refuges and the requirements for preparing comprehensive conservation plans for refuges. The Act states that the major mission of the National Wildlife Refuge (NWR) System is wildlife conservation. The Act also reinforces and expands the "compatibility standard" of the Refuge Recreation Act; thus, it authorizes the Secretary to permit the use of any area within the refuge system for any purpose, including but not limited to hunting, fishing, public recreation and accommodations, and access whenever the Secretary determines such uses are compatible with the major uses for which the areas were established. The only real limitation to use is that it be compatible with wildlife.
DoD Policy, Directives, and Instructions	
DoD Instruction 4150.07 *DoD Pest Management Program* dated 29 May 2008	Implements policy, assigns responsibilities, and prescribes procedures for the DoD Integrated Pest Management Program.
DoD Instruction 4715.1, *Environmental Security*	Establishes policy for protecting, preserving, and (when required) restoring and enhancing the quality of the environment. This instruction also ensures environmental factors are integrated into DoD decision-making processes that could impact the environment, and are given appropriate consideration along with other relevant factors.
DoD Instruction (DoDI) 4715.03, *Natural Resources Conservation Program*	Implements policy, assigns responsibility, and prescribes procedures under DoDI 4715.1 for the integrated management of natural and cultural resources on property under DoD control. States that INRMP contents should contain an assessment of natural resource management that includes effects of climate change.
OSD Policy Memorandum, 17 May 2005—*Implementation of Sikes Act Improvement Amendments: Supplemental Guidance Concerning Leased Lands*	Provides supplemental guidance for implementing the requirements of the Sikes Act in a consistent manner throughout DoD. The guidance covers lands occupied by tenants or lessees or being used by others pursuant to a permit, license, right of way, or any other form of permission. INRMPs must address the resource management on all lands for which the subject installation has real property accountability, including leased lands. Installation commanders may require tenants to accept responsibility for performing appropriate natural resource management actions as a condition of their occupancy or use, but this does not preclude the requirement to address the natural resource management needs of these lands in the installation INRMP.

OSD Policy Memorandum, 1 November 2004— *Implementation of Sikes Act Improvement Act Amendments: Supplemental Guidance Concerning INRMP Reviews*	Emphasizes implementing and improving the overall INRMP coordination process. Provides policy on scope of INRMP review, and public comment on INRMP review.
OSD Policy Memorandum, 10 October 2002— *Implementation of Sikes Act Improvement Act: Updated Guidance*	Provides guidance for implementing the requirements of the Sikes Act in a consistent manner throughout DoD and replaces the 21 September 1998 guidance Implementation of the Sikes Act Improvement Amendments. Emphasizes implementing and improving the overall INRMP coordination process and focuses on coordinating with stakeholders, reporting requirements and metrics, budgeting for INRMP projects, using the INRMP as a substitute for critical habitat designation, supporting military training and testing needs, and facilitating the INRMP review process.
MOU between DoD, USFWS, International Association of Fish and Wildlife Agencies on Cooperative Integrated Natural Resource Program on Military Installations, dated 31 January 2006	This MOU ensures that the INRMP is developed in a manner to complement the management guidelines presented in the Nevada State Wildlife Action Plan and the USFWS Comprehensive Conservation Plan for DNWR.
MOU between DoD and USDA Natural Resources Conservation Service, dated 8 November 2006, on Cooperative Natural Resource Conservation	Includes partnering with the National Resources Conservation Service, state officials, and private landowners in the development of land management practices.
Watchable Wildlife MOU	Conservation organizations and federal agencies, including USAF, agree to develop program.
MOU Between the U.S. DoD and USFWS to Promote the Conservation of Migratory Birds, dated 5 September 2014	Protection of migratory birds with respect to military mission activities.
MOU between DoD and Bat Conservation International	Provides guidance for conservation of bats on military installations.
DoD Directive 4715.21, Climate Change Adaptation and Resilience	Directs DoD Component Heads to integrate climate considerations into DoD policies, guidance, plans, and operations; assess and manage risks to built and natural infrastructure, including changes to natural resource management; and leverage authoritative environmental prediction sources for appropriate data analysis products to assess weather/climate impacts.

USAF Instructions and Directives	
AFI 32-1015, *Integrated Installation Planning* and 32 CFR Part 898, as amended	This publication establishes a comprehensive and integrated planning framework for development/redevelopment of Air Force installations. Provides guidance and responsibilities in the EIAP for implementing INRMPs. Implementation of an INRMP constitutes a major federal action and therefore is subject to evaluation through an Environmental Assessment or an Environmental Impact Statement.
AFMAN 32-7003, *Environmental Conservation*	Implements AFPD 32-70, *Environmental Quality;* DoDI 4715.03, *Natural Resources Conservation Program*; and DoDI 7310.5, *Accounting for Sale of Forest Products*. It explains how to manage natural resources on USAF property in compliance with Federal, state, territorial, and local standards. Requires installations to address climate change within INRMPs. This Manual also implements DoDI 4710.1, Archaeological and Historic Resources Management. It explains how to manage cultural resources on USAF property in compliance with Federal, state, territorial, and local standards.
AFI 91-212	BASH program.
AFI 13-212	Range Planning and Operations: Overall management and policy of ranges.
AFI 32-1053	This AFI provides guidance for pest management programs at Air Force installations. Major commands must approve pesticides contracts, pesticide applications.
AFI 32-10112 Installation Geospatial Information and Services (IGI&S)	This instruction implements Department of Defense Instruction (DoDI) 8130.01, Installation Geospatial Information and Services (IGI&S) by identifying the requirements to implement and maintain an Air Force Installation Geospatial Information and Services program and Air Force Policy Directive (AFPD) 32-10 Installations and Facilities.
AFPD 32-70, *Environmental Quality*	Outlines the USAF mission to achieve and maintain environmental quality on all USAF lands by cleaning up environmental damage resulting from past activities, meeting all environmental standards applicable to present operations, planning its future activities to minimize environmental impacts, managing responsibly the irreplaceable natural and cultural resources it holds in public trust and eliminating pollution from its activities wherever possible. AFPD 32-70 also establishes policies to carry out these objectives.
Policy Memo for Implementation of Sikes Act Improvement Amendments, HQ USAF Environmental Office (USAF/ILEV) on January 29, 1999	Outlines the USAF interpretation and explanation of the Sikes Act and Improvement Act of 1997.
Neotropical Birds Conservation Agreement	Federal, state, and nongovernmental organizations, including USAF, conserve these birds.

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14.2 Installation Appendices

14.2.1 Appendix B. Fauna of Nellis Air Force Base and the Nevada Test and Training Range

14.2.2 Appendix C. Complete floristic list for Nellis Air Force Base and the Nevada Test and Training Range compiled from the Nellis Natural Resources Program geodatabase.

14.2.3 Appendix D. Current and historical seeps and springs on Nellis Air Force Base and the Nevada Test and Training Range.

14.2.4 Appendix E. Threatened, Endangered, and Sensitive species known or having the potential to occur on Nellis Air Force Base and the Nevada Test and Training Range.

14.2.5 Appendix F. USFWS Information for Planning and Consultation Species

15.0 ASSOCIATED PLANS

15.1 Tab 1—Wildland Fire Management Plan

15.2 Tab 2—Bird/Wildlife Aircraft Strike Hazard (BASH) Plan

15.3 Tab 3—Golf Environmental Management (GEM) Plan

15.4 Tab 4—Installation Cultural Resources Management Plan (ICRMP)

15.5 Tab 5—Nellis Air Force Base Installation Pest Management Plan (NAFB IPMP)