U. S. AIR FORCE

INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

Cannon Air Force Base

&

Melrose Air Force Range

DRAFT

(See INRMP signature pages for plan approval date)

ABOUT THIS PLAN

This installation-specific Environmental Management Plan (EMP) is based on the U.S. Air Force's (AF) 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-U.S. territories will comply with applicable Final Governing Standards. Where applicable, external resources, including Air Force Instructions (AFIs); AF Playbooks; federal, state, local and Final Governing Standards, biological opinion, and permit requirements, are referenced.

Certain sections of this INRMP begin with standardized, AF-wide "common text" language that address AF 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 AF-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 AF environmental Installation Support Teams and/or installation personnel.

NOTE: The terms 'Natural Resources Manager', 'NRM', and 'NRM/POC' 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 DoD Instruction (DODI) 4715.03.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

DOCUMENT CONTROL

Standardized INRMP Template

In accordance with (IAW) the Air Force Civil Engineer Center (AFCEC) Environmental Directorate (CZ) Business Rule 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 not 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 not less than every five years. Annual reviews and updates are accomplished by the base Natural Resources Manager (NRM), and/or an Installation Support Team 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 NR Media Manager) conducts an annual review of the INRMP in coordination with internal stakeholders and local representatives of the United States Fish and Wildlife Service (USFWS), state fish and wildlife agency, and National Oceanic and Atmospheric Administration (NOAA) Fisheries, where applicable, and accomplishes pertinent updates. Installations will document the findings of the annual review in an Annual INRMP Review Summary. By signature to 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. Following update, the installation NRM obtains approval signatures on the updated document.

INRMP APPROVAL/SIGNATURE PAGES

The following three pages are designated for documentation of concurrence with this INRMP by the 27th Special Operations Wing Commander, the U.S. Fish & Wildlife Service, and the New Mexico Department of Game & Fish (AFI 32-7064 2004, Sikes Act 2010).

EXECUTIVE SUMMARY

The Department of Defense (DoD) manages approximately 25 million acres of land in the United States (U.S.). Each military installation that has suitable habitat for conserving and managing natural ecosystems is required to prepare, maintain, and implement an Integrated Natural Resources Management Plan (INRMP). This INRMP was prepared for Cannon Air Force Base (CAFB) and Melrose Air Force Range (MAFR), in accordance with the following authorities:

- DoD Instruction (DoDI) 4715.03, Natural Resources Conservation Program;
- Air Force Manual 32-7003, *Environmental Conservation*;
- 16 U.S. Code (U.S.C.) 670a-670f, Sikes Act, as amended, 18 November 1997; and
- 32 Code of Federal Regulations (CFR) Part 190, DoD Natural Resources Management Program.

This INRMP is a long-term planning document that guides implementation of the natural resources program to help ensure support for the installation mission, while protecting and enhancing natural resources and providing a variety of outdoor recreational opportunities for station personnel. This plan documents the military mission, baseline condition of natural resources, impacts to natural resources due to the military mission, the management approaches to conserve and enhance natural resources, and a list of specific projects to protect and enhance natural resources at CAFB and MAFR.

In accordance with the Sikes Act, this INRMP was prepared in cooperation with the Secretary of the Department of Interior, acting through the Director of the U.S. Fish and Wildlife Service (USFWS), and the New Mexico Department of Game and Fish (NMDGF). Because of this coordination effort, the INRMP reflects the mutual agreement of these parties concerning conservation, protection, and management of fish and wildlife resources. Future involvement of the state and federal wildlife agencies during informal annual reviews and formal five-year renewals will ensure continued mutual agreement and cooperation in managing the natural resources at CAFB and MAFR.

Eleven resource-specific natural resources program elements have been developed to address relevant issues at CAFB and MAFR. Existing conditions, baseline survey data, current management practices, and recommended management actions are described for each program element. Management program elements covered in this INRMP include:

- Fish and Wildlife Management
- Outdoor Recreation and Public Access to Natural Resources
- Conservation Law Enforcement
- Threatened and Endangered Species, Species of Concern, and Habitats
- Water Resource Protection
- Wetlands Protection
- Grounds Maintenance
- Wildland Fire Management
- Integrated Pest Management
- Bird/Wildlife Aircraft Strike Hazard (BASH)
- Cultural Resources Management
- Public Outreach
- Climate Change Vulnerabilities
- Geographic Information Systems (GIS) Management

The management actions and projects identified for the CAFB and MAFR natural resources program are intended to help installation commanders manage natural resources effectively to ensure installation lands remain available and in appropriate condition to support the military mission and to ensure compliance with relevant environmental regulations. These actions are based on the principles of ecosystem management and are consistent with Air Force (AF) policy on sustainable, multiple use of natural resources on AF property (AFMAN 32-7003).

1.0 OVERVIEW AND SCOPE

This 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. 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 Air Force adaptability in all environments. The Air Force has stewardship responsibility over 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 Air Force natural resources program is to sustain, restore and modernize natural infrastructure to ensure operational capability and no net loss in the capability of Fir Force (AF) 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 base personnel. The Sikes Act is the legal driver for the INRMP.

1.1 Purpose and Scope

INRMPs provide for the management of natural resources, including fish, wildlife, and plants. They incorporate, to the maximum extent practicable, multiple use ecosystem management principles and provide the landscape necessary for the sustainment of military land uses. Consistent with the use of military installations to ensure the readiness of the Armed Forces, the purpose of INRMPs is to provide for the conservation and rehabilitation of natural resources on military lands.

INRMPs are intended principally to guide the management of an installation's natural resources effectively to ensure that its lands remain available and in good condition to support the installation's military mission and with "no net loss" in the capability of military installation lands to support the military mission of the installation. To ensure frequent and continued use of land for military training, now and in the future, management programs and actions in INRMPs must ensure natural resource utilization is (1) sustainable, (2) in accordance with laws and regulations, and (3) optimally integrated with existing military installation plans and mission requirements.

The Cannon Air Force Base (CAFB) and Melrose Air Force Range (MAFR) INRMP provides the foundation of ecosystem management goals and objectives to direct management and stewardship of its lands. This INRMP documents and assists the development, integration, and coordination of natural resources management on CAFB and MAFR. Further, it describes CAFB and MAFR natural resources management programs and how those programs provide for: (1) the conservation and rehabilitation of natural resources; and (2) the sustainable use of resources. In addition to describing natural resources management programs, this document is intended to accomplish the following:

- Provide baseline information and conditions that support daily decision-making and compliance with regulatory and planning processes;
- Identify, document, and facilitate the organizational capacity, support, and linkages necessary for successful implementation and administration of the INRMP and management of CAFB and MAFR natural resources;
- Integrate the various natural resources management programs to reduce overlap and redundancy, improve management effectiveness, and ensure that CAFB and MAFR lands remain available and in good condition to support the military mission;

- Show the interrelationships between current and proposed components of natural resources management (e.g., vegetation, wetland, fish and wildlife), mission requirements, and other land use activities;
- Establish natural resources program management goals, objectives, and actions that will be implemented during the duration of the plan, and provide time frames for proposed actions;
- Identify lower priority projects that may be done as funding becomes available; and
- Establish a process for the periodic review, update, and reporting of program goals, objectives, and projects within the INRMP.

This INRMP is intended to integrate natural resources conservation and management efforts in support of land use and military mission requirements and responsibilities at CAFB and MAFR. This INRMP reflects the installation's approach to natural resources management and stewardship and summarizes baseline information and agreements through which compliance with regulatory and planning processes, such as those required by the Sikes Act Improvement Act, National Environmental Policy Act (NEPA), and Endangered Species Act (ESA), is accomplished. This INRMP also fulfills other responsibilities with regard to DoDIs and DoD Directives, as well as the USAF policies for natural resource planning, conservation, management, and rehabilitation in support of the Base's military training mission.

1.2 Management Philosophy

The guiding principle behind the development of this INRMP is sound ecosystem management. Managing ecosystems involves addressing the environment as a complex system of interrelated components rather than a collection of isolated units. Military operations and compliance with federal, state, and local requirements are essential components of the CAFB mission. Successful ecosystem management requires AF environmental managers to consider factors such as the military mission, state and federal laws, community values, socioeconomics, and adjacent land uses in addition to the biological environment when setting management goals.

The overall comprehensive goal of ecosystem management is to maintain and improve the sustainability and biological diversity of native ecosystems to support the AF mission and the needs of the military community. The INRMP implements ecosystem management by setting goals for attaining a desired land condition.

Two major components of ecosystem management are biodiversity conservation and control of exotic and invasive species. For biodiversity, the goal is to maintain or re-establish viable populations of native species on AF controlled lands when practical and consistent with the military mission. The primary goals associated with control of exotic and invasive species are to determine presence/absence of these species and, where necessary, to develop and implement plans to control or eradicate these species. To increase the effectiveness of control, management plans for the control of exotic and invasive species should be a cooperative effort with federal, state, and/or local agencies, and adjoining landowners.

This INRMP is also based on a set of principles developed by the AF as guidelines for environmental conservation (AFMAN 32-7003, Integrated Natural Resources Management). These principles are:

- Maintain or restore native ecosystem types across their natural range where practical and consistent with the military mission;
- Maintain or restore natural ecological processes such as fire and other disturbance regimes where practical and consistent with the military mission;
- Maintain or restore the hydrological processes in streams, floodplains, and wetlands where practical and consistent with the military mission;

- Use regional approaches to implement ecosystem management on an installation by collaboration with other DoD components, as well as other federal, state, and local agencies and adjoining property owners.
- Provide for outdoor recreation, agricultural production, harvesting of forest products, and other practical utilization of the land and its resources, provided that such use does not inflict long-term ecosystem damage or negatively impact the AF mission.

1.3 Authority

Congress enacted the Sikes Act in 1960 to address wildlife conservation and public access on military installations. The Sikes Act, as amended, 16 United States Code (U.S.C.) 670a-670f, requires the Secretary of Defense to carry out a program to provide for the conservation and rehabilitation of natural resources on military installations in cooperation with the USFWS and the state fish and wildlife agencies. The 1997 amendments to the Sikes Act require the DoD to develop and implement an INRMP for each military installation with significant natural resources. INRMPs are prepared in cooperation with the USFWS and the state fish and wildlife agency and reflect the mutual agreement of these parties concerning conservation, protection, and management of fish and wildlife resources on military lands.

The Sikes Act requires the Secretaries of the military departments to prepare, implement, and review/revise INRMPs for each military installation, unless exempted due to the absence of significant natural resources. To make the exemption determination, AFMAN 32-7003 is used to classify military installations and ranges into one of two natural resource management categories. Category I installations/ranges are those that have natural resources requiring protection and management, such as habitat for protected species, aquatic resources, or any habitat for conserving and managing wildlife. Category II installations have a limited natural resources land base and no significant natural resources. CAFB and MAFR are classified as Category I installations.

The Sikes Act requires each installation possessing significant natural resources to prepare and implement an INRMP that supports the mission of the installation and complies with the suite of federal laws governing natural resources management and protection (e.g., ESA, Clean Water Act [CWA]). Thus, an INRMP reflects an installation's programs and intent to comply with other federal and state laws, most notably laws associated with environmental documentation, endangered species, water quality, and management of wildlife in general.

The Sikes Act, Updated Guidance on Implementation of the Sikes Act Improvement Act of 10 October 2002 (U.S. DoD 2002), Office of the Secretary of Defense (OSD) Supplemental Guidance for Implementation of the Sikes Act Improvement Act of 1 November 2004 (U.S. DoD 2004), OSD Supplemental Guidance for Implementation of the Sikes Act Improvement Act of 5 September 2005 (U.S. DoD 2005), Air Force Policy Directive (AFPD) 32-70, *Environmental Quality*, and the AFMAN 32-7003, *Environmental Conservation* provide detailed guidance on and identify required elements to be included in the preparation and update of INRMPs.

An ecosystem management approach with natural resources stakeholders that is within the constraints of the military mission is mandated by the Sikes Act, DoDI 4715.03, and AFMAN 32-7003. DoDI 4715.03 further states that installation ecosystem management will be achieved by developing and implementing the INRMP and ensuring that it remains current. AFPD 32-70 provides directives to clean up environmental damage, plan future activities to reduce environmental impacts, manage responsibly the natural and cultural resources and eliminate pollution from its activities whenever possible on AF installations. AFMAN 32-7003, implements DoD and AFPD directives by establishing the Installation INRMP as the primary

388 planning document for natural resources at AF installations. The INRMP assures compliance with key acts,
389 statutes, and Executive Orders (EOs) including, but not limited to:

390 • Clean Air Act
391 • CWA
392 • ESA
393 • Migratory Bird Treaty Act (MBTA)
394 • Bald and Golden Eagle Protection Act (BGEPA)
395 • EO 13112, Invasive Species
396 • EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds

397 The ESA requires all federal agencies to implement protection programs for designated (listed) species and
398 to use their authorities to further the purposes of the act. Other legislation protecting birds includes the
399 BGEPA, the MBTA, and EO 13186. To comply with the ESA, the USAF is required under AFMAN 32-
400 7003 to inventory for federally listed threatened and endangered (T&E) species, and if present on USAF
401 land, provide an overall ecosystem approach for the protection and management of the species. Although
402 not required, when practical a similar approach should be used for listed federal candidate species and state-
403 listed species (AFMAN 32-7003). The federal government is also legally mandated to protect and maintain
404 healthy migratory bird populations and to ensure the conservation of more than 800 species of migratory
405 birds and their habitats by domestic legislation and through international conventions and treaties.

Installation-Specific Policies (including State and/or Local Laws and Regulations)	
Tree Care Ordinance	It shall be the policy of CAFB to maintain an active tree program, consisting of three areas: tree planning, tree planting, and tree maintenance.

406

407

408 ### *1.4 Integration with Other Plans*

409 The 27th Special Operation Civil Engineering Squadron (27 SOCES) Civil Engineering Wing (SOCES/CE)
410 manages several programs integral to land use of the installations. The INRMP supports the Base
411 Comprehensive Planning Process by identifying natural resources that need to be considered and
412 incorporated into the Installation Development Plan (IDP) found in Tab 5, element plans, and other
413 component plans. Natural resources installation project plans are identified and prioritized for a five-year
414 period in the INRMP to provide for advanced planning, funding, and management. There is frequent
415 overlap of the different Subject Matter Experts (SMEs) within the squadron. The following describes how
416 this INRMP integrates with or supports the entire Squadron's mission:

417 • Installation Development Plan (IDP): Objective 6 of the recently completed plan is to, "Be leaders
418 in sustaining an environmentally conscious culture while ensuring mission effectiveness and meet
419 or exceed all appropriate state and federal environmental laws." The INRMP is thoroughly
420 integrated into the IDP, which can be found in Tab 5.
421 • Air Installation Compatible Use Zone (AICUZ): The INRMP does not significantly overlap with
422 the AICUZ. However, SMEs work closely together as part of the 27 SOCES program to ensure
423 there are no conflicts.

- Bird/Wildlife Aircraft Strike Hazard (BASH): The BASH Program is in conformance with this INRMP as described in Section 7.12 (Bird/Wildlife Aircraft Strike Hazard). Annual reporting of BASH activities and the annual application for a new Depredation Permit are within the purview of the Natural Resources (NR) Program Section of the Environmental Element of 27th Special Operation Civil Engineering Squadron, Environmental Program Managers (SOCES/CEIE). Updating and renewing the INRMP is also within the purview of the NR Program. Both plans are overseen by the NR Program, thus ensuring integration. This plan can be found in Tab 2.
- The Integrated Pest Management Plan (IPMP): Identifies two species of mutual concern with the INRMP: black-tailed prairie dogs (*Cynomys ludovicianus;* BTPD) and western burrowing owl (*Athene cunicularia;* BUOW). The Entomology department is part of SOCES/CE and coordinates with the Environmental Element of SOCES/CE to ensure adherence to INRMP Section 7.11 (Integrated Pest Management Program). Specifically, any harm to BUOW nesting and breeding habitat should be avoided. This plan can be found in Tab 6.
- Cannon Green – Sustainable Landscape Development Plan: This plan emphasizes the use of low maintenance landscaping, specifically low water use species. The plan recommends xeriscape practices such as targeted irrigation and the use of native and drought tolerant plants. The plan, found in Tab 3, is in practice and in conformance with INRMP Section 7.6 (Grounds Maintenance) of this INRMP.
- Wildland Fire Management Plan for CAFB and MAFR 2012: The goals of the most recent plans have changed since 2012 with the cessation of domestic livestock grazing leases. The current MAFR Prescribed Fire Burn Plan 2014 is described in INRMP Section 7.9 (Wildland Fire Management), and the plan can be found in Tab 1.
- Cannon Air Force Base (Cannon Main Base & Melrose Air Force Range) 2009 Integrated Cultural Resources Management Plan (ICRMP): The intent and purpose of this plan, found in Tab 4, is to be an integral part of the Base General Plan (now called IDP). The INRMP Section 7.11 (Cultural Resources Management) states the ICRMP should be consulted prior to implementation of mission or natural resources management activities.

CAFB and MAFR development plans will be consistent with the INRMP upon completion of all necessary planning requirements and administrative approvals. As appropriate, CAFB and MAFR plans will be reviewed and revised based on the results of this integrated planning effort. The INRMP baseline information and its associated GIS layers will be reviewed annually, where necessary, using an interdisciplinary process, and revised and modified as necessary to ensure a quality foundation for integrated planning efforts and natural resource management at CAFB and MAFR. The INRMP itself must be reviewed annually with the USFWS and NMDGF and revised as needed every five years per the Sikes Act Improvement Act.

460 **2.0 INSTALLATION PROFILE**

Office of Primary Responsibility	27 SOCES/CEIE 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/POC	Charles Dixon, Ph.D. (575) 904-6731 charles.dixon.6@us.af.mil
State and/or local regulatory POCs (For U.S. bases, include agency name for Sikes Act cooperating agencies)	NMDGF Mark Watson (505) 476-8115 mark.watson@state.nm.us USFWS NM Ecological Services Field Office Chuck Hayes (505) 761-4754 charles_hayes@fws.gov
Total acreage managed by installation	74,128
Total acreage of wetlands	63.18
Total acreage of forested land	N/A
Does installation have any Biological Opinions? (If yes, list title and date, and identify where they are maintained)	No
NR Program Applicability (Place a checkmark next to each program that must be implemented at the installation. Document applicability and current management practices in Section 7.0)	☒ 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)

461

2.1 Installation Overview

2.1.1 Location and Area

CAFB is located in rural Curry County, New Mexico. The Base covers approximately 4,397 acres and is approximately 17 miles west of the Texas-New Mexico state line; seven miles west of Clovis, New Mexico; and 12 miles north of Portales, New Mexico. The major highways serving the installation are United States (U.S.) Highways 60, 70, and 84. MAFR, which is administered by CAFB, is a training range. MAFR is located approximately 13 miles southwest of Melrose, New Mexico in Roosevelt and Curry Counties and comprises 69,731 acres (Figure 2-1; Table 2-1).

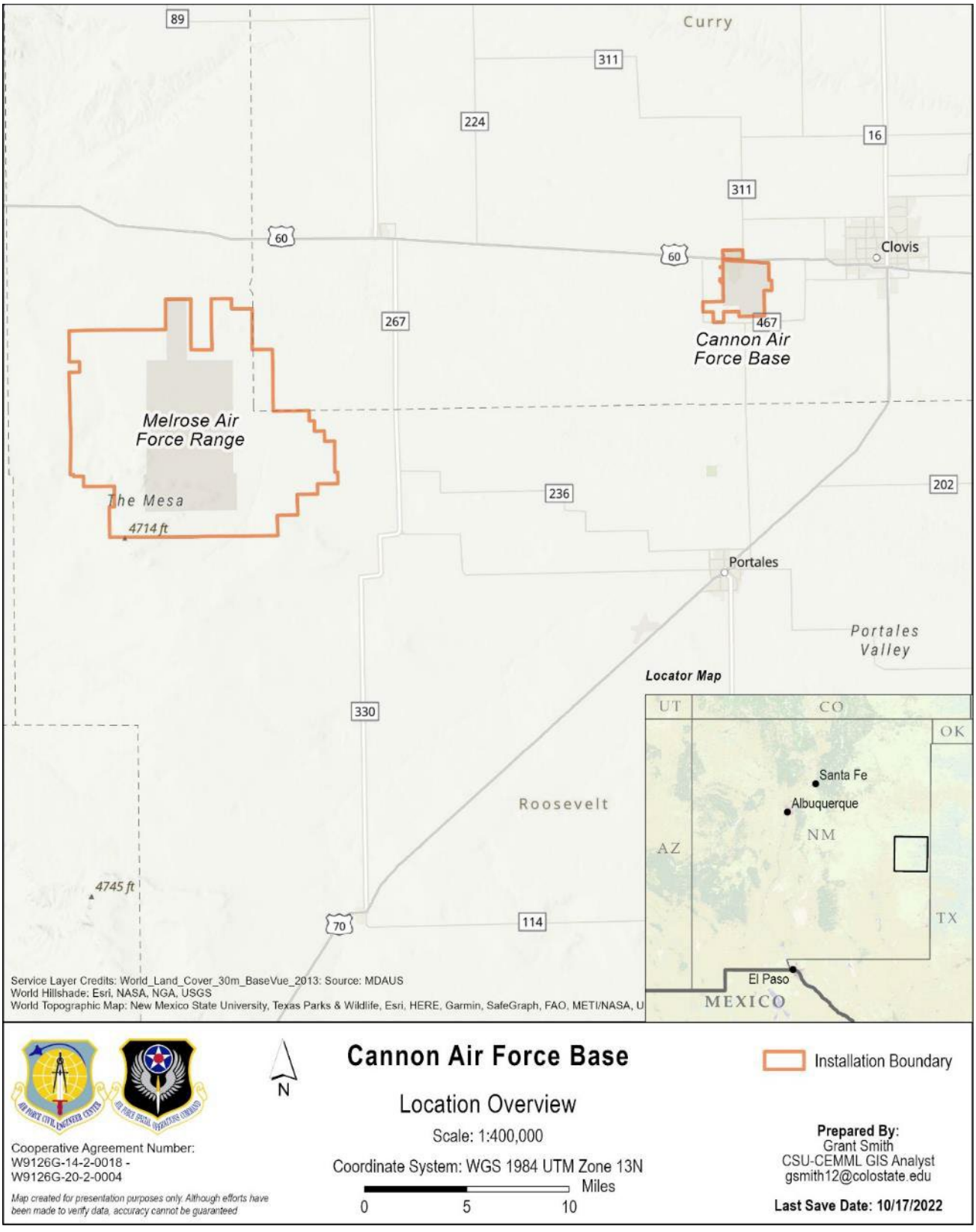


Figure 2-1. Regional Location of CAFB and MAFR

Table 2-1. Installation/Geographically Separated Units (GSUs) Location and Area Descriptions

Base/GSU Name	Main Use/Mission	Acreage	Addressed in INRMP?	Describe NR Implications
CAFB	Special Operations Command	4,397	Yes, throughout this document	Urban with artificial attractions for birds. Need to minimize bird strike hazards on airfield.
MAFR	Training Range	69,731	Yes, throughout this document	Unimproved rangelands used by migratory birds and as wildlife corridor. Need to control invasive brush to maximize ground movement training.

2.1.2 Installation History

2.1.2.1 Cannon Air Force Base

During the late 1920s, Portair Field was established on the current site of CAFB as a civilian passenger terminal for transcontinental commercial flights. The airport's name was changed to Clovis Municipal Airport in the 1930s. After U.S. entry into World War II, the Army Air Corps took control of the airfield, which became known as Clovis Army Air Base. A glider detachment was the first military detachment to use the base. In 1943, the 16th Bombardment Operational Wing arrived, which was a training unit for the crews of the B-17, B-24, and B-29 heavy bombers. The Base was renamed Clovis Army Airfield in 1945. Flying, bombing, and gunnery classes continued until the end of World War II, with deactivation of the base in 1947. In 1951, the installation was reactivated as Clovis AFB and the airfield was reassigned to the Tactical Air Command. The first unit to arrive was the 140 Fighter-Bomber Wing. The 140 Fighter-Bomber Wing flew the F-86 “Sabre” jet fighter and was composed of Air National Guard elements from Utah, Colorado, and Wyoming. The Base became a major training site for “Sabre” pilots, with the transfer in 1954 of the 474 Fighter-Bomber Group from Taegu Air Base, Korea.

The installation was renamed CAFB on 08 June 1957, in honor of the late General John K. Cannon, a former commander of the Tactical Air Command. The 474 and 312 Fighter-Bomber Groups were also redesignated as Fighter Attack Groups during this year, with the 832nd Air Division being activated to oversee their activities. Two years later, the 312 Fighter-Bomber Group was deactivated and replaced by the 27th Tactical Fighter Wing (TFW), an F-100 unit transferred from Bergstrom Air Force Base, Texas. When F-100 training ceased at CAFB in 1969, the 27 TFW was re-equipped with the F-111E.

In July 1971, the last F-111E left CAFB, to be replaced with the F-111D in November of that same year. Following deactivation of the 832nd Air Division in July 1975, the 27 TFW became the principal AF unit at CAFB. On 01 October 1991, the 27 TFW was renamed the 27 Fighter Wing (FW). In preparation for the DoD-announced retirement of the F-111 in 1996 and EF-111 in 1998, the 27 FW began receiving F-16s in May 1995.

On 15 September 1998, the 428 Fighter Squadron was reactivated at CAFB. The squadron was a hybrid USAF/Republic of Singapore Air Force (RSAF) F-16 Fighter Squadron manned by highly experienced USAF instructor pilots, maintenance, and support personnel. The squadron operated 12 RSAF-owned F16C/Ds. With approximately 25 USAF personnel and 140 RSAF personnel, the unit was responsible for continued training of Singapore personnel in rapid deployment and tactical employment of the F-16 for a

wide spectrum of missions including air-to-air, joint maritime, and precision air-to-ground weapons delivery (USAF 2003).

Aircraft flight training for the 27 FW continued until 2007. On 01 October 2007, the 27 FW at CAFB was inactivated, and command of the CAFB and MAFR was transferred to Air Force Special Operations Command (AFSOC), 27 SOW.

2.1.2.2 Melrose Air Force Range

Since the Korean War, AF, Navy, and Marine Corps units have used MAFR for bombing and gunnery practice. Early in 1952, the AF leased 7,771 acres of land near Melrose, New Mexico. The land served as a bombing range for the F-86 aircraft stationed at Clovis AFB (now CAFB). Over the years, faster aircraft with more complex weapon systems were introduced (first the F-100, then the F-111). These new weapon systems required larger and more sophisticated range facilities. Between 1968 and 1989, the AF bought more than 60,000 acres of land for approximately $12.5 million to expand the range, increasing the impact area to 8,800 acres. Since the early 1990s, the AF has used MAFR as a training range for a wide variety of military aircraft (USAF 2003). A land gift from the State of New Mexico added 10,968 acres to the western edge of the existing range. In 2008, the impact area of the range expanded to almost 10,000 acres (Figure 2-2) and expanded total usable training area on MAFR to 69,731 acres. Additionally, all agricultural outleases on MAFR were terminated in 2012. Livestock grazing does not occur on the property and cropland leases do not exist.

2.1.3 Military Missions

The AFSOC official mission statement is "America's specialized air power…a step ahead in the changing world, delivering Special Operations anytime, anywhere." AFSOC, which was established on 22 May 1990, is a Major Command and the AF component of the U.S. Special Operations Command (USSOCOM). AFSOC forces provide global ability to conduct special operations missions. Prior to adding CAFB to AFSOC's mission, AFSOC was responsible to USSOCOM for the worldwide readiness of AF special operations forces (SOF). AFSOC's core tasks are grouped into four mission areas: (1) forward presence and engagement; (2) information operations; (3) precision employment and strike; and (4) SOF mobility. The primary components of AFSOC are highly trained, deployable airmen who can operate highly specialized aircraft.

Based on the *AFSOC Assets Beddown at Cannon Air Force Base, New Mexico Environmental Impact Statement* (EIS; AFSOC 2007), mission-related training that could occur during the current military mission includes:

- Flight training (touch and go, aerial re-fueling, and practice missions) with AFSOC aircraft (C130 gunships, CV-22s, Predator Unmanned Aerial Systems, and additional aircraft) at CAFB, MAFR, and on existing military training routes;
- Live fire training for C-130 gunships at MAFR;
- Drop and landing zone training at CAFB and MAFR;
- Infiltration and exfiltration of military personnel at MAFR and potentially outlying areas; and
- Amphibious training outside of MAFR.

The 27 Special Operation Wing (SOW)

The primary mission of the 27 SOW is to support USSOCOM by developing, achieving, and maintaining forces capable of meeting needs. Major groups within the 27 SOW include Operations, Mission Support, Maintenance, and Medical groups.

Table 2-2. Listing of Tenants and NR Responsibility

Tenant Organization	NR Responsibility
AFSOC 26th Special Tactics Squadron	None
AFLOA Area Defense Council	None
AFSOS WC551st Special Operations Squadron	None
AFISRA 43rd Intelligence Squadron	None
AFOSI Detachment 120	None
AETC 373rd TRS Detachment 17	None

2.1.4 Surrounding Communities

The nearest community to CAFB is Clovis, New Mexico. Clovis has an estimated population of 37,988 and is the county seat of Curry County, which has a population of 48,000 (U.S. Census Bureau 2021). Clovis has one airport accessible to small commercial and personal aircraft. The nearest major airports are in Lubbock, Texas (~100 miles southeast of Clovis) and Amarillo, Texas (~100 miles northeast of Clovis) (USAF 2003).

The nearest community to MAFR is the village of Melrose in Curry County, New Mexico. Melrose is located on the northeast side of the range, approximately 13 miles from the impact area. The population of Melrose was 622 in 2020, when the most recent census was conducted (U.S. Census Bureau 2020).

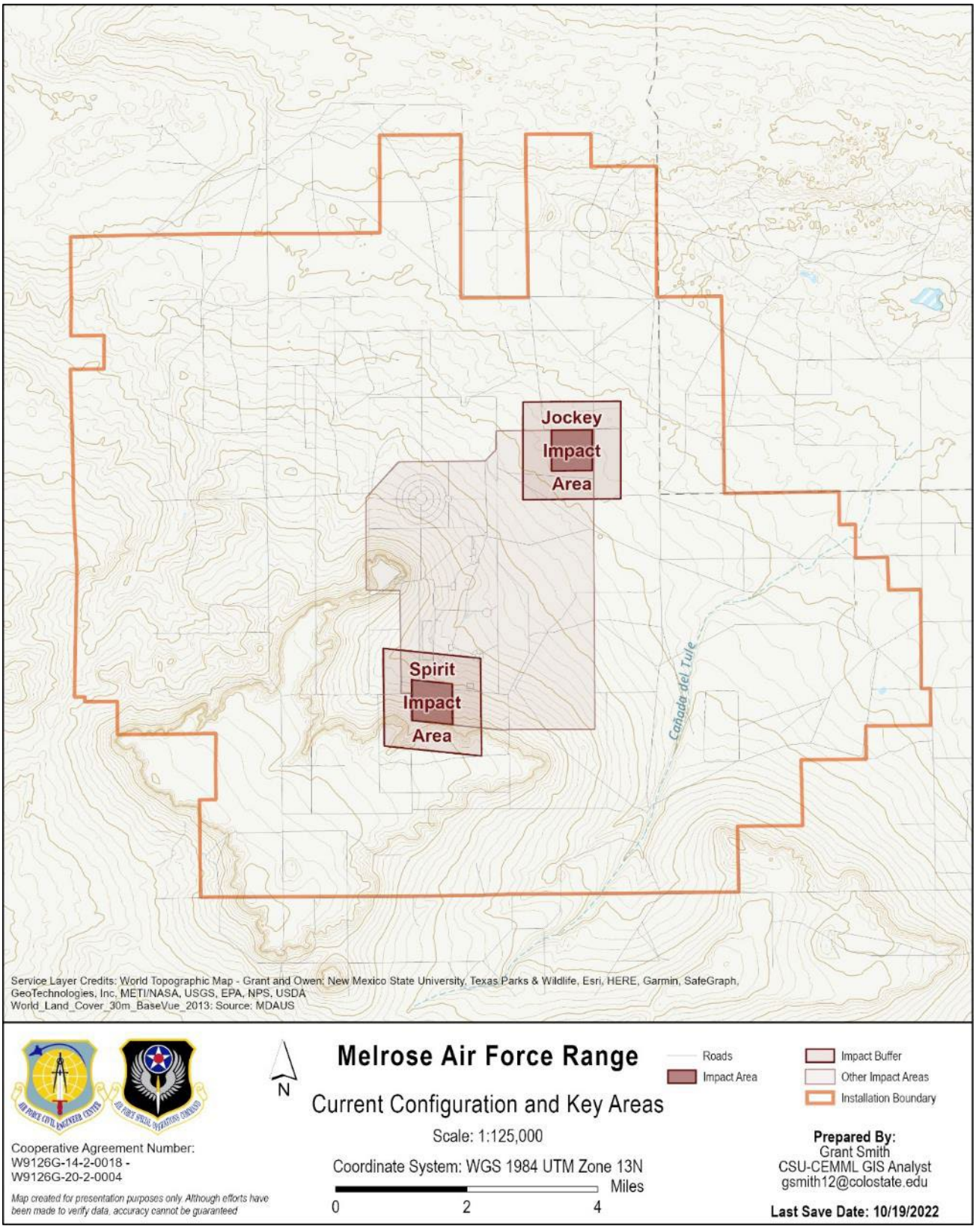


Figure 2-2. Current MAFR Configuration, Key Areas, and Location Map

2.1.5 Local and Regional Natural Areas

The Grulla and Muleshoe National Wildlife Refuges are within 30 miles of CAFB and provide habitat for various migratory bird species. Anderson Basin National Historic Landmark (Blackwater Draw Museum and Archaeological Site) is located in Roosevelt County between Clovis and Portales. Oasis State Park, located approximately 11 miles southwest of CAFB, is the closest state park. The nearest national forest to CAFB or MAFR is the Lincoln National Forest, which lies approximately 120 miles southwest of CAFB. Additionally, the Kiowa National Grassland is located approximately 125 miles north of CAFB. The nearest river is the Pecos River, approximately 55 miles west of CAFB. The City of Clovis has 17 public parks. These parks contain typical playground equipment, picnic facilities, team sport infrastructure, and a zoo (USAF 2003). Two Prairie Chicken Areas owned by NMDGF, the Claudel and Liberty areas, are located six miles south and 12 miles southwest of CAFB, respectively.

2.2 Physical Environment

2.2.1 Climate

The climate of CAFB and MAFR is semiarid to arid, with low amounts of annual precipitation, a high percentage of clear days, low relative humidity, and a relatively large change in diurnal temperatures (AFSOC 2007). For CAFB, the annual average maximum temperature is 72.8 degrees Fahrenheit (°F) and the average minimum temperature is 42.6 °F. Average monthly maximum temperatures range from 51.97 °F in December to 91.6 °F in July; average monthly minimum temperatures range from 23.5 °F in January to 63.2 °F in July. The average annual rainfall in the area is 17.92 inches, mostly occurring in summer. Most of the precipitation for this region comes from sudden thundershowers, which form over the mountains west of Clovis and travel east. Monthly precipitation averages vary from 0.4 inches in the winter months to nearly 3.0 inches in July and August (CEMML 2019).

The warming of air as it moves downslope from the mountains tends to modify air masses that pass over this area from the west and northwest. Winds from the northwest blow downslope and enhance the movement of air into the region, while winds from the south and east blow upslope and lead to increased cloud formation and precipitation. Winds in the area average 12 miles per hour and are often gusty and persistent. Wind speeds are typically highest during March and April. Prevailing surface winds are from the west (USAF 2001).

2.2.1.1 Climate Change Projections

Climate projections for CAFB and MAFR were completed by Colorado State University's Center for Environmental Management of Military Lands (CSU CEMML). CEMML modeled site-specific climate projections based on two future carbon emission scenarios: Representative Concentration Pathway (RCP) 4.5 (moderate emissions) and RCP 8.5 (high emissions). Models used historical climate data recorded from 1980–2009 to represent average historical conditions on CAFB and MAFR. These data represent the 30-year historical reference period used by the Intergovernmental Panel on Climate Change (IPCC). Models then used the two emissions scenarios to produce projections for two timeframes (2026–2035 and 2046–2055), which will be referred to as "2030" and "2050" throughout this discussion (CEMML 2019).

The climate assessment was based primarily on publicly available data and data provided by the AFCEC. Climate projections were based on recent global climate model simulations developed for the IPCC Fifth Assessment Report, the IPCC Coupled Model Intercomparison Project Phase 5, and the U.S. National Center for Atmospheric Research Community Climate System Model (Hibbard et al. 2007; Moss et al. 2008, 2010; Gent et al. 2011; Hurrell et al. 2013).

The model results below depict climate projections based on historical records and projected future scenarios. In any projected scenario, various sources of uncertainty regarding underlying climatic processes will affect the model's results. For instance, a range of possibilities for precipitation levels depend on how the ocean and atmosphere will interact as conditions change. However, these projections can be used to guide a discussion of the potential impacts of climate change on the installation's natural resources in the future.

Cannon Air Force Base

Climate models for CAFB (Table 2-3) project that minimum and maximum temperatures will increase over time under both emission scenarios. For the decade centered around 2030, both scenarios project an increase in average annual temperature (TAVE) of between 2.3 °F and 3.0 °F above the historical average. The two emission scenario projections show higher warming by 2050, with RCP 4.5 projecting a warming of 3.6 °F. RCP 8.5 projects a greater warming of 5.4 °F for this period.

For 2030, the RCP 4.5 scenario projects an increase in annual average precipitation (PRECIP) of 13% while RCP 8.5 shows an increase of 8%. For 2050, RCP 4.5 projects no change in PRECIP while RCP 8.5 shows a small increase of 3%. Seasonal trends show precipitation increasing in the spring and the fall but decreasing during the summer (CEMML 2019).

Table 2-3. Summary of Historical and Projected Climate Data for CAFB

Variable	Historical	RCP 4.5		RCP 8.5	
		2030	2050	2030	2050
PRECIP (inches)	17.9	20.3	17.9	19.3	18.5
TMIN (°F)	42.6	44.7	45.7	45.4	47.5
TMAX (°F)	72.8	75.3	77.0	76.0	78.6
TAVE (°F)	57.7	60.0	61.3	60.7	63.1
GDD (°F)	4849.0	5345.0	5646.0	5485.0	5932.0
HOTDAYS	61.7	83.6	102	96.9	119.3
WETDAYS	0.1	0.0	0.1	0.1	0.0

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

Understanding changes in daily intensity and total precipitation for multi-day precipitation events is helpful to evaluate precipitation patterns and assess annual averages. CSU CEMML generated three-day storm events (design storms) from projected precipitation data, based on RCP 4.5 and 8.5 for the 2030 and 2050 timeframes (Table 2-4; CEMML 2019). They used historical precipitation data to calculate a baseline storm event for the year 2000 for comparison. Design storms were used to model stream channel overflow in the hydrology assessment. Projected design storm discharge decreased in three of four emissions scenarios, increasing only for RCP 4.5 2050 (Table 2-4).

Table 2-4. Design Storm Precipitation for CAFB

Design Storm		Baseline	RCP 4.5		RCP 8.5	
		2000	2030	2050	2030	2050
Precipitation (inches)	Day 1	0.9	0.5	1.6	0.7	0.9
	Day 2	1.6	1.1	2.0	0.9	1.4
	Day 3	1.2	0.9	1.0	1.0	1.0
	Total	3.7	2.5	4.6	2.5	3.3
Percent change from baseline			-31%	24%	-32%	-11%

Melrose Air Force Range

Climate models for MAFR (Table 2-5) project that minimum and maximum temperatures will increase over time under both emission scenarios. For the decade centered around 2030, the scenarios project an increase in average annual temperature of between 2.2 °F and 3.0 °F over the historical average. Both emission scenario projections show higher warming by 2050, with RCP 4.5 projecting a warming of 3.7 °F and RCP 8.5 projecting a slightly greater warming of 5.3 °F.

For 2030, RCP 4.5 projects an increase in PRECIP of 16%, while RCP 8.5 shows an increase of 11%. For 2050, RCP 4.5 projects a small increase in PRECIP of 5%, while RCP 8.5 shows an even smaller increase of 1%.

Table 2-5. Summary of Historical and Projected Climate Data for MAFR

Variable	Historical	RCP 4.5		RCP 8.5	
		2030	2050	2030	2050
PRECIP (inches)	16.4	19.0	17.2	18.2	16.6
TMIN (°F)	42.7	44.8	45.8	45.5	47.6
TMAX (°F)	73.2	75.7	77.6	76.5	79.1
TAVE (°F)	58.0	60.2	61.7	61.0	63.3
GDD (°F)	4907.0	5395.0	5705.0	5529.0	5972.0
HOTDAYS	62.4	80.5	102.6	97.1	118.5
WETDAYS	0.1	0.0	0.1	0.2	0.0
Notes: TAVE ºF = annual average temperature; TMAX ºF = annual average maximum temperature; TMIN °F = annual average minimum temperatures; PRECIP (inches) = average annual precipitation; GDD ºF = Average annual accumulated growing degree days with a base temperature of 50 ºF; HOTDAYS (average # of days per year) = average number of hot days exceeding 90 °F; WETDAYS (average # of days per year) = annual number of days with precipitation exceeding two inches in a day.					

Projected design storm discharge decreased in all four design storm scenarios for MAFR (Table 2-6).

Table 2-6. Design Storm Precipitation MAFR

Design Storm		Baseline	RCP 4.5		RCP 8.5	
		2000	2030	2050	2030	2050
Precipitation (inches)	Day 1	0.9	0.7	0.7	0.9	0.6
	Day 2	1.8	1.1	1.7	1.2	1.1
	Day 3	1.1	0.9	1.3	1.3	0.8
	Total	3.8	2.7	3.7	3.4	2.5
Percent change from baseline			-29%	-3%	-11%	-34%

2.2.2 Landforms

2.2.2.1 Topography

CAFB and MAFR are located on a southeastward-sloping regional plateau known as the Southern High Plains. Topography within the plateau is typified by flat, featureless terrain. The High Plains, however, have a smooth and gently sloping or undulating surface on which scattered, normally dry, flat-bottomed depressions are the dominant relief feature.

The highest elevation on CAFB is 4,330 feet above sea level in the northwest portion of the base, and the lowest point is 4,260 feet above sea level in the southeast portion. The natural land surface is generally flat and slopes to the southeast. The only topographical features are several small, shallow, playa lakebeds that collect water during rain events. Playas often contain wetland or hydrophytic vegetation that grows mainly during wet seasons (Figure 2-3).

Elevations at MAFR range from approximately 4,200 feet above sea level in the northeast portion to over 4,600 feet above sea level in the southwest portion (Figure 2-4). Several drainages and small canyons are present on MAFR (e.g., Sheep Canyon), and playas can be found in the flat portions of MAFR. The largest topographic feature of MAFR is the Mesa, a northeast-trending, flat-topped hill rising 4,660 feet above sea level on the southwest side of the range (USAF 2003).

2.2.2.2 Improved, Semi-Improved, and Unimproved Lands

Improved, semi-improved, and unimproved lands consist of all land and water acreage for which an installation commander has responsibility. Improved grounds include acreage on which intensive maintenance activities must be planned and performed annually as fixed requirements. Semi-improved grounds are areas where periodic maintenance is performed primarily for operational reasons such as erosion and dust control, bird control, and visual clear zones. Unimproved grounds include all areas not improved or semi-improved (AFMAN 32-7003).

Of the total installation area of 4,397 acres at CAFB, 470 acres are designated as improved grounds. These include administrative areas, recreational areas, and housing areas. Semi-improved areas total 1,729 acres, and unimproved lands total 2,198 acres (Figure 2-5). MAFR encompasses a total of 69,731 acres. The improved areas on MAFR are the range administrative area and the Ground Electronic Combat Operations

compound, which in total covers approximately 340 acres. The impact and restricted areas cover 12,718 acres and is classified as semi-improved land as it is routinely managed for operational use. The remaining 56,673 acres of land on MAFR is unimproved (Figure 2-6). Additionally, five areas previously used for agricultural crops are now infiltrated with non-native grasses and can be considered neither improved nor unimproved. Currently these former agricultural areas are disturbed but not ruderal.

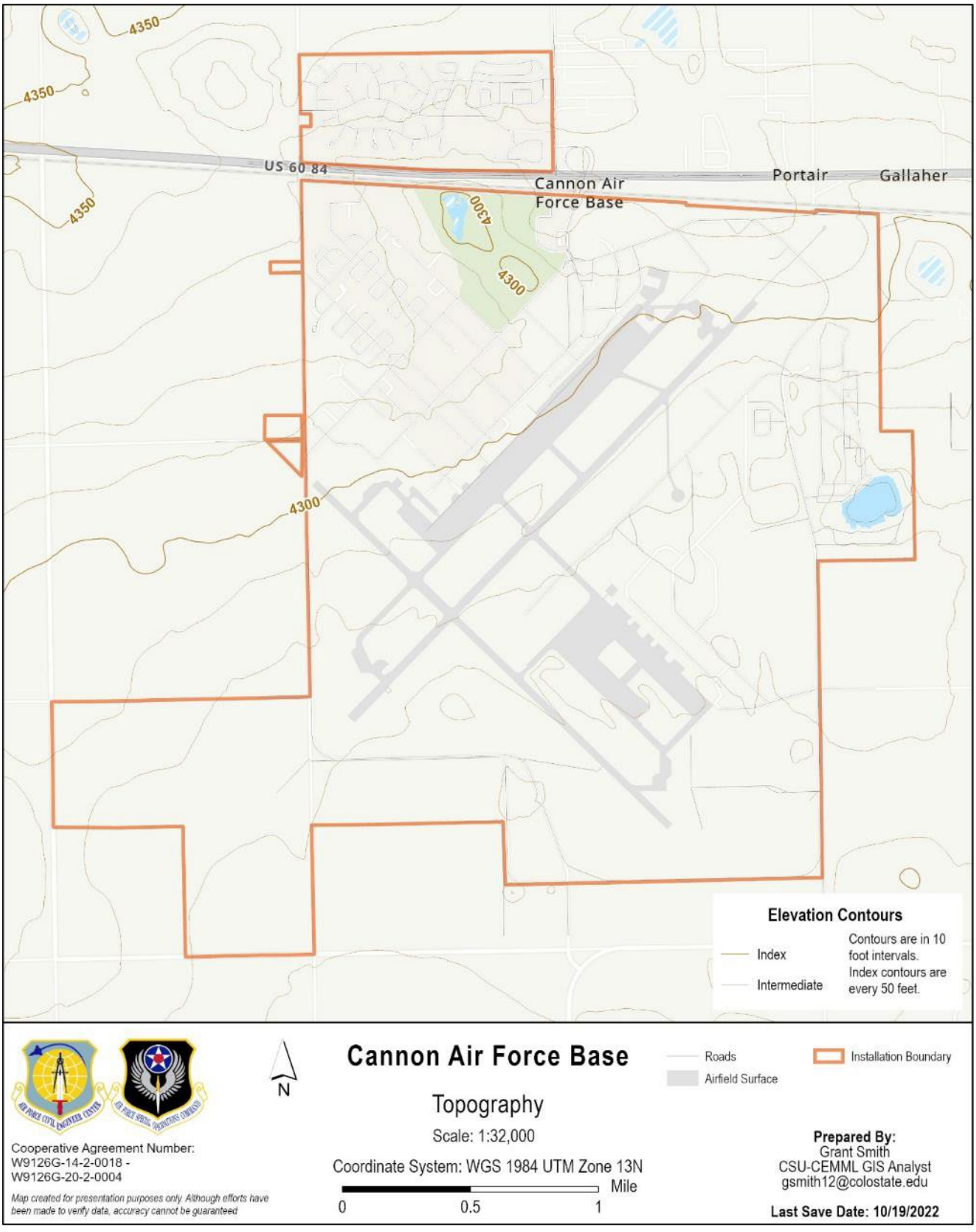


Figure 2-3. Topography of Cannon Air Force Base

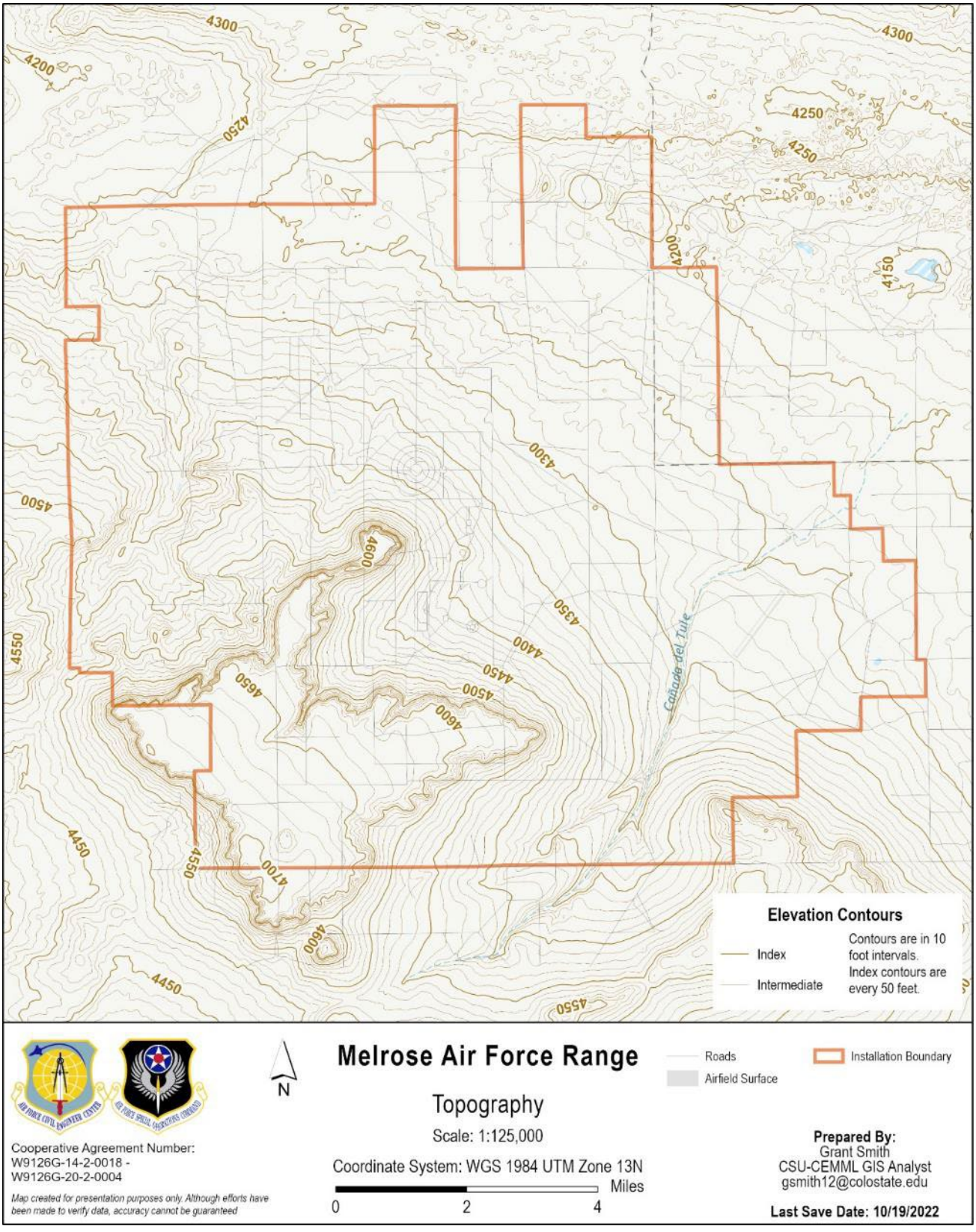


Figure 2-4. Topography of Melrose Air Force Range

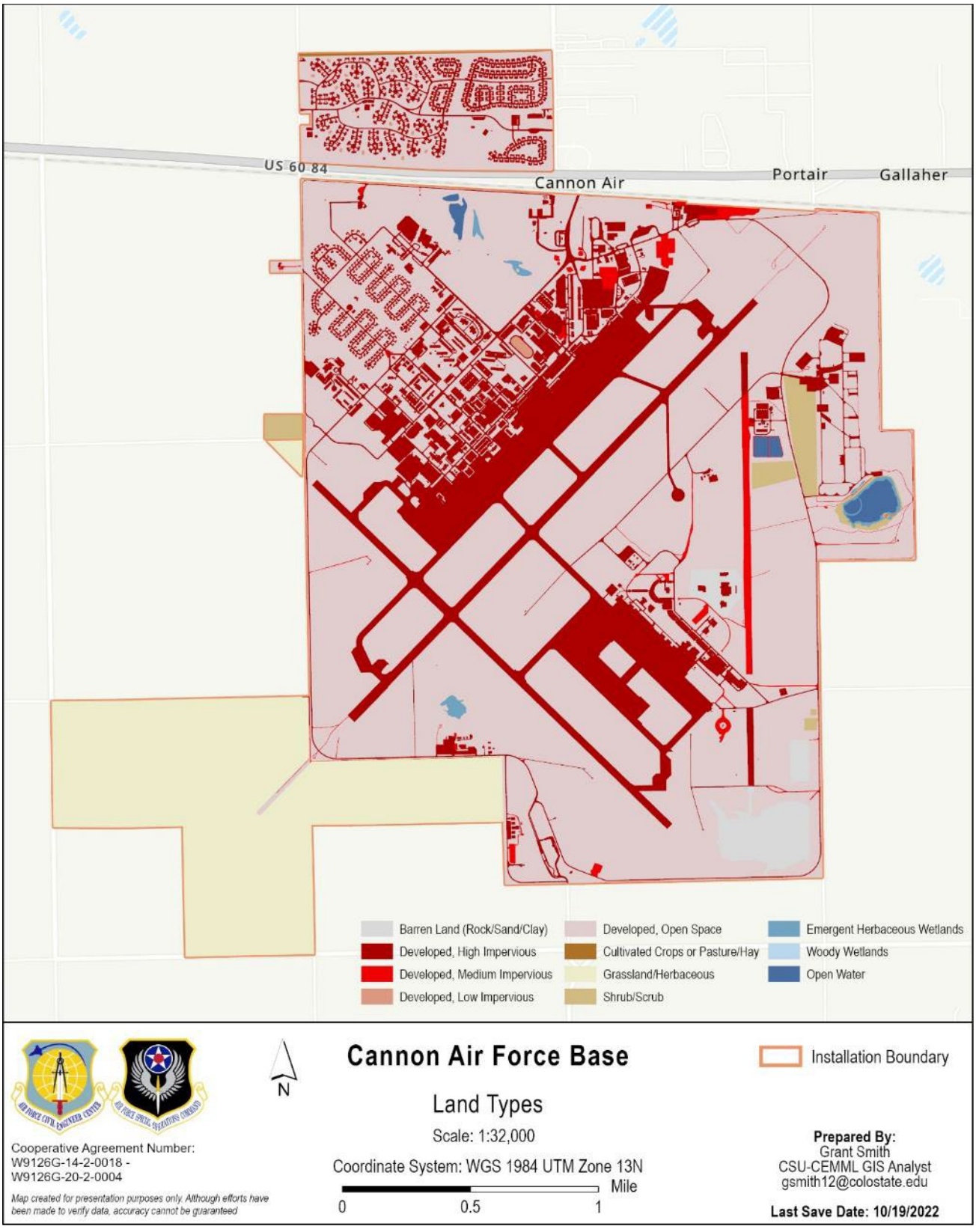
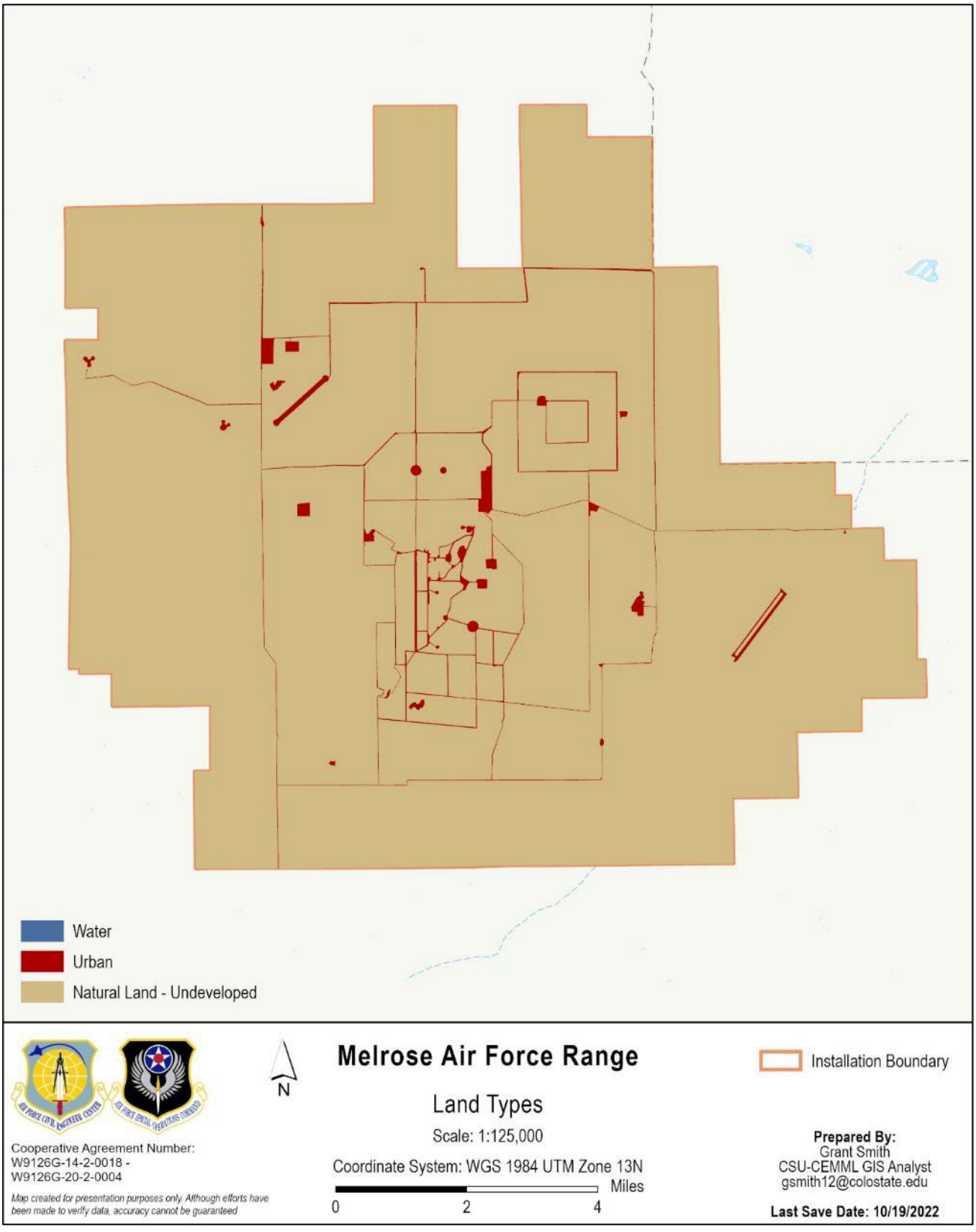


Figure 2-5. Land Types at Cannon Air Force Base



694

695 Figure 2-6. Land Types at Melrose Air Force Range
696

2.2.3 Geology and Soils

CAFB and MAFR are located in the Great Plains province, which consists primarily of horizontal Mesozoic and Cenozoic formations overlying slightly warped Paleozoic structures. As part of the Raton Section of the Great Plains, the area is unique in having high mesas and plateaus capped in part by tertiary lava flows. The area is generally underlain by approximately 200 to 400 feet of unconsolidated sediments deposited over sandstones known as the Triassic redbeds (USAF 2001). The unconsolidated sediments are composed of poorly sorted gravel, sand, silts, and clays. These sediments form the base of a section of the Ogallala aquifer. The predominant extractable natural resources are oil, natural gas, sand and gravel, natural carbon dioxide, lime, and scoria (USAF 2002).

Soils in the region consist of a thin layer of topsoil underlain at relatively shallow depths by a clay-carbonate "caliche" hardpan. Caliche forms as calcium carbonate is leached from overlying sediments and precipitated in the pore spaces of underlying host sediments. Tightly cemented layers of caliche are present in several horizons in the natural soils and in the Ogallala aquifer below.

Five major soil associations are found on CAFB (Figure 2-7). These include Amarillo fine sandy loam, Amarillo loamy fine sand, Estacado loam, Randall clay, and Ranco clay. Amarillo fine sandy loam is the dominant soil association, covering about 90% of CAFB. The Amarillo series consists of very deep, well-drained, moderately permeable soils. Amarillo soils formed in loamy eolian sediments from the Blackwater Draw Formation of Pleistocene age. These soils are found on nearly level to gently sloping plains. Slope ranges from 0 to 5%.

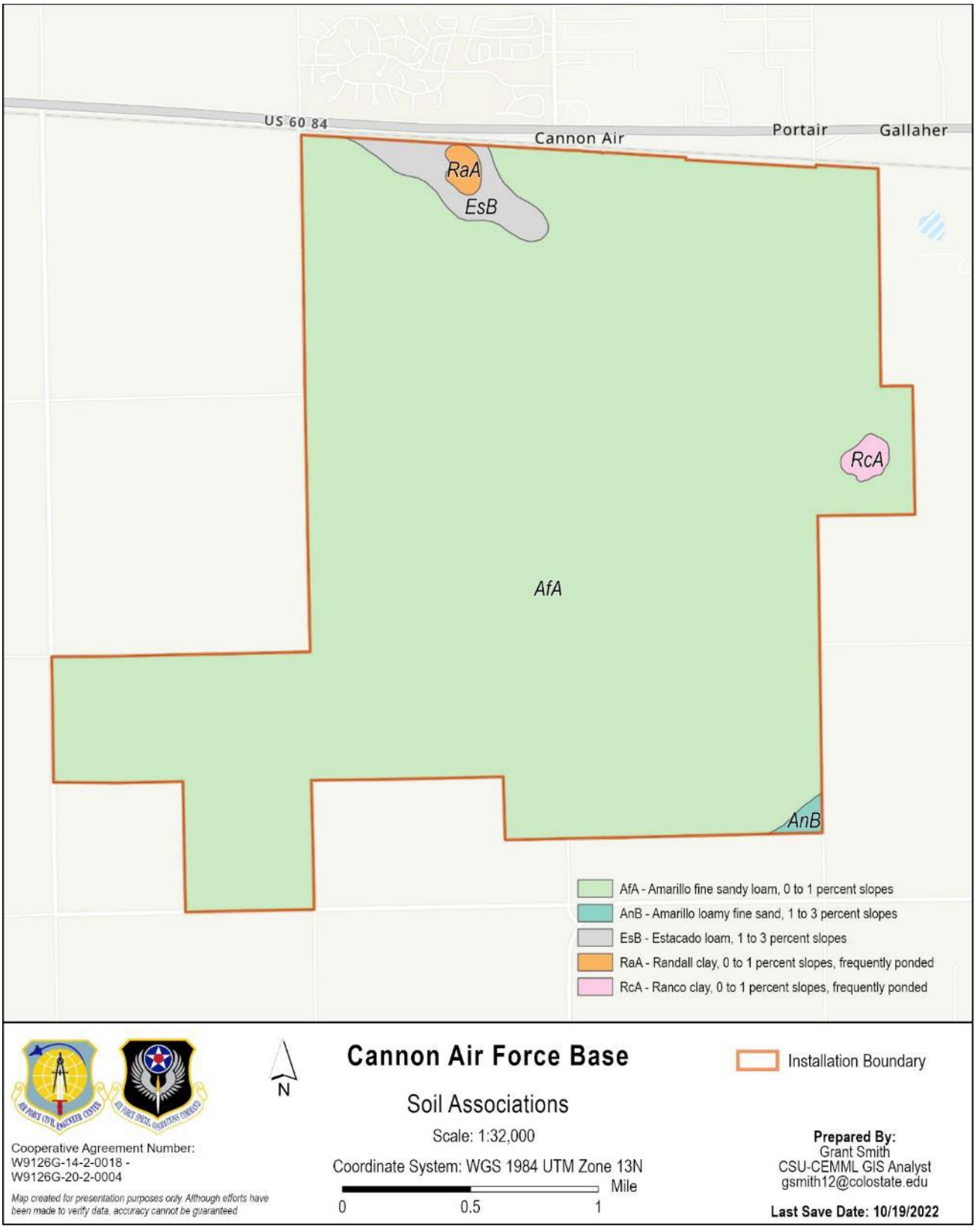


Figure 2-7. Soil Associations Found on Cannon Air Force Base

The soils on MAFR are much more complex than CAFB (Figure 2-8). Forty-nine primary soil associations are found on MAFR, with the most dominant being:

- Springer loamy fine sand—The Springer series consists of very deep, well-drained, moderately to rapidly permeable soils that formed in eolian sediments and alluvium. These nearly level to hummocky soils are on interdunes and dunes of sand sheets, and on-stream terraces of alluvial plains. Slope ranges from 0 to 10%.
- Clovis loam—The Clovis series consists of very deep, well-drained, moderately permeable soils that formed in medium and moderately fine textured sediments from quartzite, gneiss, schist, sandstone, and limestone. The Clovis soils are found on fan terraces, piedmont slopes, and plains. Slopes are 0 to 20%.
- Stegall loam—The Stegall series consists of soils that are well-drained and moderately deep, forming in loamy eolian sediments, that continue down to the petrocalcic "caliche" horizon. They are moderately to slowly permeable above the horizon and have very slow permeability below the horizon. The indurated caliche is underlain by loamy calcareous material derived from the Blackwater Draw Formation of Pleistocene age. They are on broad, smooth, nearly level to very gently sloping plains. Slope ranges from 0 to 3%.
- Mansker and Portales loams—The Mansker series consists of very deep, well-drained, moderately permeable, soils. These soils formed in loamy, calcareous eolian sediments derived mainly from the Blackwater Draw Formation of Pleistocene age. These soils are on nearly level to moderately sloping plains. Slope ranges from 0 to 8%. The Portales series consists of very deep, well-drained, moderately permeable soils. These soils formed in medium to moderately fine textured, calcareous, lacustrine sediments of Pleistocene age and are on nearly level to very gently sloping concave plains associated with playa lake basins. Slope ranges from 0 to 1%.
- Olton loam—The Olton series consists of very deep, well-drained, moderately slowly permeable soils that formed in loamy, calcareous eolian sediments in the Blackwater Draw Formation of Pleistocene age. These soils are on nearly level to gently sloping plains and upper side slopes of playas and draws. Slope ranges from 0 to 5%.

Permeability of the soils ranges from moderate in the loam soils to high in the sand soils. The soils are highly susceptible to erosion from the persistent winds of the area.

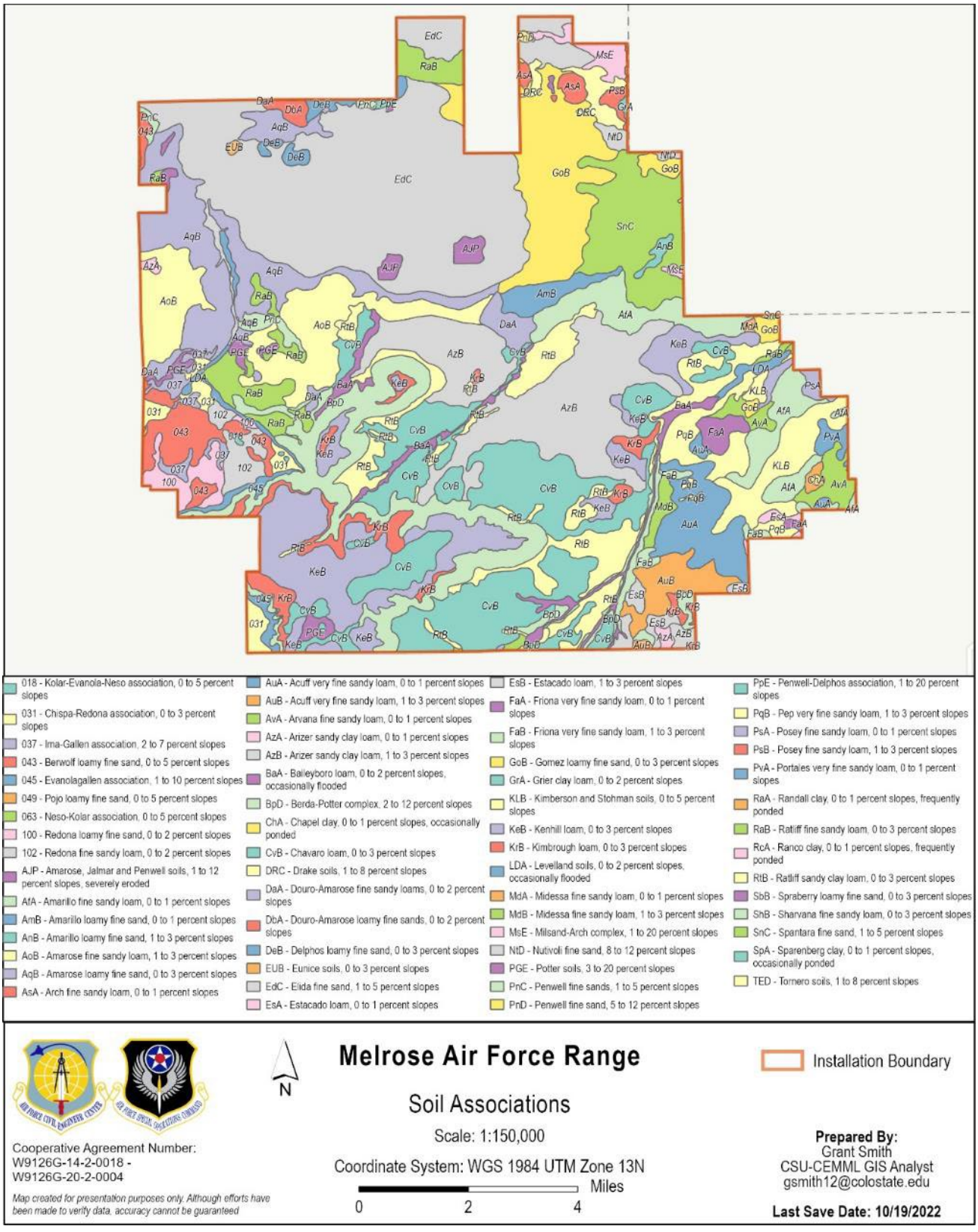


Figure 2-8. Soil Associations Found on Melrose Air Force Range

2.2.4 Hydrology

2.2.4.1 Surface Water Cannon Air Force Base

As a result of the low annual precipitation and flat topography, regional drainage in Curry County flows into poorly developed ephemeral streams or closed basins. Stream drainage is predominately to the southeast and east in long shallow valleys (locally known as draws and arroyos) that extend almost from the western edge of the High Plains to the eastern boundary of the plateau. The draws and arroyos eventually drain into one of three river valleys. These drainages seldom contribute actual flow to the rivers except during periods of heavy rainfall, since most precipitation is lost to evaporation and ground infiltration (ACC 1996).

In areas not drained by the draws, surface runoff collects in playa lakes. These ephemeral lakes are widespread on the High Plains and are important for use by migrating waterfowl and shorebirds. They also provide intermittent sources of water for other wildlife. Playas have no surface outlet, and any water they collect is eventually lost to evaporation, infiltration, or use by plants and animals (ACC 1996).

Stormwater runoff at CAFB is mostly contained on base and either evaporates or infiltrates into the ground. An insignificant amount of stormwater may run off the installation in isolated areas, such as at the extreme northeast and northwest corners. A portion of the southern section of the installation has a minor amount of stormwater runoff. Additionally, approximately 50% of the stormwater runoff from CAFB is conveyed to two playa lakes either by drainage ditches, storm sewers, or sheet flow. Most runoff from along the flight line is conveyed to South Playa Lake. Stormwater draining from north of the Fire/Crash Rescue Facility spreads out and evaporates on the eastern side of Runway 4/22. Runoff also collects in several ponds and a wetland located on the golf course (Figure 2-9).

The South Playa Lake is located on the south side of CAFB (ACC 1995) and is fed by surface runoff. Other surface features on the base include North Playa Lake and a golf course pond. Currently, North Playa Lake receives effluent from the wastewater treatment plant while the golf course pond no longer receives that effluent. No permanent surface waters exist near CAFB. Water supplies are obtained exclusively from groundwater. There are no designated waters of the U.S. on the installation.

2.2.4.2 Surface Water Melrose Air Force Range

Drainage in Roosevelt County at MAFR is mostly internal, although numerous small draws drain water from higher areas, and playas are commonly found here (USDA 1967). The drainage patterns expand in long shallow valleys that extend nearly from the western edge of the High Plains to the eastern boundary of the Southern High Plains Plateau. Rarely do the draws and arroyos contribute flow to connecting rivers due to losses from high evapotranspiration rates and infiltration.

The most prominent surface water features on MAFR occur in the long shallow valleys of the Cañada del Tule and Sheep Canyon draws; several smaller drainages carry runoff from the Mesa (Figure 2-10). The Cañada del Tule draw carries seasonal runoff from the southeastern half of the range and flows northeast through it. Historically, the draw carried water to Tule Lake, located northeast of the range; however, due to the numerous impoundments and related diversions along its course, flow has decreased and evidence of surface water flow north of Sundale Valley Road is difficult to identify. It is unknown whether these impoundments serve a function. Impoundments are further discussed in Section 2.2.4.4.

The Sheep Canyon drainage area contains a single major drainage that flows northeast from the Mesa and several small seasonal tributaries. Other surface water features on MAFR include four periodically flooded wetlands primarily located in shallow playa basins in the eastern portion of the range, two playa ponds, and

numerous on-channel impoundments in natural and constructed drainages. There are no Waters of the U.S. on the range.

2.2.4.3 Groundwater

Given the relative lack of permanent surface water resources at CAFB and MAFR, water supplies for irrigation, industrial, and domestic purposes are obtained from groundwater, although some irrigation water comes from treated effluent from the wastewater treatment plant. The base is underlain by a portion of the High Plains aquifer (regionally known as the Ogallala aquifer), which developed in the unconsolidated sediments of the Ogallala Formation. The thickness of the aquifer ranges up to 150 feet in parts of Curry County. The groundwater generally flows east to southeast. The upper 50 feet of sediments are composed of silty sand with zones cemented by caliche. These caliche zones decrease the permeability and amount of infiltration of surface water through the near-surface sediments. Most groundwater in the Ogallala aquifer is a calcium magnesium carbonate type, although some areas of southeastern New Mexico exhibit a bicarbonate sulfate quality due to high concentrations of dissolved sulfate (Mr. John Rebman, water quality expert, CAFB, personal communication, 2016).

2.2.4.4 Impoundments

Several manmade impoundments are present on CAFB and MAFR. On CAFB, impoundments exist on the golf course. On MAFR, approximately 10 earthen stock tanks are present. Their average size is estimated at one-third acre.

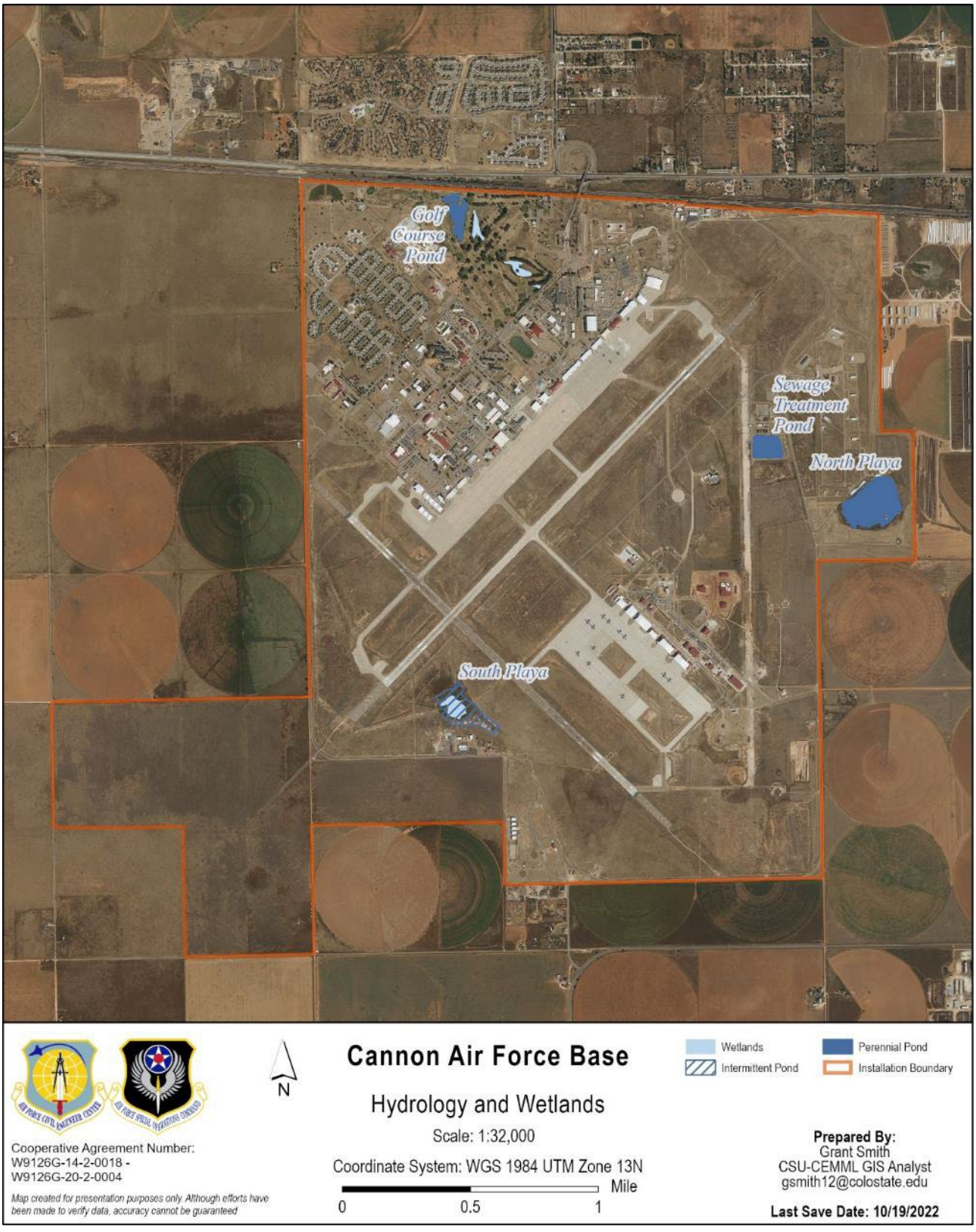


Figure 2-9. Hydrologic Features of Cannon Air Force Base

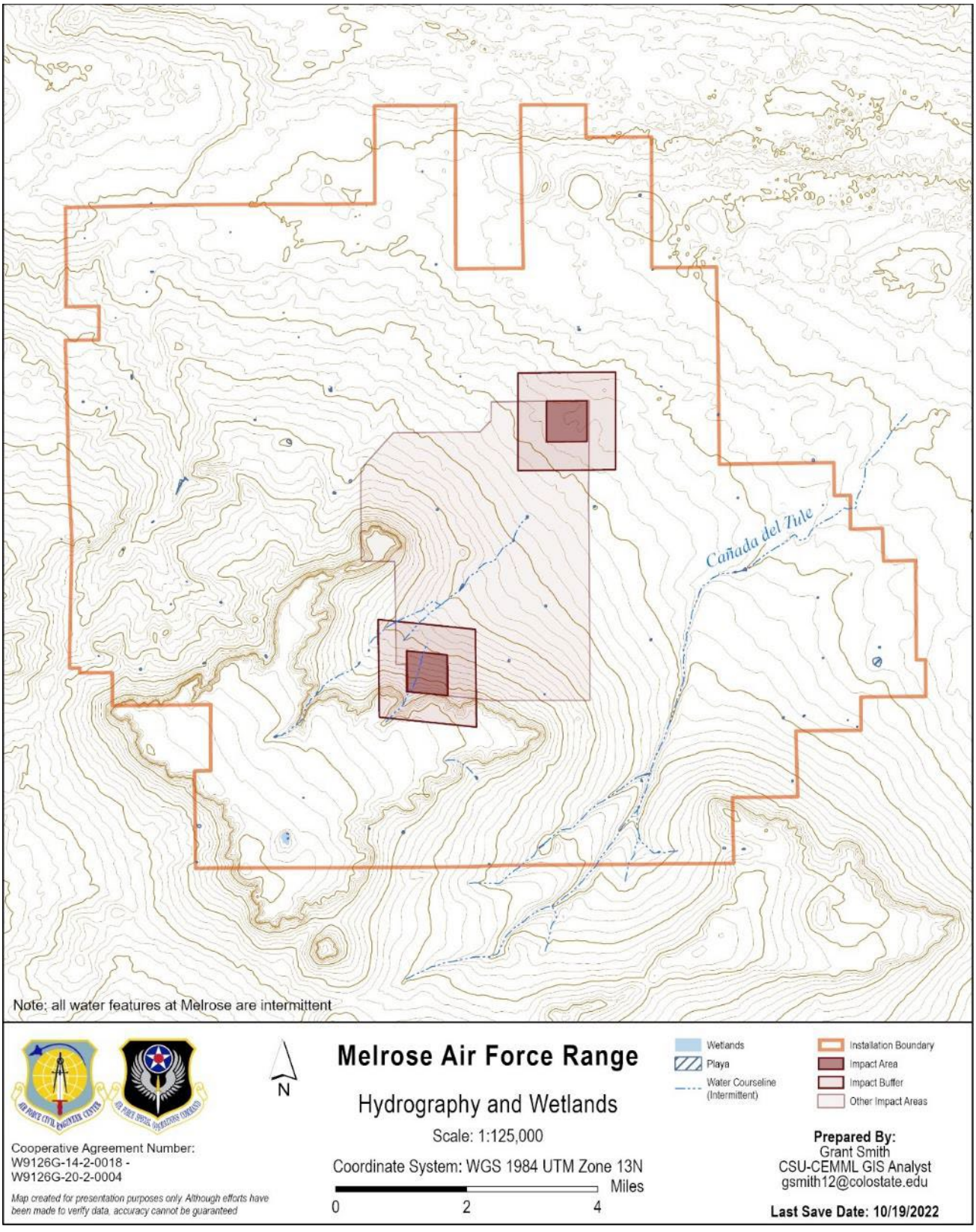


Figure 2-10. Hydrologic Features of Melrose Air Force Range

2.2.4.5 Climate Impacts to Hydrology

Flood modeling was conducted within the Sheep Canyon draw at MAFR to examine the extent of flooding associated with climate projections (CEMML 2019). Flood modeling was conducted using local watershed characteristics and the design storms generated from climate projection data (Table 2-4, Table 2-6). Inundation projections were influenced by four variable inputs: (1) variation in total precipitation between design storms, (2) variation between the daily distribution of precipitation over the three-day period, (3) land cover change over the watershed area used in hydrologic modeling, and (4) land cover change in the area within the installation used in hydraulic modeling.

Projected inundation associated with each climate scenario and the relative change from baseline conditions are summarized in Table 2-7. Projected changes in stream channel overflow can be used to assess potential vulnerabilities to species, habitat, mission, and built and natural infrastructure.

Stream channel overflow associated with the baseline design storm was estimated to inundate approximately 2,400 acres along Sheep Canyon draw. Total design storm precipitation decreased for all climate scenarios. In three of the four climate scenarios, inundation at MAFR was also projected to decrease (Table 2-5). Flooding was projected to increase by 330 acres under the RCP 4.5 emission scenario in 2050. Total design storm precipitation for this scenario decreased by only 3%, and a significant percentage of that precipitation fell on the second day, similar to the baseline event. Higher precipitation in a single day increases runoff rates within the model, affecting projected inundation.

Table 2-7. Area of Projected Inundation for MAFR.

	Baseline	RCP 4.5		RCP 8.5	
	2000	2030	2050	2030	2050
Projected inundation (acres)	2414	1679	2744	2239	1855
Change in inundation area from baseline (acres)		-734	330	-175	-559
Percent change from baseline		-30%	14%	-7%	-23%

2.3 Ecosystems and the Biotic Environment

2.3.1 Ecosystem Classification

As discussed earlier, CAFB and MAFR are located within the High Plains Ecoregion. This ecoregion is higher and drier than the Central Great Plains to the east, and in contrast to the irregular, mostly grassland or grazing land of the Northwestern Great Plains to the north, much of the High Plains is characterized by smooth to slightly irregular plains with a high percentage of cropland. Grama-buffalo grass is the potential natural vegetation in this region as compared to mostly wheatgrass-needlegrass to the north, Trans-Pecos shrub savanna to the south, and taller grasses to the east.

More specifically, CAFB and MAFR are within a sub-ecoregion of the High Plains known as the Llano Estacado. Thousands of playa lakes (seasonal, depressional wetlands) occur in this area, many serving as recharge areas for the important Ogallala Aquifer. These playa lakes are also essential for waterfowl during

their yearly migration along the Central Flyway of North America. The Llano Estacado was once covered with shortgrass prairie, composed of buffalograss (*Buchloe dactyloides*), blue grama (*Bouteloua gracilis*), sideoats grama (*Bouteloua curtipendula*), little bluestem (*Schizachyium scoparium*), and silver bluestem (*Bothriochloa laguroides*). About 80 to 90% of the Llano Estacado in Texas and New Mexico is presently tilled for agriculture, with more rangeland to the west. Farmers produce cotton, corn, and wheat under dryland agriculture or irrigated with water pumped from the Ogallala Aquifer.

Ecosystems

Broadly, CAFB and MAFR have two primary environments that support biotic communities: terrestrial and freshwater ecosystems. The terrestrial ecosystem can be further divided into shortgrass prairies, mesquite scrubland, sandsage/soapweed yucca, sand hills, canyons, current and former prairie dog towns, wind breaks, former homesteads, habitat management areas, former cropland, managed lands, disturbed lands, and urban areas (Figure 2-5, Figure 2-6). Each of these areas has a distinctive vegetation association and often unique fauna. These communities will be described in more detail in the Vegetation section. The freshwater ecosystem includes playa lakes and ephemeral streams and channels. Flora and fauna assemblages for each are also described in the following Vegetation section.

2.3.2 Vegetation

Plant community descriptions in this section are based on existing data from land condition trend analysis, wetland surveys, and invasive plant surveys.

2.3.2.1 Historical Vegetative Cover

Historically, the areas now occupied by CAFB and MAFR were a treeless grassland with a very small brush component (Marcy 1850). Depending on soil type, the grassland varied from a shortgrass to a midgrass prairie with a tallgrass component. The shortgrass areas were historically dominated by black grama (*Bouteloua eriopoda*) (Dick-Peddie 1999; USDA 2017*a*, *b*, *c*, *d*). Following settlement under the Homestead Act in 1862, most of the area was used as rangeland or for tillage agriculture. Brush species became more prominent on the rangeland as fire was suppressed and grazing pressure was confined primarily to grasses, the plants preferred by horses and cattle.

Prior to airfield construction at CAFB, cultivated agricultural fields covered the area now occupied by the base (Buchanan and Ross 1958).

Historically, much of MAFR was managed for cattle grazing and farming under CAFB's agricultural outlease program. In addition to livestock grazing, the loss of bison (*Bison bison*) herds, and fire suppression, climate change has likely contributed to altering rangeland condition. In eastern New Mexico, native shrub species that had been suppressed by bison and pre-European fire regimes began to invade productive grass-dominated rangelands, decreasing forage values and severely degrading the land's capacity to support native wildlife. The grazing and farming programs were terminated in 2012 and associated infrastructure has been removed. However, some of this infrastructure, such as aboveground stock tanks and corrals, still exists on the installation.

2.3.2.2 Current Vegetative Cover

Today, the vegetation of CAFB and MAFR is a mix of prairie, heavily shrub-invaded grasslands, and formerly grazed rangelands. Species-specific vegetation associations documented on CAFB (Figure 2-11) and MAFR are shown below (Figure 2-12). A complete list of all vegetation documented from 2012 to 2016 on CAFB and MAFR can be found in Appendix F. With the reintroduction of fire as a major

892 component of grassland management on MAFR, brush species are expected to decrease in height and
893 density. If herbicides and mechanical treatment of brush are employed as proposed, brush reduction will
894 occur more rapidly, encouraging the return of native prairie species. Fire is most effective on cholla that
895 are below approximately one foot in height, so initial applications of herbicide (especially aerial
896 applications that allow broad-scale treatment) or mechanical treatments such as chaining or railing
897 (dragging a chain or rail over the landscape to knock down the shrubs) can increase the effectiveness of
898 follow-up burns.

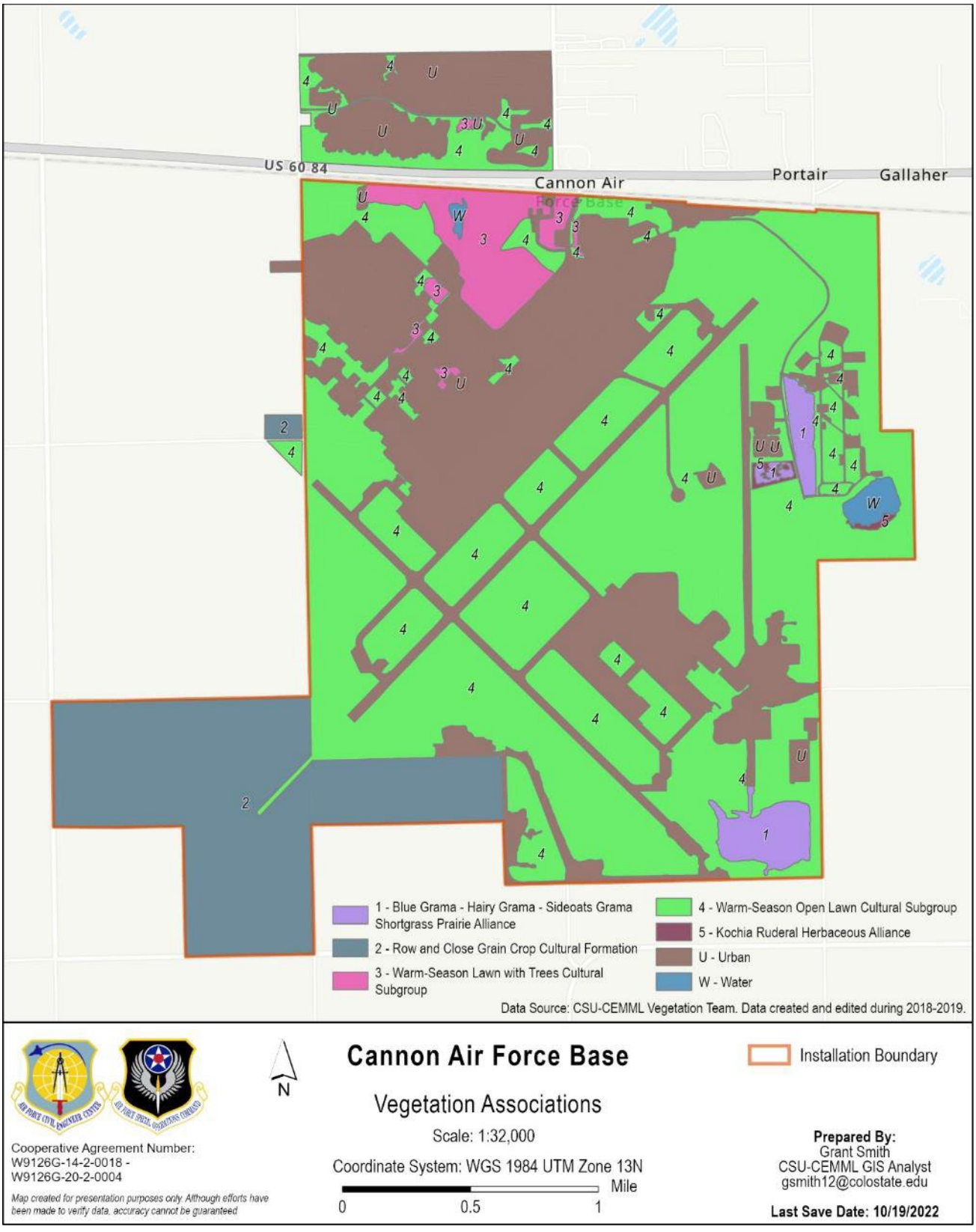
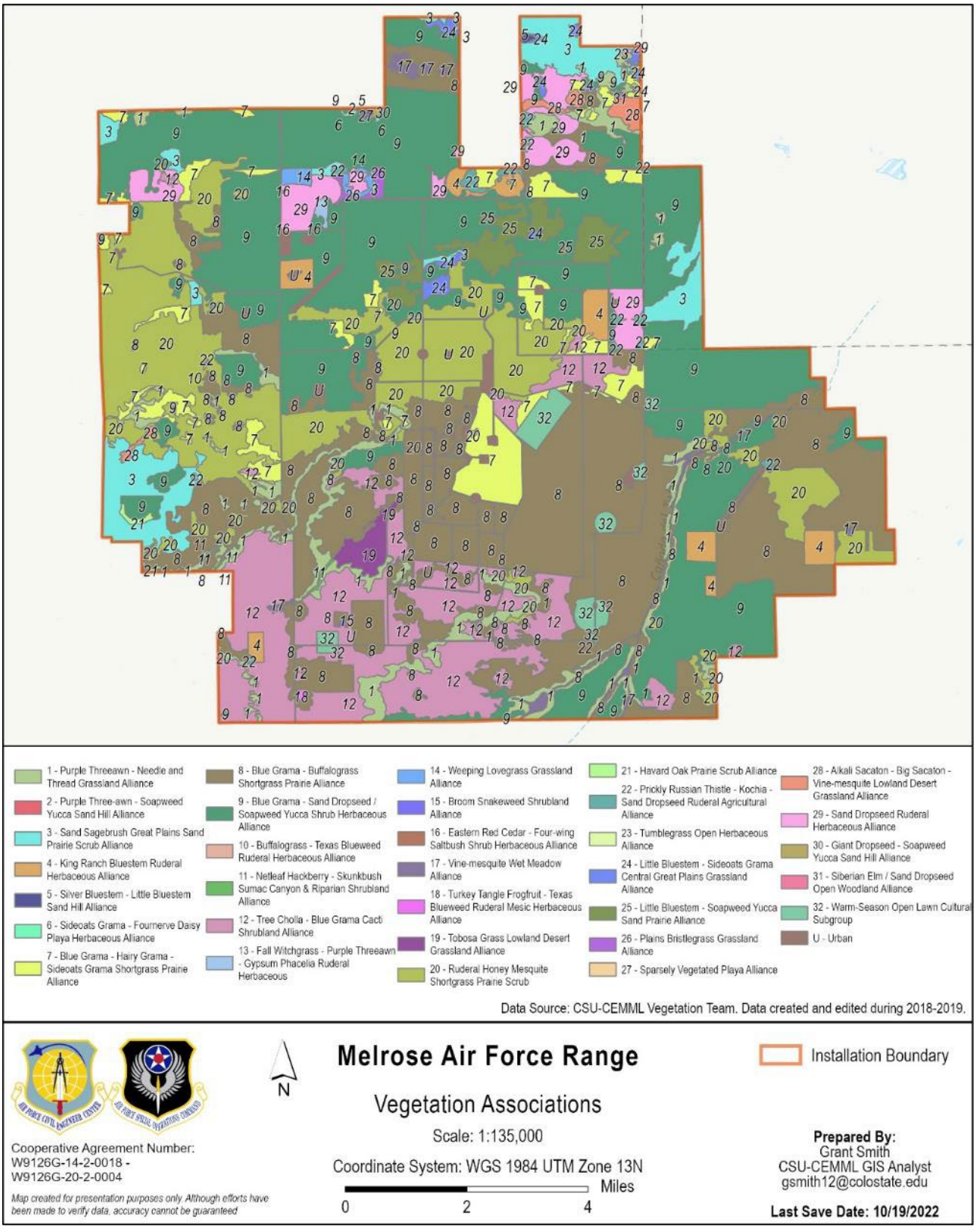


Figure 2-11. Vegetation Associations Found on Cannon Air Force Base



902

903 Figure 2-12. Vegetation Associations Found on Melrose Air Force Range

Shortgrass Prairies

Shortgrass prairie habitat occurs on the southern portions of MAFR. This plant community is dominated by blue grama and buffalograss, with black grama prominent in some areas, and lesser amounts of forbs and shrubs unevenly distributed across the landscape. The perennial grass and perennial forb components remain fairly constant in relation to each other, with the total production of both components increasing or decreasing in relation to precipitation timing and amount. The woody component increased on the older portions of the range until fire was introduced and, more recently, herbicides were applied to reduce mesquite and cholla. Cholla, honey mesquite (*Prosopis glandulosa)*, and broom snakeweed (*Gutierrizia sarothrae*) are the primary shrubby species in this area. Forbs include annual buckwheat *(Eriogonum annuum*), silverleaf nightshade (*Solanum elaeagnifolium*), common sunflower (*Helianthus annuus*), and dotted gayfeather (*Liatris punctata*). Variations in temperature, rainfall, and fire are the primary drivers of the annual grass and annual forb components. Large variations in the annual component occur as these plants are opportunistic and first to colonize bare areas following prolonged drought or fire.

The typical composition of this system is made up of 70 to 75% grasses, around 10% woody species, and 10 to 15% forbs. Additional grasses found in this area are silver bluestem, threeawn species (*Aristida* spp.), and tobosa (*Pleuraphis mutica*).

Prairie Dog Towns

The composition of the vegetation at prairie dog towns is like that of the surrounding shortgrass prairies, except the plants are shorter and a larger number of forbs are present (Institute of Renewable Natural Resources [IRNR] 2016*b*). Prairie dogs clip the plants surrounding their burrows; therefore, species shorter in stature such as buffalograss are more common than taller grasses. Forbs are more common than in the shortgrass prairie but they too are clipped short. Silverleaf nightshade and scarlet globemallow (*Sphaeralcea coccinea*) are common but are shorter than those plants found in surrounding areas. More bare ground is found in prairie dog towns and plant species that grow prostrate to the soil surface in prairie dog towns include prairie bluet (*Hedyotis nigricans*), small matweed (*Gulleminea densa*), prostrate spurge (*Chamaesyce prostrata*), and wooly tidestromia (*Tidestromia lanuginosa*) are examples.

Mesquite Scrubland

The mesquite grassland-dominated habitats on MAFR are generally located north of the shortgrass prairie; however, some portions of the shortgrass prairie are also heavily invaded by mesquite. Honey mesquite is native to eastern NM, but its density has increased over time as grazing concentrated on grass plants and fire suppression followed settlement. Furthermore, mesquite was rare in this section of the Raton prior to settlement. The individual mesquite plants range in maturity and height (mainly three to five feet but can reach >12 feet in height) and are the dominant species in this habitat type. The mesquite generally grows in closely spaced clusters or closed-canopied stands. Honey mesquite exerts a profound influence on neighboring vegetation, soils, subcanopy microclimate, wildlife, and insect populations. High densities of mesquite suppress grass growth and can reduce understory species diversity.

The mesquite grassland habitat is made up of >40% mesquite, and the remaining vegetation is forbs and grasses. The dominant forbs and grasses in this habitat include blue grama, sideoats grama, and hairy grama (*Bouteloua hirsuta*); purple three-awn (*Aristida purpurea*); silver bluestem; buffalograss; red lovegrass (*Eragrostis secundiflora*); tobosa; Hall's panicum (*Panicum hallii* var. *hallii*); prickly pear cacti (*Opuntia* spp); broom snakeweed; western ragweed (*Ambrosia psilostachya*); annual buckwheat; spinytooth gumweed (*Grindelia nuda* var. *nuda*); and common sunflower.

Initial treatment or control of mesquite requires mechanical or chemical control followed by maintenance suppression. On MAFR, some of the mesquite-infested pastures have been grubbed to open the canopy and eliminate competition, allowing forbs and shortgrass species to establish. In some areas, the canopy was reduced by fire; however, mesquite respond vigorously to removal of their tops and quickly recover to canopy at or above pre-burn levels. Mesquite in grubbed areas are reinvading from portions of plants not killed in the grubbing process and newly sprouting plants. Young mesquite can be controlled by intense fire; however, mechanical or chemical methods are required for those plants that survived the grubbing process. Tumbleweed, an exotic forb, often is first to colonize disturbed areas in mesquite scrubland. These plants break loose and blow across the land, accumulating in large drifts and causing fence damage and problems on area roads.

Sandsage/Soapweed Yucca

This habitat is dominated primarily by sand sagebrush (*Artemisia filifolia*) and soapweed yucca (*Yucca glauca*). The shrub components of this type are important in terms of nutrient cycling and ecosystem function where sagebrush, soapweed yucca, and other subdominant shrubs trap and accumulate particulates and nutrients. This continuing accretion of organic matter and nutrients is especially important to insects and ultimately to rodents, herpetofauna, and birds that consume them (Whitford et al. 1998).

An understory of grasses and forbs is also present, surrounding the woody species. Dominant grass species interspersed with the sandsage and soapweed yucca are hairy grama, purple threeawn (*Aristida purpurea*), sand dropseed, red lovegrass, mesa dropseed (*Sporobolus flexuosus*), needle and threadgrass (*Hesperostipa comata*), fringeleaf paspalum (*Paspalum setaceum*) and Hall's panicum. Queen's delight (*Stillingia sylvatica*), paperflower (*Psilostrophe tagetina*), western ragweed, small-flowered gaura (*Gaura paviflora*), common sunflower, and annual buckwheat are the dominant forb species in this habitat. Grass and forb production fluctuates widely from year to year, depending on the amount and timing of precipitation. This vegetative cover is suitable for lesser prairie chickens (LEPC).

Sand Hills

The sandhill habitat is located in the northeastern portion of MAFR and the south portion of the New Mexico Land Gift Area. The area is characterized by sand dune hills, and vegetative cover varies from none to moderate. The sandhill habitat is dominated by scattered shrubs such as sandsage and soapweed yucca with a mixed-grass and forb understory. A small amount of shinnery oak (*Quercus harvardii*) is found in the southwest areas of MAFR, while sand plum (*Prunus angustifolia*) is found in the northeast. The shrub populations are the most constant, changing with long-term moisture cycles. Forb populations fluctuate widely from year to year with amount and seasonal distribution of rainfall, past grazing regime, and fire frequency. Gaura (*Gaura* spp.), western ragweed, common sunflower, annual buckwheat, and queen's delight are the typical forb species found in this habitat type. Grasses consist largely of giant, mesa, sand, and spike sandreed; sand bluestem; black grama; and needle and threadgrass. This vegetative cover is suitable for LEPC.

Soils in this habitat type are typically deep and well-drained with a low water-holding capacity. They are highly erodible, and the soil can become unstable when organic residues and vegetative cover are removed. The vulnerability of the sandhill habitat to wind erosion and blowouts increases as these areas are disturbed.

Canyons

This habitat is confined to the southwestern portion of MAFR. The rocky limestone outcrops and canyon wall provide the steepest topographical relief on MAFR. The canyons are approximately 50 feet deep

relative to the surrounding mesa (Figure 2-4). The canyon habitat is largely composed of shortgrass species with varying amounts of perennial forbs and a few scattered shrubs. Dynamic climatic flux is exhibited by the annual grass and annual forb species, whose composition fluctuates annually with variation in rainfall and other climatic factors.

Of the plants found in this habitat type, 70 to 80% is grasses, 5 to 10% woody species, and 10 to 15% forbs. The dominant grass species in this habitat are blue, hairy, and black grama; buffalograss; false buffalograss (*Munroa squarrosa*); purple threeawn; sixweeks threeawn (*Aristida adscensionis*); silver bluestem; tumble windmill grass (*Chloris verticillata*); ring muhley (*Muhlenbergia torreyi*); and sand dropseed. Forbs include blackfoot daisy (*Melampodium leucanthum*), bigelow sage (*Artemisia bigelovii*), broom snakeweed, chocolate daisy (*Berlandiera lyrata*), feather dalea (*Dalea formosa*), and scarlet globemallow. The shrubs and cacti consist of net-leaf hackberry (*Celtis reticulata*), three-leaf sumac (*Rhus trilobata*), brown spine prickly pear (*Opuntia phaeacantha*), ephedra (*Ephedra torreyana*), mesquite, jumping cholla (*Cylindropuntia tunicata* var. *davisii*), lace hedgehog cactus (*Echinocereus reichenbachii*), and rabbitbrush (*Chrysothamnus pulchellus* ssp. *baileyi*).

Old fields

Scattered areas across MAFR were at one time cultivated. Some of these areas have lost large amounts of soil due to wind erosion or efforts to return them to grassland. Sand ridges are evident primarily on the east and north sides where blowing soil accumulated during wind events. Cultivation destroyed the soil structure and ecology; thus, recovery under the semiarid windy conditions is a long-term proposition. Fields that were abandoned or reseeded shortly after the homestead period are visible from the air and on the ground. Plant composition differs from surrounding grasslands and is less diverse. Some fields were planted to native grasses but never back to the mix that was disturbed at cultivation. Others were planted to a single species such as side-oats grama many years ago and the composition has changed little since that planting. Fields recently planted to grasses were often planted to non-native species such as yellow bluestem (*Bothriochloa ischaemum*) and weeping lovegrass (*Eragrostis curvula*), which are both invasive. Weedy species including common sandbur (*Cenchrus spinifex*), Russian thistle (*Salsola tragus*), kochia (*Kochia scoparia*), and other annual plants are common and in places dominate the composition of old fields most recently cultivated. These old fields tend to have a smaller proportion of the soil covered by perennial grasses, a greater proportion of forbs, and a greater amount of bare ground than surrounding native grasslands. Chemically treating the invasive grasses, then overseeding with appropriate native grass and forb seeds could improve these areas as wildlife habitat, reduce bare ground, and help bring them back to a healthier state.

2.3.2.3 Future Vegetation Cover

The projected increase in seasonal, annual, minimum, and maximum temperatures and changing precipitation patterns are likely to impact vegetation on the installation. Existing ecosystems are vulnerable to shifts in climatic regime because they are dry with a strong seasonal climate. Slight changes in temperature and precipitation can substantially alter the composition, distribution, and abundance of plant species and the products and services they provide. The extent of these changes will also depend on changes in precipitation and fire. Wildland fire may have significant impacts on the dominant landscapes at CAFB and MAFR, including shortgrass prairie and sandhill steppe, in which fire is a major ecological process (Brockway et al. 2007).

Increased drought frequency can also cause major changes in vegetation cover (Blair et al. 2014). Losses of vegetative cover, coupled with increases in precipitation intensity and climate-induced reductions in soil aggregate stability, will dramatically increase potential erosion rates. Rising temperatures under various

climate change scenarios will likely enhance soil decomposition. Together with reductions in rainfall, this may also reduce plant productivity over large areas.

2.3.2.4 Turf and Landscaped Areas

Turf and Landscaped Area Management

A 2021 Sustainable Landscape Development Plan for CAFB was developed by 27 Special Operations Civil Engineering Squadron/Programs Flight (27 SOCES/CEP). The goal of this plan, found in Tab 3, is to use the policies of the plan, acceptable plants species list, and landscape development zones to create pleasing and resource-efficient landscaping on the installation. The policies of the plan are:

- All projects, roads, parking lots and site modifications shall include compliant Cannon AFB green landscape development considerations and budgets consistent with the plan.
- All landscape development projects or landscape development in other construction or repair projects shall be designed or reviewed by the Natural Resources PM, a professional landscape architect, or pre-approved landscape designer.
- A pre-approved portion of the project funding shall be specifically allocated for landscape development and shall only be used for that purpose.
- All landscape development shall only use materials listed in the CAFB Approved Plant List and Approved Inert Material List as provided in the plan.
- All landscape development shall be irrigated according to the CAFB Approved Irrigation Standards as provided in the plan.
- All landscape development shall meet anti-terrorism/force protection landscape guidelines provided in the plan and other guidance documents.

The plan primarily focuses on water use reduction through the concept of xeriscape design and by providing a list of acceptable plants to use in landscaped and turfed areas. Xeriscape is the conservation of water and energy through creative and adaptive landscape design. This method of landscaping provides attractive solutions that saves money while reducing water and maintenance needs. Further, the plan details landscape development zones throughout the base as an effective way to budget for future landscape development. There are three zones of landscape development: primary, secondary, and tertiary.

- Primary zone: an area of the installation that is highly significant to the perceived visual quality and image of the installation. Some facilities, such as entry gates, administrative offices, community centers, and main roadways, may require additional funds in landscape design, construction, and maintenance.
- Secondary zone: an area that contains the remaining developed areas of the installation that does not fall into the primary zone. These are facilities and areas that are important to the daily lives of the installation community, but areas where extensive development is not essential due to decreased visibility and limited budgets. Some of these areas include squadron operations, family support centers, publicly visible areas of the perimeter fence, and dining halls.
- Tertiary zone: those areas that will require little to no long-term landscape development. Many of these areas are close to flight lines, near clear zones, or serve as force protection setbacks. Some of these areas include munitions storage, airfield facilities, service roads, and water treatment facilities.

Urban Habitat

Flora—Urban areas on CAFB comprise a large portion of the base in the northwest quadrant. This area includes buildings, housing, munitions storage, aircraft hangers, and parking lots. The small urban area on

MAFR is located near the range offices to the northwest and the range tower on the mesa in the central portion of the range. Urban areas are highly maintained and consist primarily of ornamental and non-native grasses, shrubs, and trees. Irrigation has assisted landscaped plants in establishment and allowed denser, thicker vegetation than that found in other habitats on the installation. The grass in this area is composed primarily of Bermuda grass (*Cynodon dactylon*), Johnson grass (*Sorghum halapense*), buffalograss, tumble windmillgrass, and blue grama. Many of the vacant lots are overgrown with various forb species including sandbur, Russian thistle, pigweed, and kochia. Various exotic and ornamental trees and shrubs are found throughout the urban areas. Siberian elms are plentiful throughout the urban housing areas on CAFB.

Fauna—The abundance of large trees and shrubs within urban areas attract many common avian species, including mourning dove (*Zenaida macroura*), Eurasian collared dove (*Streptopelia decaocto*), great-tailed grackle (*Quiscalus mexicanus*), European starling (*Sturnus vulgaris*), house sparrow (*Passer domesticus*), and American robin (*Turdus migratorius*).

2.3.3 Fish and Wildlife

All faunal community descriptions in this section are based on surveys for migratory, endangered, threatened, candidate, and sensitive species, plus general biological surveys. Sections are organized by habitat.

Historical Fauna

The wildlife on CAFB and MAFR have changed considerably since the area was settled by Europeans. Before that occurred, immense bison herds wandered over large expanses and were the dominant species of the treeless plain. Their pounding hooves and foraging created an enormous impact on the environment as they moved through an area. Fire, both natural and human-caused, was another major force, and was responsible for the lack of trees and minimal brush. Large numbers of pronghorn (*Antilocarpa americana*) were resident, as the bison and fire promoted the forbs and small shrubs that make up their diet. Mesquite was virtually absent from the landscape. Cholla, although present, covered a smaller area and did not form dense thickets as it does today. Only those species not dependent on brush or trees were found in the area. Raptors and ravens were limited, since few perches were available. Additionally, wolves (*Canis lupus*), were the top predator on the plains until they were extirpated by settlers, and then the top predator role fell to coyotes (*Canis latrans*).

Cannon Air Force Base

CAFB is 4,397 acres in size, consisting of a highly impacted shortgrass prairie. Impacts include a golf course, runways, streets, parking areas, xeriscape, buildings, mowed grasslands, lawns, recreation areas, playas that receive supplemental water, ponds with permanent water, landfills, and more. Every portion of CAFB is highly modified from the natural state. Despite this fact, CAFB provides habitat for a variety of resident, transitory, and migrant wildlife species.

Ungulate species are seldom, if ever, present on CAFB due to several factors, primarily a fence constructed to exclude unauthorized access. Large animals would present a hazard if they wandered onto the runways. Pronghorn and mule deer (*Odocoileus hemionus*), although found nearby, are unlikely to find their way onto CAFB, although they have been photographed along the fence. CAFB does not provide suitable mule deer habitat, but if they, or any other large animal, did wander onto the base, they would be removed to eliminate runway hazards.

Several native species are present on CAFB, including five New Mexico Species of Greatest Conservation Need (SGCN). One SGCN, the BTPD, is one of the most visible species and is present across much of

CAFB. Their abandoned burrows are used by BUOW (also a SGCN), cottontail rabbits, snakes, lizards, and other wildlife.

CAFB is home to ponds, playas, drainages, and wetlands that add to the diversity of wildlife found on the base. These wet areas are not classified as jurisdictional waters of the U.S. The playas found on CAFB receive larger amounts of water than similar playas in the surrounding landscape. This additional water has two primary sources: the sewage treatment plant and runoff from rain falling on impervious surfaces such as buildings, parking lots, streets, sidewalks, and runways. The north playa has standing water continually, as it receives water from the sewage treatment plant in addition to overland flows from rainfall events. This playa provides habitat for numerous water and wading birds, including mallard (*Anas platythyncos*), ruddy duck (*Oxynura jamaicensis*), American avocet (*Recurvistra americana*), great blue heron (*Athea herdias*), and also small, unidentified fish of unknown origin. Other birds and mammals use the playa as a source of drinking water. The availability of water, the presence of humans, and the food left out for pets makes CAFB one of the more likely places in the area to find raccoon (*Procyron lotor*).

See Appendix C, Fauna of CAFB and MAFR, for a list of species observed on CAFB.

Melrose Air Force Range

In the recent past, most of MAFR was grazed rangeland, similar to surrounding rangelands. Since the fall of 2012, grazing has ceased. Fire has since been used instead of cattle to manage rangeland vegetation and wildfire risk in support of the military mission. With frequent fire, a shift from scrub/grasslands toward pure grassland is probable. If herbicides and/or mechanical methodologies are applied, this shift will occur more rapidly. Brush species such as mesquite, cholla, sandsage, yucca, etc., will become a lesser portion of the species composition and those that remain will be shorter. Forbs will be a larger component of the plant composition. If large areas infested with mesquite are treated with herbicides, the action will promote a shift toward a pure grassland. Grass species most adapted to fire will dominate. Shifting herbaceous diversity will promote a proportional shift in wildlife species to those more adapted to grassland. Pronghorn will be favored over mule deer, and the habitat will be more suited to horned larks, Western meadowlarks (*Sturnella neglecta*), and Chihuahuan meadowlarks (*Sturnella lilianae*) than to loggerhead shrikes (*Lanius loudovicianus*) and Bullock's orioles (*Icterus bullokii*).

No permanent water bodies exist on MAFR, although three playas are classified as wetlands. Temporary and ephemeral water is present during wet periods in playas, drainages, and ponds developed for livestock. These provide temporary habitat for water-associated species such as waterfowl and amphibians, supply water for various wildlife, and add diversity to flora and fauna on the landscape.

The elevation of MAFR ranges from approximately 4,200 feet in the north to 4,600 feet on the southern mesa. Wildlife habitat changes with the terrain. At the lower elevations, soils tend to be sandy and grasses taller. The higher elevations tend toward loamy soils and shortgrasses. Some wildlife species such as coyotes are generalists and are found across MAFR. Most of the reptiles are widespread as well, such as prairie rattlesnakes (*Crotalus viridis*), coachwhips (*Masticophis flagellum*), bullsnakes (*Pituophis catenifer*), prairie lizards (*Sceloporus undulatus*), lesser earless lizards (*Holbrookia maculata*), Texas horned lizards (*Phrynosoma cornutum*), and ornate box turtles (*Terrapene ornata*). Pronghorn rely on speed and line-of-sight for defense, so they prefer open habitats. Hearing may be more important to mule deer, which employ a stotting (bouncing) gait for evasion and prefer areas with more cover. Mourning dove, striped skunk (*Mephitis mephitis*), desert cottontail (*Sulvilagus audubonii*), black-tailed jackrabbit (*Lepus californicus*) and white-footed mice (*Peromyscus leucopus*), too, can be found across the entire range. Other species are much more location-specific. For instance, cactus wren (*Campylorhynchus brunneicapillus*) are found only where there are large cholla, in which they build a nest and rear young; loggerhead shrikes are

found in mesquite areas; BUOW where there are existing burrows to inhabit; and rufous-crowned sparrows (*Aimophila ruficeps*) only in canyon habitats.

Shortgrass Prairies

Although many species are common across MAFR habitats, some are prevalent only in areas with shorter vegetation. These animals prefer open areas with clear lines of sight or other aspects of this habitat.

Pronghorn are common in shortgrass prairies, as are the thirteen-lined ground squirrel (*Spermophplus tridecemlineatus*), grasshopper mouse (*Onychomys leucogaster*), plains pocket mouse (*Perognathus flavescens*), and plains pocket gopher (*Geomys bursarius*). Bird species preferring these areas include horned lark (*Eremophila alpestris*) and long-billed curlew (*Numenius americanus*).

Prairie Dog Towns

BTPDs shape the landscape through the creation of communal habitats known as "prairie dog towns." BTPD populations vary drastically from year to year with births, deaths, disease, and precipitation. These towns provide habitat for numerous other species through the creation of burrows and relatively vegetation-free areas. 117 species have been documented to have associations with prairie dogs (Kotliar et al. 1999). Killdeer (*Charadrius vociferus*) prefer the openness of these areas for nesting, rearing young, and foraging. BUOW almost exclusively use abandoned burrows for nesting and brood rearing. Desert cottontails, plus numerous small mammals and reptiles, also use the areas for their numerous abandoned burrows. Prairie dog towns attract predators such as American badger (*Taxidea taxus*), coyote, gray fox (*Urocyon cinereoargenteus*), ferruginous hawk (*Buteo regalis*), and red-tailed hawk (*Buteo jamaicensis*).

Mesquite Scrubland

The mesquite scrublands come in a variety of configurations, including scattered mesquite in grasslands, grasslands dominated by dense mesquite, areas dominated by sand mesquite mounds, and variations. The added scrub cover provides structure for southern plains woodrat (*Neotoma micropus*) to build middens. At times, mesquite bark becomes a major winter food. These shrubs provide a place for loggerhead shrikes to nest and hang their prey. Mule deer are more likely to be found amongst these shrubs than in the open grasslands. Mesquite infestations (dense mesquite stands) could provide habitat for LEPCs if the mesquite is controlled and the branches that are used as perches by raptors are removed.

Sandsage/Soapweed Yucca

Sandsage, soapweed yucca, and associated bunchgrasses provide a habitat that is more open at ground level, contains taller vegetation, and is more diverse in structure than the grasslands or mesquite shrublands. This is the primary LEPC habitat on MAFR. Often this area supports a higher proportion of forbs than most other habitats in the area, resulting in more food for seed-eating birds. Scaled quail use this habitat for escape cover, and several species of small birds find nesting sites among the shrubs. Cassin's sparrow (*Peucaea cassinii*) prefers these shrubs, both for nesting and as a perch for singing and display. White-tailed deer (*Odocoileus virginianus*) were observed in this area, including in some of the mesquite shrublands and sand hills, but no observations have been documented since 2012. This was also the last year that LEPCs were observed on MAFR, although it is unknown whether the observations occurred within sandsage and soapweed yucca or sand hills habitat.

Sand Hills

Sand hills are often surrounded by sandsage/soapweed yucca communities, with which they are closely associated. Thus, the same wildlife species are found in both areas. The sand makes for easy den digging

for coyote, fox, badger, and others, who bear and rear young there. During the extreme heat of summer, sand hills are used by mule deer, LEPCs and others to escape heat, as the dunes promote cooler microclimates. The open areas provide a place for birds such as common nighthawks (*Chordeiles minor*) to lay their speckled eggs on the bare earth. There they incubate and hide their chicks, depending solely on camouflage to avoid predation.

Canyons

The canyons make up a small portion of MAFR but are the most diverse in topography, soils, plants, elevation, wildlife use, moisture retention, and more. The rock outcroppings are a unique, limited feature within the range and are widely exploited by resident wildlife. They provide perches for raptors, denning/basking areas for reptiles, rodents, and carnivores, and so on. The canyons provide hiding cover for mule deer, escape cover for species such as scaled quail, ambush concealment for species like bobcat (*Lynx rufus*), and escape from the wind for many other species. The ephemeral streams in the canyon bottoms provide primary habitat for New Mexico spadefoot toad (*Spea miltiplicata*), green toad (*Bubo debilis*), Woodhouse toad (*Bufo woodhousii*), and barred tiger salamander (*Ambystroma tiginum*), in addition to many other, less habitat-specific, species.

Old fields

The old fields are much the same as the surrounding grasslands in terms of wildlife species present. Often these old fields provide less hiding cover but a higher proportion of forbs than the surrounding native grasslands. No species are known to be obligate to the old fields. A portion of the old fields in the north is potential LEPC habitat and would be more attractive to resident wildlife species if converted to native grasses similar to the surrounding grasslands.

2.3.3.1 Climate Impacts on Fish and Wildlife

Projected increases in temperature and precipitation are not likely to pose direct threats to most wildlife species found on CAFB and MAFR, but may create indirect threats. Migrating birds may be indirectly vulnerable to rising temperatures because they time their migration to coincide with the springtime emergence of insects. Rising temperatures will prompt insects to emerge earlier, and birds migrating to or through the bases will miss a major feeding opportunity, potentially resulting in decreased bird populations (Both et al. 2010).

Higher temperatures and temperature extremes increase water requirements for diurnal species and are particularly detrimental to insect- or animal-eating birds since they obtain water from their prey. Increased water requirements will translate to increased hunting and energy expenditure, reducing their fitness (Robbins 2020). Additionally, High Plains bird species, such as those at CAFB and MAFR, may lose significant portions of their range due to climate change (Peterson 2003). Most of the remaining species at these locations are generalists capable of tolerating a wide range of environmental conditions; hence, they are not as threatened by a changing climate.

Climate change has the potential to alter vegetation communities and may harm specialist wildlife species that depend on specific native plant communities (Dukes and Mooney 1999). Changing environmental conditions may allow non-native invasive species to expand onto CAFB and MAFR. Newly arriving invasive species often outcompete native species experiencing reduced fitness due to shifting environmental conditions (Hellmann et al. 2008). Higher temperatures may increase the potential for infectious diseases carried by animals to be transmitted to humans, such as rabies and West Nile virus (Süss et al. 2008). On a local level, increased winter-spring precipitation augments productivity of small mammal food resources

causing an increase in the abundance of plague hosts. Thus, drier climate conditions, such as dry soils and lower primary productivity, are associated with reduced incidences of plague vectors, host infestation, and disease outbreaks (Parmenter et al. 1999).

Increasing temperatures will likely impair water quality, particularly in lentic systems. As water temperatures rise in lentic systems, dissolved oxygen content decreases, harming habitat quality, particularly for larval amphibians and aquatic macroinvertebrates. Increasing water temperature may also lead to algal blooms, further depleting dissolved oxygen content and habitat quality (Paerl et al. 2011). Increased temperatures and reduced precipitation during the summer may reduce water sources for wildlife. This may stress wildlife and limit populations during exceptionally dry periods (NRCS 2010).

2.3.4 Threatened and Endangered Species and Species of Concern

Several pieces of legislation relevant to CAFB and MAFR regulate the listing criteria for special status species and dictate the responsibilities of federal landholders. The acts described below are the primary drivers for the information about T&E species and Species of Concern (SoC) in this INRMP.

The ESA (16 U.S.C. §1531 et seq.), enacted in 1973, requires all federal agencies to provide a program for the conservation of threatened and endangered species, and to use their authorities to further the purposes of the act.. Federal agencies, in consultation with the USFWS and/or NOAA, must ensure that actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of designated critical habitat of such species. Further, the act prohibits "taking" of any listed species of endangered fish or wildlife without an applicable permit or authorization. To comply with the ESA, the USAF is required under AFMAN 32-7003 to inventory its lands for federally listed T&E species, and if present, provide an overall ecosystem approach for the protection and management of the species. Although not required, when practical, a similar approach should be used for state-listed species (AFMAN 32-7003).

The BGEPA prohibits any person or agency, without a permit issued by the Secretary of the Interior, from "taking" bald or golden eagles, including their parts, nests, or eggs. Further, the act defines "take" actions as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb." If these species are present on the installation, potential impacts of construction projects, training events, or other actions should be assessed. Consultation with the USFWS may be necessary to reduce or eliminate impacts on the species.

The MBTA is intended to ensure the sustainability of all protected migratory species by prohibiting their take without prior authorization by the Department of the Interior (16 U.S.C. 703-712). Further, Executive Order No. 13186 provides guidelines for the responsibilities of federal agencies to protect migratory birds. This EO requires federal agencies that are taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations to develop and implement a Memorandum of Understanding with the USFWS.

The New Mexico Wildlife Conservation Act (17-2-37 to 17-2-46 NMSA 1978) protects wildlife species at risk of becoming endangered or that are in jeopardy of extinction or extirpation from the state. The New Mexico Wildlife Conservation Act designates the NMDGF to create and maintain recovery plans for species that are listed under the act. Several species that are listed by the federal and/or state government were seen on CAFB or MAFR prior to the CAFB 2003 INRMP. Peregrine falcon (*Falco peregrinus*), loggerhead shrike, and Baird's sparrow (*Ammodramus bairdii*) were all seen on CAFB in 1997. Bald eagle (*Haliaeetus leucocephalus*) and mountain plover (*Charadrius montanus*) were seen on MAFR in 1998. The LEPC, whose southern population segment is designated as federally endangered, was last sighted in 2012.

These species were considered rare, accidental, or uncommon migrants. Currently, no threatened or endangered species are known residents of CAFB or MAFR.

Sixty-eight federal and state threatened, endangered, and candidate species, SoC, bird of conservation concern (BCC), and state-designated SGCN that occur or could potentially occur on CAFB and MAFR are presented in Table 2-8. Table 2-8 shows presence/absence data from biological survey data. However, it lacks dates observed, seasonality of observations, breeding status, likelihood of occurrence of non-detected species, and has data gaps (such as wintering grassland bird surveys). CAFB will update the table with the forementioned information, identify all data gaps, and revise upcoming survey projects to account for gaps within the INRMP planning period. Within Table 2-8, several listing status designations apply to wildlife species that could potentially occur on CAFB and MAFR:

- Federal Threatened (T) and Endangered (E) species—Listed as Threatened or Endangered under the federal ESA and afforded all the protections provided by that law. A species is federally listed under Section 4 of ESA with an effective date that is generally 30 days after the final rule is published in the Federal Register. Per AFMAN 32-7003, installations known to sustain federally listed T&E species, or their habitats must address T&E species conservation in the INRMP.
- Federal Candidate Species (C)—Candidate species is a plant or animal taxon considered for possible addition to the list of endangered and threatened species. These are taxa for which the USFWS has on file sufficient information on biological vulnerability and threat(s) to support issuance of a proposal to list, but issuance of a proposed rule is currently precluded by higher priority listing actions. USFWS reviews the candidate species status annually. These species have no legal protection under the ESA, but, when practical and not in conflict with the military mission, the base will provide protections for federal candidates like those for species afforded full protection under the ESA.
- Federal Proposed Species—Proposed species are any species of fish, wildlife or plant that is proposed in the Federal Register to be listed under Section 4 of the ESA.
- Federal Petitioned Species—Petitioned species are a taxon for which the USFWS has received a petition from an individual or organization requesting the listing of the species as threatened or endangered, reclassify a species, or delist a species. If the petition presents credible and substantial scientific or commercial information indicating that the petitioned action may be warranted, the USFWS will then initiate a full status review.
- Federal Delisted Species—Delisted species are a taxon removed from the Federal Lists of Endangered and Threatened Wildlife and Plants once the USFWS determines that threats have been controlled or eliminated. Five-year monitoring of the species must be initiated after the delisting.
- Species of Concern (SoC)— SoC are sensitive species that have not been listed, are not currently proposed for listing, nor placed in candidate status. SoC is an informal term with no legal protection, and the use of the term does not necessarily mean that the species will eventually be proposed for listing as a T&E species. The New Mexico USFWS Ecological Services Field Office is in the process of developing an At-Risk Species plan that will contain a list of At-Risk Species.
- Migratory Bird Treaty Act (MBTA) Species—MBTA species are migratory bird species that are listed in the MBTA and are afforded the federal protections listed under the act.
- Bald and Golden Eagle Protection Act (BGEPA)— The BGEPA 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 USFWS-proposed revisions to regulations authorizing incidental take permits were published in the Federal Register in September 2022.

- Birds of Conservation Concern (BCC)—These are species of migratory and non-migratory birds (beyond those already designated as federal T&E species) that represent the highest conservation priorities (USFWS 2021c). The USFWS identified "Bird Conservation Regions" and species are considered BCCs for a specific region, and not necessarily throughout the species' entire range. CAFB and MAFR are within Bird Conservation Region 18 (Shortgrass Prairie). This designation does not convey any legal protection.
- Species of Greatest Conservation Need (SGCN)—A designation given by the NMDGF to species with the greatest conservation need within the state of New Mexico (NMDGF 2016). To be considered for this designation, species must occur within the state and meet at least one condition: declining, vulnerable, endemic, disjunct, or keystone. This designation does not convey any legal protection.
- Sensitive Taxon (ST)—A designation given to taxa on the installation that are sensitive to impacts such as habitat loss, habitat degradation, climate change, and more.
- Harvested Furbearer (HF)—A designation given by NMDGF to species that can legally be harvested on private lands with purchase of a trapping license from NMDGF.

Table 2-8. Habitat Description, Listing Status, and Observed/Not Observed of Potentially Occurring Listed Species On Cannon Air Force Base and Melrose Air Force Range Based on Recent Surveys.

Listed Species	Habitat[1]	Status[2]		Observed at the installation?		County Listed
		Federal[3]	State[4]	CAFB	MAFR	
Amphibians						
Plains Leopard Frog (*Lithobates blairi*)	Permanent and intermittent water sources and flooded prairie habitats		SGCN	No	No[5]	Curry, Roosevelt
Tiger Salamander (*Ambystoma tigrinum*)	Permanent water sources with little or no current; shelter in rodent burrows or under structures where ample moisture is present		SGCN	Yes	No	Curry, Roosevelt
Reptiles						
Western Massasauga Rattlesnake (*Sistrurus tergeminus*).	Shortgrass prairie with sandy soils (Degenhart et al. 1996)		SGCN	No	Yes	Roosevelt
Eastern Collared Lizard (*Crotaphytus collaris*)	Shortgrass steppe, midgrass prairie, barren rock outcrops		SGCN	No	Yes	Roosevelt

Table 2-8. Habitat Description, Listing Status, and Observed/Not Observed of Potentially Occurring Listed Species On Cannon Air Force Base and Melrose Air Force Range Based on Recent Surveys.

Listed Species	Habitat[1]	Status[2]		Observed at the installation?		County Listed
		Federal[3]	State[4]	CAFB	MAFR	
Milk Snake (*Lampropeltis triangulum*)	Terrestrial and riparian habitats; Shortgrass and midgrass prairie grasslands with some or no shrub cover		SGCN	No	No	Roosevelt
Ornate Box Turtle (*Terrapene ornata ornata)*	Desert and Semi-desert grasslands		SGCN	Yes	Yes	Curry, Roosevelt
Dunes Sagebrush Lizard *(Sceloporus arenicolus)*	Active sand dunes vegetated by shinnery oak	Proposed	E, SGCN	No	No	Roosevelt
Western Diamondback Rattlesnake (*Crotalus atrox*)	Rocky hillsides and canyons and in a variety of vegetative types including mesquite, grassland, and desert; most abundant in xeric or seasonally dry lowland regions		SGCN	No	Yes	Roosevelt
Western Painted Turtle (*Chrysemys picta*)	Still or slow-flowing bodies of water, ditches, and cattle tanks; can travel up to a mile away from water sources		SGCN	No	No	Roosevelt
Birds						
American Golden Plover (*Pluvialis dominica*)	**Migration**: short-grass prairies, burned grasslands, recently plowed fields, sun-baked stubble, occasionally beaches/shores adjacent to water	MBTA, BCC		No	No	Curry, Roosevelt
Arctic Peregrine Falcon (*Falco peregrinus tundrius*)	**Migration and Winter**: Areas with abundant prey	MBTA, SOC	T	No	No	Curry, Roosevelt
Baird's Sparrow (*Ammodramus bairdii*)	**Migration and Winter:** desert to upland grasslands	MBTA, BCC, SOC	SGCN	No[3]	No	Roosevelt

Table 2-8. Habitat Description, Listing Status, and Observed/Not Observed of Potentially Occurring Listed Species On Cannon Air Force Base and Melrose Air Force Range Based on Recent Surveys.

Listed Species	Habitat[1]	Status[2]		Observed at the installation?		County Listed
		Federal[3]	State[4]	CAFB	MAFR	
Bald Eagle (*Halieetus leucocephalus*)	**Nesting**: large trees near or along rivers and lakes **Migration and Winter**: rivers, lakes, ponds, and reservoirs; sometimes wanders through plains and grasslands searching for carrion and/or prairie dog towns, far from water.	MBTA, BGEPA, SOC	T, SGCN	No	No[3]	Curry, Roosevelt
Band-tailed Pigeon (*Patagioenas fasciata*)	**All Year**: Irrigated and non-irrigated agricultural fields with less than 5% wood cover.	MBTA	SGCN	No	Yes	Roosevelt
Bank Swallow (*Riparia riparia*)	**All Year:** areas of open water, mudflats, and sites containing extensive cover; breed in open country and savannas, especially near running water; usually found where insect prey is abundant and in association with dirt or sand banks where it digs its burrows	MBTA	SGCN	No	No	Curry
Bell's Vireo (*Vireo bellii*)	**Nesting**: thickets along streams or second growth shrubs, forest edges, brush patches	MBTA, SOC	T	No	No	Curry, Roosevelt
Black-throated Gray Warbler (*Setophaga nigrescens*)	**Migration:** urban residential developments with trees or riparian areas **Nesting and Winter**: areas of dense, woody vegetation	MBTA	SGCN	No	No	Roosevelt

Table 2-8. Habitat Description, Listing Status, and Observed/Not Observed of Potentially Occurring Listed Species On Cannon Air Force Base and Melrose Air Force Range Based on Recent Surveys.

Listed Species	Habitat[1]	Status[2]		Observed at the installation?		County Listed
		Federal[3]	State[4]	CAFB	MAFR	
Buff-breasted Sandpiper (*Tryngites subruficollis*)	**Migration**: shortgrass prairies, burned grasslands, recently plowed fields, sun- baked stubble, occasionally beaches/shores adjacent to water	MBTA, BCC, SOC		No	No	Curry, Roosevelt
Cassin's Finch (*Haemorhous cassinii*)	**Migration:** mountain forests of conifers, sometimes in open woods of lower valleys.	MBTA, BCC	SGCN	No	Yes	Curry, Roosevelt
Cassin's Sparrow (*Peucaea cassinii)*	**Nesting and Migration**: shortgrass prairie with scattered shrubs, sometimes in shrublands with grassy openings. Territory composition: 20% to 35% bare ground, 40% to 80% shortgrass/mixed-grass, >4% shrub cover	MBTA	SGCN	Yes	Yes	Curry, Roosevelt
Chestnut-collared Longspur (*Calcarius ornatus*)	**Migration and Winter**: shortgrass and mixed grass prairie with scattered shrubs with a preference for a mix of short and tall grasses (<20 in. tall)	MBTA, BCC		No	No	Curry, Roosevelt
Common Nighthawk (*Chordeiles minor*)	**Nesting:** generally uses and inhabits open or semi-open areas.	MBTA	SGCN	No	Yes	Curry, Roosevelt

Table 2-8. Habitat Description, Listing Status, and Observed/Not Observed of Potentially Occurring Listed Species On Cannon Air Force Base and Melrose Air Force Range Based on Recent Surveys.

Listed Species	Habitat[1]	Status[2]		Observed at the installation?		County Listed
		Federal[3]	State[4]	CAFB	MAFR	
Eared Grebe (*Podiceps nigricollis*)	**All year**: vegetated lakes at middle elevations; rest in waters where they feed; prefer undisturbed bodies of water during migration	MBTA	SGCN	No	No	Curry
Elf Owl (*Micranthene whitneyi*)	**All year**: open to dense vegetation of shrubs, low trees, and succulents; riparian woodlands at lower (2800-5500 feet) to middle (5000-7500 feet) elevations	MBTA	SGCN	No	No	Roosevelt
Ferruginous Hawk (*Buteo regalis*)	**Nesting**: grasslands, deserts, open areas with isolated trees and shrubs, in areas with less than 50% cultivation **Migration and Winter**: prairie dog towns in grasslands in and south of nesting range	MBTA	SGCN	No	Yes	Curry, Roosevelt
Golden Eagle (*Aquila chrysaetos*)	**Nesting:** on cliffs near open habitats **Migration and Winter**: cliffs and in large expanses of dry treeless grassland	MBTA, BGEPA, SOC		No	Yes	Roosevelt

Table 2-8. Habitat Description, Listing Status, and Observed/Not Observed of Potentially Occurring Listed Species On Cannon Air Force Base and Melrose Air Force Range Based on Recent Surveys.

Listed Species	Habitat[1]	Status[2]		Observed at the installation?		County Listed
		Federal[3]	State[4]	CAFB	MAFR	
Grasshopper Sparrow (*Ammodramus savannarum*)	**Nesting**: most types of grassland, especially tall grass and mixed-grass prairies, but also shortgrass, especially where scattered shrubs, trees, or other tall plants are present; require some areas of bare ground, up to 35% of their territory; prefer sites where much of the vegetation is at least 4" tall **Migration and Winter**: found in areas of dense grass with scattered low shrubs, and in weedy fields	MBTA		No	No	Curry, Roosevelt
Interior Least Tern (*Sterna antillarum athalassos*)	**Nesting**: river sand bars; and islands, ponds, lakes with gravel and/or sand bars, often surrounded by water **Migration**: thought to use river corridors, but may travel across terrestrial terrain using other aquatic habitats (lakes, ponds, reservoirs) in-route to nesting area	MBTA, BCC, Delisted	E	No	No	Curry, Roosevelt
Lesser Prairie Chicken (*Tympanuchus pallidicinctus*)	**All Year:** arid natural grasslands with interspersed shrubs three feet tall or less; in New Mexico the species is normally found with shinnery oak	MBTA, E	ST, SGCN	No		Curry, Roosevelt

Table 2-8. Habitat Description, Listing Status, and Observed/Not Observed of Potentially Occurring Listed Species On Cannon Air Force Base and Melrose Air Force Range Based on Recent Surveys.

Listed Species	Habitat[1]	Status[2]		Observed at the installation?		County Listed
		Federal[3]	State[4]	CAFB	MAFR	
Lewis's Woodpecker *(Melanerpes lewis)*	**Migration and Winter:** vagrant to open country with scattered trees. In fall areas must have fruits/berries and in winter needs oaks with acorns	MBTA, BCC	SGCN	No[5]	No	Curry, Roosevelt
Loggerhead Shrike (*Lanius ludovicianus*)	**All Year:** open country with scattered brush and trees, with a mix of short (<4 in.) and tall grasses (>8 in.)	MBTA	SGCN	No	Yes	Curry, Roosevelt
Long-billed curlew (*Numerius americanus*)	**Nesting:** shortgrass and mixed grass prairie usually <12 in. and often <4 in. with a total ground cover of 50% to 95%; occasionally within wheat stubble (often within 0.25 miles of water) **Migration:** similar to nesting habitat but also includes open fields and shores of freshwater lakes	MBTA	SGCN	No	Yes	Curry, Roosevelt
Lucy's Warbler (*Oreothlypis luciae*)	**Nesting and Migration:** lowland riparian woodlands; open to dense vegetation of shrubs, low trees, and succulents	MBTA	SGCN	No	No	Roosevelt

Table 2-8. Habitat Description, Listing Status, and Observed/Not Observed of Potentially Occurring Listed Species On Cannon Air Force Base and Melrose Air Force Range Based on Recent Surveys.

Listed Species	Habitat[1]	Status[2]		Observed at the installation?		County Listed
		Federal[3]	State[4]	CAFB	MAFR	
Mountain Plover (*Charadrius montanus*)	**Nesting:** shortgrass prairie on flat and gently sloping topography with sparse vegetation cover (>30% bare ground and very short grass [<2 in].) **Migration and Winter:** alkali flats, plowed or burned fields, fallow fields, sod farms, heavily grazed grassland	MBTA, BCC	ST, SGCN	No	No[5]	Curry, Roosevelt
Mourning Dove (*Zenaida macroura*)	**Nesting:** variety of tree species, shrubs, vines, and building structures **Migration:** use a variety of habitat types from agricultural fields, grasslands, to coniferous and deciduous forests	MBTA		Yes	Yes	Curry, Roosevelt
Northern Harrier (*Circus hudsonius*)	**Nesting:** open area (e.g., prairies, plains, meadows, swamps, and marshes) with herb or low woody vegetation for nest concealment **Migration and Winter:** similar to nesting habitat	MBTA		No	Yes	Curry, Roosevelt
Northern Pintail (*Anas acuta*)	**Nesting:** wide variety of pastures, grasslands, and croplands **Migration and Winter:** open water or emergent vegetation at lower (2800-5500 feet) and middle (5000-7500 feet) elevations	MBTA		No	No	Roosevelt

Table 2-8. Habitat Description, Listing Status, and Observed/Not Observed of Potentially Occurring Listed Species On Cannon Air Force Base and Melrose Air Force Range Based on Recent Surveys.

Listed Species	Habitat[1]	Status[2]		Observed at the installation?		County Listed
		Federal[3]	State[4]	CAFB	MAFR	
Olive-sided Flycatcher (*Contopus cooperi*)	**Migration and Winter:** riparian and agricultural lands; prefers edge habitat between grasslands and tall, woody vegetative structures	MBTA, BCC	SGCN	No	No	Roosevelt
Osprey (*Pandion haliaetus*)	**All Year:** generally found near water sources at lower elevations; use grasslands and forests adjacent to water sources	MBTA		No	No	Curry
Painted Bunting (*Passerina ciris*)	**All Year:** shortgrass prairie grasslands adjacent to shrub cover for nesting	MBTA		No	No	Curry, Roosevelt
Peregrine Falcon (*Falco peregrinus*)	**Nesting:** high cliffs, bluffs, slopes, cutbanks, building ledges with nearby abundant prey **Migration and Winter:** Areas with abundant prey	MBTA SOC	SGCN, T	No[5]	No	Curry, Roosevelt
Pinyon Jay (*Gymnorhinus cyanocephalus*)	**Nesting:** grasslands with nearby tall, woody vegetation **Migration:** areas of desert/rocky slopes, woodlands, and scrub habitat	MBTA, BCC, Petitioned	SGCN	No	No	Curry, Roosevelt

Table 2-8. Habitat Description, Listing Status, and Observed/Not Observed of Potentially Occurring Listed Species On Cannon Air Force Base and Melrose Air Force Range Based on Recent Surveys.

Listed Species	Habitat[1]	Status[2]		Observed at the installation?		County Listed
		Federal[3]	State[4]	CAFB	MAFR	
Prairie Falcon (*Falco mexicanus*)	**Nesting:** low rock outcrops to vertical cliffs (30 to 400 feet tall, respectively); prefers cliffs with sheltered ledge with loose debris or gravel for a nest scrape; sometimes in old hawk, raven, and eagle nests **Nesting, Migration and Winter:** prairies, deserts, riverine escarpments, canyons, foothills, and mountains, generally in arid environments	MBTA, BCC		Yes	Yes	Curry, Roosevelt
Red-headed Woodpecker (*Melanerpes erythrocephalus*)	**All Year:** riparian woodlands, planted trees, anthropogenic structures; forage over grasslands and woodlands	MBTA, BCC	SGCN	No	Yes	Curry, Roosevelt
Sage Thrasher (*Oreoscoptes montanus*)	**Migration:** sagebrush shrubland; shrubby areas at lower (2800-5500 feet) and middle (5000-7500 feet) elevations	MBTA		No	Yes	Roosevelt
Sagebrush Sparrow (*Artemisiospiza nevadensis*)	**All Year:** sagebrush grassland habitat at lower (2800-5500 feet) and middle (5000-7500 feet) elevations	MBTA	SGCN	No	No	Curry, Roosevelt
Sandhill Crane (*Antigone canadensis*)	**Migration:** irrigated pastures and agricultural fields; desert riparian marshes and other water sources	MBTA		No	No	Roosevelt

Table 2-8. Habitat Description, Listing Status, and Observed/Not Observed of Potentially Occurring Listed Species On Cannon Air Force Base and Melrose Air Force Range Based on Recent Surveys.

Listed Species	Habitat[1]	Status[2]		Observed at the installation?		County Listed
		Federal[3]	State[4]	CAFB	MAFR	
Scaled Quail (*Callipepla squamata*)	**All Year:** desert and mixed grasslands, with a combination of annual weeds, shrubby or spiny ground cover, and available surface water; agricultural grasslands and croplands	MBTA		No	Yes	Roosevelt
Snowy Plover (*Charadrius nivosus*)	**Migration:** Alkali flats, sandy shores, dried/wet mud flats, around lakes, reservoirs, ponds	MBTA, BCC	SGCN	No	No	Curry, Roosevelt
Solitary Sandpiper (*Tringa solitaria*)	**Migration:** woodland streams, ponds, marshes, stagnant pools, and mud flats	MBTA		No	No	Curry, Roosevelt
Sprague's Pipit (*Anthus spragueii*)	**Migration:** extensive grasslands that are dominated by medium height grasses; also in shortgrass areas in fields grazed by cattle, and grassy shorelines	MBTA, BCC	SGCN	No	No	Curry, Roosevelt
Varied Bunting (*Passerina versicolor*)	**Nesting:** desert shrublands; prefer dense stands of mesquite and associated growth in canyon bottoms	MBTA, BCC, T	SGCN	No	No	Roosevelt
Vesper Sparrow (*Pooecetes garmineus*)	**Migration:** favors open grassy fields, often in rather dry situations with much open soil	MBTA	SGCN	No	Yes	Curry, Roosevelt

Table 2-8. Habitat Description, Listing Status, and Observed/Not Observed of Potentially Occurring Listed Species On Cannon Air Force Base and Melrose Air Force Range Based on Recent Surveys.

Listed Species	Habitat[1]	Status[2]		Observed at the installation?		County Listed
		Federal[3]	State[4]	CAFB	MAFR	
Western Burrowing Owl (*Athene cunicularia hypugaea*; BUOW)	**Nesting, Migration, Winter**: treeless areas with short vegetation (<4 in. tall) within and adjacent to prairie dog colonies; nests only in prairie dog, badger, fox burrows	MBTA SOC	SGCN	Yes	Yes	Curry, Roosevelt
Whooping Crane (*Grus americana*)	**Migration:** prairie potholes and riparian areas; forage in agricultural fields and pastures	MBTA E	E	No	No	Roosevelt
Williamson's Sapsucker (*Sphyrapicus thyroideus*)	**Nesting and Migration:** riparian areas adjacent to forested habitat	MBTA	SGCN	No	No	Curry, Roosevelt
Wilson's Phalarope (*Phalaropus tricolor*)	**Migration:** riparian areas at lower (2800-5500 feet) and middle (5000-7500 feet) elevations	MBTA		No	No	Curry, Roosevelt
Yellow Warbler (*Setophaga petechia*)	**Nesting and Migration:** mesic woodland habitats; riparian woodlands at lower (2800-5500 feet) to middle (5000-7500 feet) elevations; urban and agricultural lands	MBTA		No	No	Roosevelt
Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*)	**Nesting:** eastern subspecies nests in dense thickets near water, second growth woodland; western subspecies in cottonwood/willow riparian forest to mesquite/salt cedar **Migration:** primarily woodlands	MBTA SOC	SGCN	No	No	Curry, Roosevelt

Table 2-8. Habitat Description, Listing Status, and Observed/Not Observed of Potentially Occurring Listed Species On Cannon Air Force Base and Melrose Air Force Range Based on Recent Surveys.

Listed Species	Habitat[1]	Status[2]		Observed at the installation?		County Listed
		Federal[3]	State[4]	CAFB	MAFR	
Mammals						
Black-tailed Prairie Dog *(Cynomys ludovicianus)*	Grassy plains and prairie ecosystem	SOC	SGCN	Yes	Yes	Curry, Roosevelt
Eastern Red Bat (*Lasiurus borealis*)	Riparian habitats with associated deciduous trees		ST	No	No	Roosevelt
Least Shrew (*Cryptotis parva*)	Dense ground cover in mesic habitats		T	No	No	Roosevelt
Little Brown Bat (*Myotis lucifugus*)	Wide variety of habitats, although foraging occurs primarily in relation to water features.			No	No	
Red Fox (*Vulpes vulpes*)	Mixed shrub, sagebrush, pinyon/juniper, juniper, and agriculture habitats interspersed with farms and pastures, and margins of urban areas		HF	No	No	Curry
Ringtail (*Bassariscus astutus*)	Usually less than a half-mile from perennial water in rocky areas and cliffs in grassland and woodland		HF	No	No	Curry
Swift Fox (*Vulpes velox*)	Shortgrass to midgrass prairie with sufficient prey availability	SOC	HF	No	No	Curry, Roosevelt
Insects						
Monarch Butterfly (*Danaus plexippus*)	Prairie, shrubland, and forest habitat containing milkweed.	C		No	No	

[1] DeGraaf et al. 1991; Gillihan et al 2001; BISON-M 2016

[2] Species listing status from NMDGF 2020.

[3] **Federal Listing Codes**: E = Federally Endangered, T = Federally Threatened, C = Federal Candidate for listing, MBTA = Protected by Migratory Bird Treaty Act, SOC = Species of Concern, BCC = Bird of Conservation Concern

[4] **State of New Mexico Listing Codes**: HF= Harvested Furbearer, SGCN = Species of Greatest Conservation Need

[5] Species was not observed during surveys but was sighted between 1997 and 2002.

2.3.4.1 Latest Surveys for Threatened and Endangered Species and Species of Concern

Cannon Air Force Base

Since 2016, four surveys or studies with relevance to T&E species have been conducted on CAFB. These consist of two T&E species assessments and two migratory and breeding bird surveys. The T&E assessments use previous surveys and current vegetation data to assess the likelihood of a T&E species occurring on the installation. Additionally, these assessments identify SoC that occur on the installation and outlines their priority for conservation efforts (NRI 2021*c*). These species are given priority due to their increased likelihood of being designated as a T&E species under the ESA in the future. Currently, one avian federal SoC and one mammal SoC are known to occur on the installation:

- BUOW (SoC, summer resident/nester)
- BTPD (formerly Petitioned, SoC, resident)

The migratory and breeding bird surveys utilizes a point count survey method during the spring/fall migration period and the breeding season to determine which avian species are using the installation (NRI 2021*b*). None of the surveys or studies have observed or identified a federal or state-listed species that occurs on the installation.

Wildlife Surveys on Melrose Air Force Range

Numerous studies of endangered, threatened, and candidate species, SoC, and birds of conservation concern were conducted recently on MAFR with the most recent studies listed below:

- Bald and Golden Eagle Aerial Surveys for Melrose Air Force Range, New Mexico (IRNR 2016*a*),
- Threatened and Endangered Species Assessment, Natural Resources Support for Cannon Air Force Base and Melrose Air Force Range, New Mexico (NRI 2021*c*),
- Lesser Prairie Chicken Management Plan, Melrose Air Force Range and Melrose Land Gift, New Mexico (IRNR 2016*c*),
- Lesser Prairie Chicken Surveys Report, Natural Resources Support for Cannon AFB and Melrose AFR, New Mexico (NRI 2021*a*),
- Migratory Bird Surveys Report, Natural Resources Support for Cannon AFB and Melrose AFR, New Mexico (NRI 2021*b*), and
- Western Burrowing Owl and Black-tailed Prairie Dog Surveys, Natural Resources Support for Cannon AFB and Melrose AFR, New Mexico (2021*d*).

The migratory and breeding bird surveys (IRNR 2016*e*, NRI 2021*b*) directed that the bird species survey effort emphasize listed and birds of conservation concern that are breeding or nesting. No federally listed threatened or endangered bird species were found to be residents on MAFR during the 2015 to 2016 or 2020 to 2021 surveys. Additionally, five federal birds of conservation concern were found during the surveys:

- Northern harrier
- Ferruginous hawk
- Long-billed curlew
- Cassin's finch
- BUOW

To comply with the requirements stated in the Federal Candidate Species and Federal Species of Management Concern Plans (IRNR 2016*b*), surveys were conducted on MAFR to inventory any species listed as endangered, threatened, candidate, sensitive, SoC, federal birds of conservation concern, or SGCN in 2015 to 2016 and 2020 to 2021. The scope of work emphasized listed species surveys for plants, reptiles, birds, and mammals. No federally listed threatened or endangered animal species were found to be residents on MAFR during the surveys. One mammalian SoC and state sensitive species, BTPD, was observed during both surveys. All the birds listed in Table 2-8, plus all migratory birds that are found on MAFR, are protected under the Migratory Bird Treaty Act of 1918. Resident, non-migratory birds fall under the protection of New Mexico Department of Game and Fish, including scaled quail (regulated hunting season and bag limit) and LEPC (full protection). No hunting is allowed on MAFR.

The northern harrier and Cassin's finch are two of the birds of conservation concern found on MAFR that are spring/fall migrants or winter residents, and the other three are summer residents/nesting species and spring/fall migrants (Swainson's hawk, long-billed curlew, and BUOW). Birds of conservation concern are not protected under the ESA; however, they are protected from take under the Migratory Bird Treaty Act and could benefit from appropriate management actions.

Pollinators

CAFB and MAFR are likely to host a diversity of pollinator species, although no surveys have been done for pollinators at this time. Compliance with existing laws, regulations, and policies related to pollinators is essential for sustaining the AF mission. The pollinators with the highest level of protection are those listed under the ESA and/or the MBTA. In addition, all pollinators are afforded consideration under the Presidential memorandum, "Creating a Federal Strategy to Promote the Health of Honey Bees and Other Pollinators" (White House 2014). This memorandum focuses on development of a federal strategy to promote pollinator health and calls upon the DoD to, "consistent with law and the availability of appropriations, support habitat restoration projects for pollinators." It also directs DoD installations to use pollinator-friendly native landscaping and minimize use of pesticides harmful to pollinators. In response, AFCEC and USFWS issued the "U.S. Air Force Pollinator Conservation Strategy", which aims to sustain the mission and ecological integrity on AF installations by implementing management practices that support pollinators, especially those with regulatory protections, and enhance their habitat. Although only three protected or candidate pollinators have a high potential to occur on the installation (western bumble bee [*Bombus occidentalis*], monarch butterfly [*Danaus plexippus*], and rufous hummingbird [*Selasphorus rufus*]; USFWS 2017), several habitats on the installation support diverse forb communities that are likely to provide resources for pollinators. In turn, pollinators likely play a large role in sustaining habitats for LEPC (Gilgert and Vaughan 2011). The U.S. Air Force Pollinator Reference Guide (USFWS 2017), which was later adapted by the DoD and distributed as the DoD Pollinator Conservation Reference Guide (Armed Forces Pest Management Board 2018), describes ways to support this ecologically important group.

Lesser Prairie Chicken Surveys

On 4 April 2007, during the annual LEPC lek surveys conducted by the CAFB range biologist, a lek was located in the northern section of the range. LEPCs were, at the time of the first observation, a federal candidate species that had not been observed on the range before. A habitat assessment was conducted in July 2007. Following those surveys, a Candidate Species Management Plan was prepared, which incorporated LEPC. A second lek was discovered in the spring of 2008. As part of the management plan, a habitat and population assessment was recommended (Figure 2-14). The last confirmed sighting of LEPC on MAFR was in 2012; however, annual monitoring efforts have continued (IRNR 2016*d*). In 2015, the threatened status of the LEPC was vacated by judicial action. In 2021, the USFWS again proposed listing

the LEPC under the ESA, splitting the species into two distinct population segments (DPS). CAFB and MAFR fall into the southern DPS, which was designated as Endangered under the ESA on 27 November 2022.

Surveys for LEPC were conducted in 2016, 2018, and 2021 using two survey methods, point counts and acoustic monitoring. These surveys did not result in a detection or positive identification of LEPC on MAFR (IRNR 2016*e*; NRI 2019*b*, 2021*a*). Habitat management recommendations for the LEPC on MAFR is detailed in the report "Lesser Prairie Chicken Management Plan, Melrose Air Force Range and Melrose Land Gift, New Mexico" (IRNR 2016*c*). Continuing surveys for the LEPC and monitoring the habitat for the species on MAFR are a priority for the installation and these projects are detailed in Chapter 8.0.

Eagle Aerial Surveys

Since 2007, CAFB has been conducting aerial surveys to determine the occurrence status of the golden eagle (*Aquila chrysaetos*) and bald eagle. Aerial surveys allow comprehensive coverage of MAFR, and searches include potential feeding areas (e.g., carcasses). Aerial surveys were conducted by flying a standardized grid pattern over the entire range. Although surveyors were primarily looking for bald and golden eagles, they recorded other ancillary sightings of large mammals. This information has helped CAFB natural resources staff determine which species are present, their abundance, and what portion of the range they are using.

The aerial surveys were conducted three times for this project: on 26 September 2015, 09 April 2016, and 30 October 2016. Seventy-six detections of 150 animals were recorded during the 26 September 2015 survey. During the 09 April 2016 survey, 114 detections of 309 animals were recorded, including four detections of golden eagles. Similarly, during the most recent 30 October 2016 aerial survey, 129 detections of 439 animals were recorded, including two detections of two golden eagles and four additional observations that were likely one or more additional golden eagles (noted as "unknown large raptor" during flight; subsequent discussions post flight revealed unanimous agreement that these detections were likely golden eagles based upon size). Additionally, migratory bird surveys in 2020 and 2021 detected four golden eagle individuals on three different point count routes. Complete aerial survey data and management implications can be found in the report "Bald and Golden Eagle Aerial Surveys for Melrose Air Force Range, New Mexico" (IRNR 2016*a*).

Prairie Dog Surveys

Surveys for this species have been conducted since 2011 to determine the approximate size of the prairie dog population on CAFB and MAFR. In 2011, surveys observed 86 BTPDs on CAFB. In 2015, the number decreased to 35. Since 2015, the number of BTPDs on CAFB has increased rapidly, with recent surveys in 2020 and 2021 showing 448 and 332 BTPDs, respectively. Additionally, new towns have been observed, with ten on CAFB as of 2021 (Figure 2-13; NRI 2021*d*). BTPD populations commonly experience population cycles of collapse and rebound due to drought and disease. Thus, this recent increase is to be expected. Base personnel are managing the BTPD population to reduce BASH risks.

On MAFR, 62 BTPDs were observed at nine different colonies in 2011. This decreased to 49 BTPD observed at six colonies in 2015. Recent surveys in 2020 and 2021 showed an increase in the population, with 650 and 612 individuals in 13 towns across the range (Appendix G). The acreage occupied by BTPD has also varied greatly over the survey years. Approximately 3,300 acres were occupied by BTPDs prior to a plague outbreak in 2005 and 2006. In 2009, 10 acres were occupied by BTPDs. In 2021, 254 acres were occupied (NRI 2021*d*). MAFR controls BTPD at critical areas, primarily adjacent to landing strips, on an

as-needed basis. No additional management is conducted on MAFR to manipulate BTPD populations, but surveys are ongoing. Management of BTPDs is further discussed in Section 7.11.

Western Burrowing Owl Surveys

Beginning in 2016, BUOW surveys were conducted annually on both CAFB and MAFR to track population sizes and trends. BUOWs are known to use abandoned BTPD tunnels for nesting and roosting, and they can be a BASH risk when inhabiting BTPD towns near a flightline (Tab 2 - Bird/Wildlife Aircraft Strike Hazard (BASH) Plan). Limiting the expansion of BTPD towns will indirectly limit the number of BUOWs, and no other active control methods are being used on the species.

The number of BUOWs on CAFB has decreased recently, with 168 individuals detected in 2018 and just 48 individuals detected in 2021. In 2021, BUOWs were observed using all ten BTPD towns on the installation. The recent decline of BUOWs on CAFB could be a result of natural population fluctuations but is more likely due to BTPD control measures (NRI 2021*d*).

The number of BUOWs observed on MAFR has increased rapidly over the years. In 2021, 64 individuals were observed in 13 BTPD towns. In 2021, of the 64 individuals detected, 47 were adults, six were juveniles, and 11 were undetermined (NRI 2021*d*).

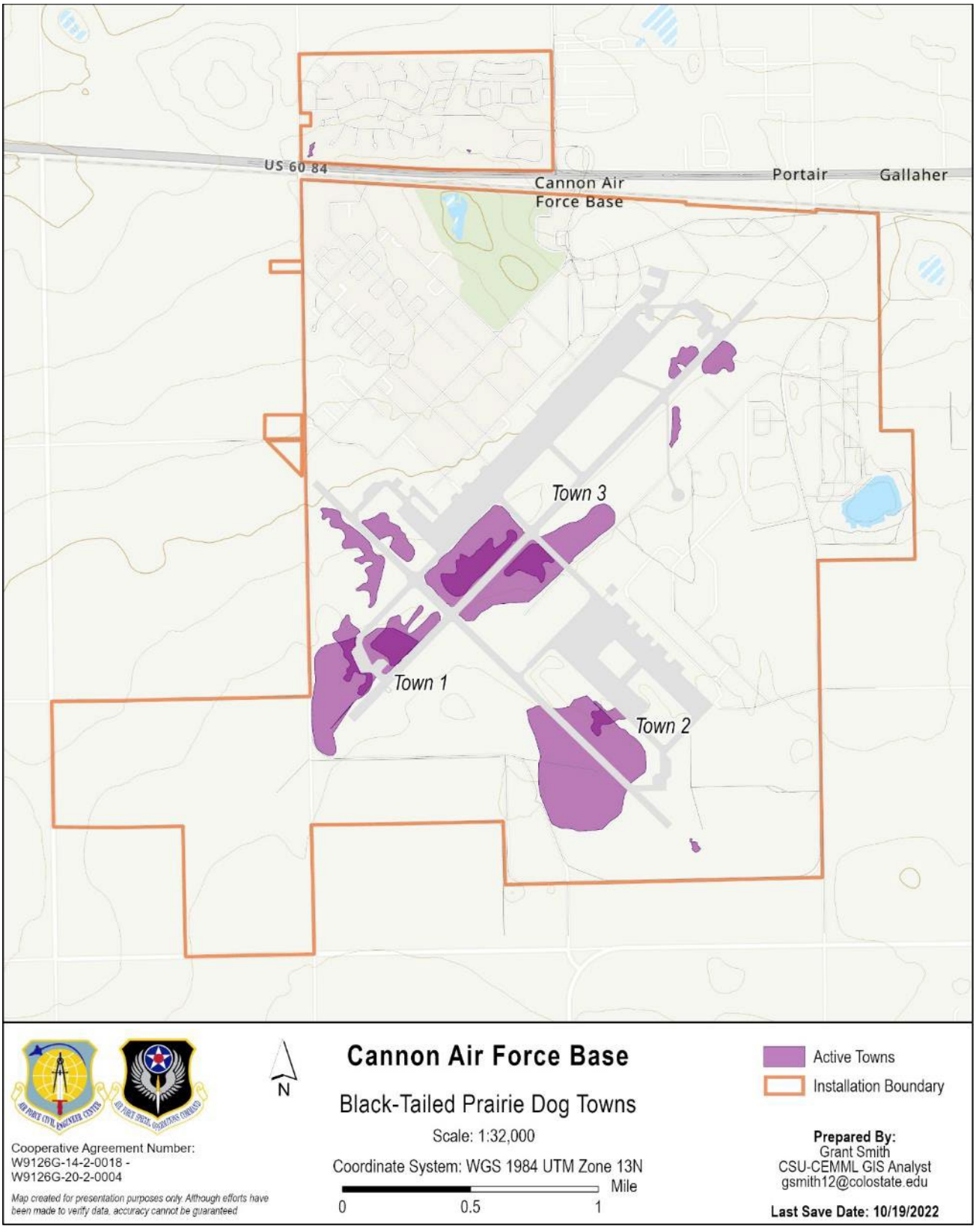


Figure 2-13. Black-tailed Prairie Dog Towns on Cannon Air Force Base.

2.3.4.2 Listed Species Population Trends and Threats

Lesser Prairie Chicken

Overview—The LEPC is found primarily in arid natural grasslands with interspersed shrubs three feet tall or less; in New Mexico, the species is normally found in habitat with shinnery oak. On MAFR, however, little shinnery oak occurs and sand sagebrush fills the "shrub" role. LEPCs do not occur on CAFB and are considered absent on MAFR, as they have not been detected there since 2012.

Status—The southern DPS of the LEPC, whose range overlaps with CAFB and the MAFR, is federally endangered and protected under the ESA. LEPCs also have full protection by the NMDGF in the state of New Mexico and are listed as a SGCN in the State Wildlife Action Plan for New Mexico and a sensitive taxon (an informal classification) (NMDGF 2016).

Trend—Ongoing surveys have been conducted by the Western Association of Fish and Wildlife Agencies across five states containing the four ecoregions inhabited by LEPCs. New Mexico LEPC populations have fluctuated since 1998, but do not show an upward trend (Beauprez 2016). After a dramatic population downturn associated with historic drought in 2013, LEPC populations have stabilized at slightly over 25,000 birds across the five-state region. Survey data from 1998 through 2022 shows a slight increase in the minimum spring breeding population of LEPCs in New Mexico, despite a 12% decline from 2021. Contrasting this, data from the same time period indicates a slight decrease in leks (Beauprez and Liley 2022). The LEPC population in the shinnery oak ecoregion, which includes New Mexico, was estimated to be less than 600 individuals (Nasman et al. 2022).

Threats—LEPCs have undergone a dramatic decline in distribution and abundance over the past century (Hagen and Giesen 2020, USFWS 2021*a*), due primarily to habitat loss and fragmentation; oil, gas and wind energy development; and woody plant encroachment and grazing practices (USFWS 2021*b*, NatureServe 2022*c*). Continued evaluation and monitoring of the LEPC and habitat are needed.

Detections—LEPC were detected on MAFR during the winter of 2012 in the southeast portion, approximately four miles south of the South Krider Gate near Krider Road. During the spring of 2012, LEPC were observed on the lek depicted in Figure 2-14. No other detections have been recorded on MAFR since that time. Ongoing efforts are being conducted and reports produced.

Although LEPC have not been detected on MAFR since 2012, they were present in the past and could be now and/or in the future. LEPC habitat is present and being used by humans either on a full- or part-time basis. Prior to the cessation of grazing, livestock were used to manage vegetation and fuels on the range. Portions of the recently acquired Land Gift Area on the extreme southern portion of the range appear to be LEPC habitat, which consists of sandy soils, mid and tall bunch grasses, a prominent forb component, and a brush component (primarily sandsage but a small amount of shinnery oak). Photographs and observation by SECOS/CEIE personnel provide evidence of heavy grazing. The sustained absence of grazing has allowed these areas to at least begin recovery. In the future, fire will be the primary tool of vegetation management with herbicide application being a secondary tool. Planning is ongoing to control mesquite and these activities in conjunction with prescribed fire could expand the portion of MAFR used by LEPC.

Areas of MAFR within three miles of an observed LEPC will be managed as occupied habitat. Most of MAFR is modeled in the Southern Great Plains Crucial Habitat Assessment Tool (CHAT) as CHAT 3, suitable habitat (Western Association of Fish and Wildlife Agencies 2022), although much of the south and east portions are dominated by short grasses and the west by honey mesquite at densities that make them unattractive to LEPC. The CHAT indicates that MAFR is outside the Focal Area and Connectivity Zone,

the areas of primary focus for LEPC management. The most consistently occupied LEPC habitat in the area lies south of MAFR on and around the Claudel Prairie Chicken Area. Where practical, management will include:

- Maintain optimum habitat cover to include 40 to 60% grass, 15 to 25% forbs and 20% low-growing shrubs.
- Burn no more than 20 to 30% of the LEPC habitat and allow a three-to-five year recovery period between burns.
- Manually remove any dead standing mesquite following prescribed burns.
- Apply chemical control to invasive honey mesquite, followed by controlled burns, to allow possible expansion of LEPC habitat.
- Remove raptor perches such as fences, power poles, and mesquite within the LEPC habitat areas.
- Minimize disturbance of LEPC lek, nesting, and brood-rearing areas when birds are present.
- Coordinate planning with CAFB fire personnel to develop prescribed burning strategies to enhance or create LEPC habitat and reduce the potential for wildfire.
- Continue to coordinate with CAFB planning personnel to minimize fragmentation of LEPC habitat with new development projects.

Bioacoustic digital recording devices (Song Meter 4s; Wildlife Acoustics Inc., Concord, MA, USA) are being used to survey for LEPC and other birds due to operational constraints at MAFR. The bioacoustics method typically has not been used for LEPC but has been successfully used for numerous other species (Venier et al. 2012, Marques et al. 2013, Rogers et al. 2013, Lambert and McDonald 2014). The acoustic monitoring has been used successfully at MAFR in previous years.

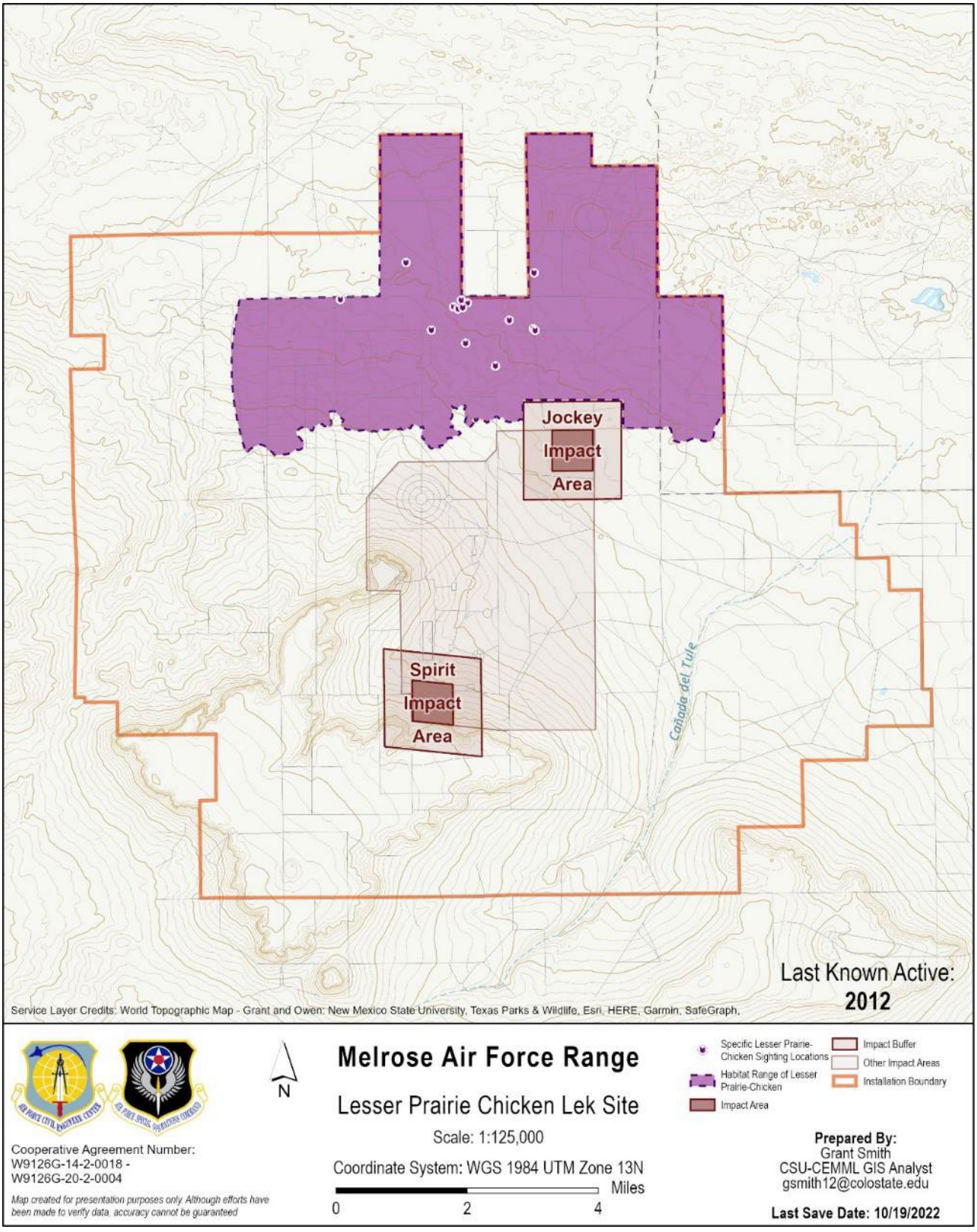


Figure 2-14. Lesser Prairie Chicken Lek Site at Melrose Air Force Range, Last Known Active 2012

Western Burrowing Owl

Overview—BUOW are common breeders and summer residents at both CAFB and MAFR. The BUOW is found in treeless areas with short vegetation (<4 in. tall) within and adjacent to prairie dog colonies. It nests only in abandoned prairie dog, badger, or fox burrows (Gillihan et al. 2001). Artificial burrows are also commonly used by BUOWs, but require annual maintenance. BUOWs are common residents of CAFB and MAFR.

Status—The BUOW is a BCC and SoC.

Trend—This species has declined across their range in recent decades and become locally extirpated in some areas, with the Breeding Bird Survey data showing significant declines in Florida, Montana, Colorado, and South Dakota (Drost and McCluskey 1992). All BUOW observed on CAFB and MAFR were on current or former BTPD towns. The BUOW populations on CAFB and MAFR appear stable with recent surveys in 2021 showing 48 and 64 individuals, respectively. Surveys are ongoing and reports will continue to be written.

Threats—Primary causes of decline include habitat loss (e.g., conversion to agriculture), habitat degradation (e.g., control of burrowing mammals), habitat fragmentation, and the use of pesticides (Evans 1982, Dundas and Jensen 1995, James and Espie 1997, Wellicome et al. 1997). As the BTPD population declines, so will the BUOW. Prairie dogs dig burrows that BUOW use to nest. Poisoning and nest site loss resulting from human efforts to control ground squirrels and prairie dogs are the biggest threat (Ehrlich et al. 1988).

Black-tailed Prairie Dog

Overview—BTPDs are found primarily in grassy plains and prairie ecosystems. They are a very social animal, living in colonies made up of extensive burrows. Many other animals use these burrows to escape the extreme conditions found in a prairie environment and the species is a prey item for several predators, making them a "keystone species." BTPDs are common to MAFR and less common on CAFB. Additional BTPD towns were observed on MAFR and CAFB as of 2021 (Appendix G).

Status—BTPD are a former federal Candidate species, a SoC and SGCN in the state of New Mexico. However, regulation of this species falls under the New Mexico Department of Agriculture.

Trend—Although this species retains a relatively large population size and range across the Great Plains, their abundance and distribution has declined by > 95% from historical levels (NatureServe 2022*a*). As such, populations appear secure but at greatly reduced levels (Colorado Divison of Wildlife 2003, Luce 2003 USFWS 2009).

Threats—BTPD have been pushed out of their native habitat by ranching and farming activities for the past 50 years or more (Texas Parks and Wildlife Department 2022). Sylvatic plague (*Yersinia pestis*) can extirpate entire colonies, reducing the genetic variability of the species. The primary causes of this species' population and range decline are eradication and control efforts, habitat loss and fragmentation, and diseases like sylvatic plague (Miller et al. 1994, Mulhern and Knowles 1995, Cully and Williams 2001, Colorado Division of Wildlife 2003, USFWS 2009). Sylvatic plague was introduced to North America in the early 20th century and its impact on prairie dog colonies can be devastating, often killing > 95% of the colony (Cully and Williams 2001).

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

Climate change poses serious threats to species, both independently and in conjunction with other stressors. The Climate Adaptation Program at CEMML evaluated climate change vulnerability of T&E species and other species of conservation concern using climate change vulnerability assessments (CCVA) (CEMML 2019, 2023). Managers can use CCVAs in the adaptation planning process to identify factors that contribute to vulnerability.

Black-tailed Prairie Dog

Although historical declines of BTPD are not linked to climate change, periods of reduced precipitation have correlated with lower reproduction (Grassel et al. 2016). Several studies have also established a strong relationship between plague outbreaks and climatic variables (Savage et al. 2011, Eads et al. 2016, Grassel et al. 2016, Eads and Hoogland 2017). During dry years, prairie dogs have limited access to food and water, which weakens their defenses against fleas and increases their susceptibility to plague epizootics (Eads et al. 2016, Eads and Hoogland 2017). CAFB and MAFR occur near the southern edge of their range, where droughts are more likely to severely impact their populations (Facka et al. 2010). Due to the location of the installation within a drought-prone region and climate change projections indicating more severe and frequent droughts, the CEMML CCVA assessment categorized them as moderately vulnerable. Despite their moderate vulnerability, any population declines due to increasing temperatures and decreasing precipitation projected in climate models could have cascading effects on other species of conservation concern present on CAFB and MAFR (CEMML 2023).

Western Burrowing Owl

Although the historical declines of BUOW are not directly linked to climate change, their populations are expected to decline in coming decades, which could be further exacerbated by climate change (DeSante and George 1994). Recent research shows that increasing temperatures and decreasing precipitation, both of which are projected for CAFB and MAFR, negatively impact the population size and reproduction trends of BUOW populations (Cruz-McDonnell and Wolf 2016). Additionally, climate is a strong predictor of BUOW home-range habitat selection, with moderate minimum and maximum temperatures in spring being ideal. Moisture conditions during the spring and winter migration can also influence nest phenology, with more intense droughts increasing the probability of later nest initiation (Stevens et al. 2011, Porro et al. 2020). Summer temperatures at CAFB and MAFR may exceed critical thresholds (91 ºF) for the BUOW (Cruz-McDonnell and Wolf 2016, CEMML 2023).

Changes in climate can also have indirect impacts on BUOW populations through changes in prey abundance and hence the availability of nesting burrows. In general, increasing drought frequency and severity, and warmer temperatures will reduce the quality and availability of the owl's prey species. Nesting owls require a mammal burrow or natural cavity, and the elimination of burrowing rodents through control programs is the primary factor in historical and recent BUOW population declines (Desmond and Savidge 1996, Desmond et al. 2000, Klute et al. 2003). BUOW frequently use BTPD burrows and some research has shown that the number of nesting owls is correlated to BTPD colony area and number of burrows (Ray et al. 2016). In areas lacking burrowing rodents, burrow availability can be limiting to owl populations (Desmond and Savidge 1996). Although BUOW are widespread across North America and relatively common in some areas, they are declining in other areas and have been directly affected by warmer temperatures and drought, as well as indirectly impacted through prey and burrow availability, so the CEMML CCVA assessment categorized them as moderately vulnerable.

Northern Harrier

Northern harriers are winter residents at MAFR. Harriers are medium-sized raptors that breed and hunt throughout North America in large, undisturbed grasslands and wetlands, wintering in the southern U.S. and Central America (Duebbert and Lokemoen 1977, Kantrud and Higgins 1992, Smith et al. 2011). Their abundance and distribution have declined in recent decades, due primarily to loss and degradation of the grassland and wetland habitats they rely upon (Slater and Rock 2005, Smith et al. 2011). Although climate change is not a direct factor in recent northern harrier declines, their reliance on climate change-vulnerable habitats, coupled with their decreasing abundance and distribution, increases their vulnerability. Northern harrier abundance is positively correlated with both small mammal abundance and the previous year's precipitation, which increases the productivity of the grassland and wetland habitats they rely upon (Hamerstrom et al. 1985, Dechant et al. 2002, Forcey et al. 2007). Additionally, the probability of extinction for northern harrier was shown to increase with increasing temperatures (Jarzyna et al. 2016) and their abundance has been predicted to decrease in the future due to climate change (Matthews et al. 2004, Hoving et al. 2013, Sohl 2014). As a result, the CEMML CCVA assessment indicated that northern harriers are moderately vulnerable to the projected changes in climate (CEMML 2023).

Ferruginous Hawk

The ferruginous hawk is a year-round resident at MAFR. It nests in open grasslands and shrub steppe communities and its abundance and distribution across North America have declined over the past half century (Hall et al. 1988, Olendorff 1993, Preston 1998, Ng et al. 2020). The primary causes of decline are habitat loss or conversion, human disturbance, electrocution, hunting, and poisoning of prey species (Gilmer et al. 1985, Olendorff 1993, Preston 1998, Copeland et al. 2011, Coates et al. 2014). The effects of climate change on the historical decline of the ferruginous hawk are not well known, but the species has strong associations with open grasslands and BTPD populations, both of which may be affected by the increasing temperatures projected at MAFR (Plumpton and Andersen 1997, Berry et al. 1998, Colorado Division of Wildlife 2003). Ferruginous hawks have a wide distribution, large range wide abundance, and relatively stable populations, resulting in a low climate change vulnerability categorization (CEMML 2023).

Swainson's Hawk

Swainson's hawks have been confirmed breeders on MAFR. They hunt in wooded and riparian areas near open grasslands and wetlands. In North Dakota, Murphy (2010) found that nearly 50% of their prey consisted of wetland-dependent species. In recent decades populations have declined, largely due to grassland habitat loss and pesticide use in their wintering habitat of South America (Hull et al. 2008, Bechard et al. 2010). Swainson's hawks are heavily dependent on grassland and wetland habitats, which are moderately vulnerable to projected changes in climate. However, climate change is not a major factor in their decline and they still retain a large breeding range throughout western and central North America, resulting in a low climate change vulnerability categorization (CEMML 2023). These results agree with other climate change vulnerability assessments that have been conducted in other portions of Swainson's hawk range (Gardali et al. 2012, Wilsey et al. 2019).

Prairie Falcon

Prairie falcons are winter residents at CAFB and MAFR. They inhabit dry environments of western North America where open plains and shrub-steppe deserts surround cliffs and bluffs (Steenhof 2020). Their prey consists of small mammals and birds. Population trends for prairie falcons have remained relatively stable since 1950, although western North America populations have declined (Farmer et al. 2008, National

Audubon Society 2011, Sauer et al. 2020). The major threats to their populations have been shooting, human disturbance, and predation (Enderson 1964, Van Tighem 1967, Steenhof 2020). Prairie falcons maintain a wide distribution and stable population trends, so they were categorized as having low climate change vulnerability (CEMML 2023).

Lesser Prairie Chicken

While climate change has not been responsible for past LEPC declines, the low abundance, fragmented landscape, and isolated nature of the southern population segment increases its vulnerability to climate impacts in the future. Although climate projections for CAFB and MAFR indicate increasing temperatures and possible increases in precipitation, in general climate change for the southern population segment region is expected to result in warmer and drier weather with more frequent and intense droughts. These conditions could impact LEPC reproduction and survival directly, or indirectly through large-scale shifts in vegetation (Grisham et al. 2013, Ross et al. 2016, Fritts et al. 2018, USFWS 2021*b*). Of particular concern are the effects of climate change on the sandsage and soapweed yucca habitat on MAFR, the primary habitat for the LEPC, which is classified as having moderate to high vulnerability to climate change (CEMML 2019). Due to the LEPC's already reduced distribution and low abundance, as well as its sensitivity to drought and extreme weather events, the CEMML CCVA analysis categorized LEPC as having high climate change vulnerability (CEMML 2023).

Long-billed Curlew

The grassland-associated long-billed curlew has been confirmed breeding in the shortgrass prairie of MAFR. It breeds across much of the Intermountain West and Great Plains of North America, but its population is declining, particularly in the shortgrass and mixed-grass prairie of the western Great Plains (Fellows et al. 2001, Dugger and Dugger 2002, Fellows and Jones 2009, Pollock et al. 2014). Studies attribute historical population declines to over-hunting and the conversion of native prairies for agriculture, but current threats to populations include habitat loss and destruction, energy development, human disturbance, and contaminants (Fellows et al. 2001, Oring 2006, Askins et al. 2007, Fellows and Jones 2009, Blus et al. 2020). Although climate change has not been directly linked to declines, the species relies on grasslands and prairie habitats for breeding and nesting, which could be negatively affected by the projected increases in temperature at MAFR. Furthermore, the species is a vulnerable, high priority species for shorebird monitoring, resulting in a moderate climate change vulnerability categorization (CEMML 2023).

Loggerhead Shrike

Loggerhead shrikes are year-round residents that have been confirmed at both CAFB and MAFR, although they prefer the mesquite shrublands of the MAFR. They range across most of the continental U.S. and southern Canada (Yosef 2020). Despite an overall population loss of nearly 80% across their range since 1966, loggerhead shrike populations in Colorado, Montana, and Oregon have remained stable (Wiggins 2005, Sauer et al. 2020). They prefer open habitats, agricultural fields, riparian areas, and open woodlands with short, scattered shrubs and trees for nesting (Bellar and Maccarone 2002, Wiggins 2005, Michaels and Cully 2019, Froehly et al. 2020). Borgman and Wolf (2016) found that loggerhead shrike nest initiation dates were positively correlated with mean maximum air temperature during the spring and that initiation dates advanced an average of 20 days over six years. Although Borgman and Wolf (2016) found that nesting attempts were positively correlated with mean breeding season temperature and winter precipitation, nest failures due to predation also increased in hot and dry conditions. Collister and Wilson (2007) also found predation to be a main cause of nest failure, but daily nest survival was positively correlated with temperature and negatively correlated with precipitation. Following wildfires, loggerhead shrike density

decreased, most likely due to loss of nesting habitat (Humple and Holmes 2006). The researchers also found that shrikes more frequently nested in vegetation other than sagebrush following a wildfire, whereas they nested almost exclusively in sagebrush prior to the wildfire (Humple and Holmes 2006). Climate change has not been shown to play a major role in their decline compared to other threats and they still maintain a large distribution across North America; hence, they have been categorized as having low vulnerability to climate change (CEMML 2023).

Lark Bunting

The lark bunting (*Calamospiza melanocorys*) is a North American endemic grassland species that breeds and resides at CAFB and MAFR throughout the spring and summer. Some individuals may be expected to be year-round residents. The major threats to its populations are habitat loss and degradation associated with the conversion of native grasslands to agriculture (Shane 2000). Breeding Bird Survey data indicate a relatively stable or slightly declining population across its entire range, with a more pronounced decline in the Great Plains (Sauer et al. 2020). Despite its recent declines, the species has a low climate change vulnerability categorization due to its widespread distribution, abundant population size, and relatively stable population trend (CEMML 2023).

Cassin's Sparrow

Cassin's sparrow inhabits arid shrub grasslands of the southwestern U.S. and northern Mexico and has been confirmed nesting on CAFB and MAFB (Dunning et al. 2020). Breeding Bird Survey data from the 1960s to 2015 indicate that populations have undergone a long-term decline in North America (Lynn 2006, Dunning et al. 2020, NatureServe 2022*b*). Major threats to Cassin's sparrow are the loss and degradation of its preferred grassland habitat, grazing, and non-native grasses (Lynn 2006, Ruth 2000). Populations can fluctuate dramatically from year to year, possibly driven by rainfall. In the southwestern portions of its range, breeding populations and reproductive success were positively correlated with summer rainfall, yet in more mesic portions of its range, breeding success decreased with increasing rainfall (Lynn 2006, Dunning et al. 2020). Although Cassin's sparrow may be affected by decreases in rainfall, increases have been projected for CAFB and MAFB (CEMML 2019). Additionally, Cassin's sparrow is widespread, abundant and has shown relatively stable regional populations (Dunning et al. 2020), resulting in a low climate change vulnerability categorization (CEMML 2023).

Monarch

Since the early 2000s, populations of the North American subspecies (*D. p. plexippus*) have declined precipitously (Anderson and Brower 1996; Brower et al. 2002, 2012; USFS 2015; USFWS 2020; Crossley et al. 2022; NatureServe 2022h; Zylstra et al. 2022). Studies indicate that climate is a major driver of the species' population dynamics (Barve et al. 2012, Zipkin and Oberhauser 2012). Increasing temperatures and decreasing precipitation in some areas, such as the Midwest and southern U.S., are expected to negatively impact their phenology , further affecting their populations (Scott et al. 2022, Yang et al. 2022, Zylstra et al. 2022). Therefore, projected climate-change scenarios, such as altered timing and magnitude of weather events, could have substantial impacts on monarch populations (Barve et al. 2012, Zipkin and Oberhauser 2012). Multiple ecological niche models have projected that their populations will decline an additional 19% to 89% by the end of the 21st century due to climate-related impacts and habitat loss, in both their winter and summer ranges (Oberhauser and Peterson 2003, Batalden et al. 2007, Barve et al. 2012, NatureServe 2022h, Walker et al. 2022, Zylstra et al. 2022).

Along with climate-driven population declines, monarchs have undergone significant habitat loss as a result of native milkweed eradication and land development (USFWS 2020). Poorly timed management practices

can also negatively affect this species. Additional threats to monarchs include invasive species, such as fire ants and oleander aphids, and pesticides (USFWS 2020, Scott et al. 2022). Overall, monarch populations are declining precipitously as a result of multiple climate change factors, as well as other anthropogenic causes such as habitat loss, pesticide use, invasive species, and poor habitat management. For all these reasons, the monarch received a very high climate change vulnerability categorization.

Tricolored Bat

Prior to the impacts of WNS, tricolored bats were thought to be common and possibly expanding their range northward (Kurta et al. 2007, Center for Biological Diversity and Defenders of Wildlife 2016, NatureServe 2022b). Over the last 15 years WNS has dramatically impacted populations, with projections of a 45% to 60% decline by 2035 (Langwig et al. 2015, 2016; Solari 2018; Bat Conservation International 2022d; NatureServe 2022b). Additional threats to their populations are collisions with wind turbines, habitat loss, pesticide use, and climate change (Kunz et al. 2007, Arnett et al. 2008, Langwig et al. 2015, Center for Biological Diversity and Defenders of Wildlife 2016, NatureServe 2022b).

As mentioned above, bats may be among the most sensitive species to climate change and serve as early-warning indicators of large-scale ecological effects (Jones et al. 2009, Adams 2010, Sherwin et al. 2013, Cornman 2014). Higher temperatures in hibernacula can promote greater fungal loads and higher WNS infection rates (Langwig et al. 2016). Increasing temperatures may also prompt bats to break hibernation more frequently, putting them at greater risk of mortality through rapid energy use. Changes in temperature and precipitation could also decouple insect emergence and bat emergence in the spring, which could negatively affect bat populations (Sherwin et al. 2013, Center for Biological Diversity and Defenders of Wildlife 2016). Many bat species are expected to shift their ranges northward over the next century due to climate change (Center for Biological Diversity and Defenders of Wildlife 2016), and although the tricolored bat's ability to move across landscapes may help it to cope with climate change, it is not known how temperature increases may affect reproductive success and hibernation. Due to declining populations, and susceptibility to WNS and climate-change related impacts, the tricolored bat was given a very high climate change vulnerability categorization.

2.3.5 Wetlands and Floodplains

A wetland delineation was completed for CAFB and MAFR in 2005. No waters of the U.S. were found on MAFR; however, several areas on CAFB, including the golf course ponds and North Playa Lake, required a determination. It was determined that all water bodies and drainages within the CAFB are isolated and not subject to regulation under the CWA. In 2006, the U.S. Army Corps of Engineers (USACE) concurred with a 2005 delineation report indicating that none of the water bodies on CAFB are Waters of the U.S.

2.3.5.1 Playas

Playa habitats are natural depressions in the landscape that support standing water from seasonal rains. Playas form from intermittent flooding followed by evaporation and infiltration. Playas have no surface outlet, and any water they collect is eventually lost to evaporation, infiltration, and/or use by plants and animals (ACC 1995). The vegetation in this habitat varies with moisture cycles, when excluding any human disturbances and fire. Grass species mainly grow in the depressions, while sparse forbs and sometimes shrubs grow around the margins of the playas. Playas are an important part of the prairie ecosystem. They provide most of the standing water and many animals native to shortgrass prairies use playas as a water source and foraging area. Migrating waterfowl and shorebirds also use this habitat. On MAFR, these habitats are predominantly located in the northeast and southwest portions of the range. Several ephemeral channels on MAFR, including the Cañada del Tule, Sheep Canyon, and Chapman Draw, support similar

vegetation and habitats. The thicker vegetation and intermittent water supply of the ephemeral streams on MAFR attract the New Mexico spadefoot toad (*Spea multiplicata*), which in turn attracts the plains hognose snake (*Heterodon nasicus*), which feeds on these toads.

The habitat on CAFB includes playa lakes and associated ephemeral channels or ditches. The channels are concentrated around the playas and carry runoff to the north and south playa lakes and to the golf course playas and, during extreme events, ponds. CAFB historically contained four significant natural ephemeral playas, which have been impacted to varying degrees by past and current human activities. The golf course ponds are lined and intensely maintained; however, the lining of the golf course pond is currently being replaced. Runoff from the adjacent housing area has created a permanently inundated, nutrient-rich aquatic environment. Algal problems (e.g., extensive blooms) resulted and sterile grass carp (*Ctenopharyngodon idella*) were stocked to alleviate the problem. Canada geese (*Branta canadensis*) and Mississippi kite (*Ictinia mississippiensis*) are often seen around the golf course ponds.

North Playa Lake is the most significant playa for wildlife habitat and is currently receiving effluent wastewater. This has created a permanently inundated and extremely nutrient-rich aquatic environment. Barred tiger salamanders (*Ambystoma tigrinum*) and plains leopard frog (*Rana blairi*) are common amphibian residents. The most common reptile is yellow mud turtle (*Kinosternon flavescens*). Ducks, waders, and shorebirds are observed regularly. Some of the more common bird species include double-crested cormorant (*Phalacrocorax auritus*), great blue heron (*Ardea herodias)*, and black-crowned night heron (*Nycticorax nycticorax*) during the summer, and mallard (*Anas platyrhynchos*), blue-winged teal (*Anas discors*), green-winged teal (*Anas crecca*), northern shoveler (*Anas clypeata*), and ruddy duck (*Oxyura jamaicensis*) during migration and winter seasons.

The southern playa has also been affected by human activity. Modern agricultural practices (e.g., contour tilling), and construction of the runways, perimeter road, and public road on the west side of the base, have altered the natural hydrology of the southern playa; however, drainage from the surrounding uplands still flows into it. This has resulted in a more natural playa system with fluctuating wet and dry periods, creating a wetland plant community. Past dumping activities have created a steep bank around the edge of the playa and several concrete piles have been created in the center of the playa. Coyote, desert cottontail, striped skunk, deer mouse, hispid cotton rat (*Sigmodon hispidus*), and southern plains woodrat use the concrete piles.

2.3.6 Other Natural Resource Information

Previously, several other natural resources projects and surveys have been conducted at CAFB and MAFR. A summary of one of those projects is below.

2.3.6.1 Land Condition Trend Analysis

Given the nature of the training and testing activities on military installations, the potential for disturbance to the landscape is high. As the soil surface becomes increasingly disturbed and protective vegetation is lost, soil erosion accelerates. If allowed to continue unchecked, extensive damage from soil loss, gullying, sedimentation, and flooding can occur. Land Condition Trend Analysis (LCTA) plots allow the Natural Resources Management Element to monitor vegetation communities and soil conditions, enabling MAFR to identify an issue before it escalates. This is beneficial because periodic land maintenance is often much more cost-effective than extensive repair of severely degraded lands. LCTA is a critical land management component for maintaining the ecosystem communities necessary to support wildlife.

A total of 171 LCTA plots have been established on MAFR. An additional 30 new plots were established on the Land Gift Area. With the 2016 surveys, all 141 original plots have been surveyed as well as the 30 newly established plots. Surveys consist of (1) a 100-meter line-intercept sample used to determine ground cover, canopy cover, and surface disturbance, (2) a belt transect for surveying all woody species, and (3) a biomass estimation used to calculate available forage (yield) on a site.

2.4 Mission Impacts on Natural Resources

2.4.1 Natural Resource Constraints to Mission and Mission Planning

The soils of MAFR and CAFB are primarily sandy or sandy loam with moderate to high permeability. Although these soils are suited to construction due to a lack of shrink-swell potential, they are highly susceptible to the effects of wind and water erosion during both construction and ground forces training exercises. Construction on these types of soils requires extensive erosion control during the project and after completion.

At times, bird activity over the airfield at CAFB, over MAFR, and/or along flight training routes has resulted in bird-aircraft strikes. Bird strikes create hazards for flight crews and damage aircraft. Removing aircraft from the flight schedule for repairs negatively impacts both training and the wing budget due to repair costs.

Active prairie dog towns can damage portions of the range infrastructure. For example, regular repair has been required at Bobcat Landing Zone and Range 5 due to burrowing activity.

2.4.1.1 Potential Future Constraints due to Climate Change

Climate change has the potential to affect the mission, mission-critical infrastructure, and natural resources. The mission relies on the natural environment, and may be affected indirectly by shifting ecosystems, wildfire, and regulatory burden. See Section 7.16 for a more detailed discussion of climate change vulnerabilities to the mission and operations.

2.4.2 Land Use

2.4.2.1 Cannon Air Force Base

Since its establishment in 1942, CAFB has greatly influenced land use patterns and development in its vicinity. The Base contains a variety of land use activities including runways, industrial facilities, housing areas, and administrative, training, and support facilities. Airfield and open space make up the greatest percentage of total land area at the Base. The existing land use categories and acreage are presented in Figure 2-5 and Table 2-9.

Table 2-9. Existing Land Uses at Cannon Air Force Base

Land Use Category	Acreage
Airfield (includes 239 acres of airfield pavement)	1,469
Airfield Operations and Maintenance	111
Industrial	287
Administrative	30
Community (Commercial)	57
Community (Service)	13
Medical	7

Housing (Accompanied)	986
Housing (Unaccompanied)	45
Outdoor Recreation	224
Open Space	1,138
Water	30
Total	**4,397**

Safety and noise influence land use planning on the installation and vicinity. The Air Installation Compatible Use Zone (AICUZ) program provides AF bases and surrounding communities with guidelines to address safety and noise issues in land use planning. As part of its AICUZ program, the county and state purchased easements to allow CAFB to establish a Clear Zone and two Accident Potential Zones (APZs) at the end of each runway. Within the Clear Zones, only limited agriculture uses are permitted. Within the APZs, residential development or other land uses that promote public assembly are discouraged. Land uses allowed within APZ I include a variety of industrial, open space, and agricultural uses. APZ II includes the same uses as APZ I but adds some commercial uses and services. The AF holds property rights to off-base portions of Clear Zones to prevent incompatible land uses.

From a natural resources standpoint, the presence of munitions on CAFB is beneficial in that munitions storage areas are surrounded by safety clearance zones where any unrelated uses are not permitted. These Quantity-Distance safety zones effectively restrict facility development in the eastern part of the base. These undeveloped areas provide habitat for a variety of wildlife.

Current direct land use impacts on CAFB are similar to those described from the previous mission at CAFB. Changes in land use impacts are expected to occur periodically as the base is developed to accommodate the AFSOC mission; however, the magnitude and timing of the changes is unknown since funding has not yet been acquired for all AFSOC infrastructure changes.

2.4.2.2 Melrose Air Force Range

Of the more than 69,731 acres comprising the range, approximately 7,640 acres comprise the impact areas with another 5,078 acres comprising a restricted area.

Around 340 acres of the range supports facilities, including a fire station, maintenance areas, and a camera station for monitoring ordnance practice. A breakdown of land use is found in the table below (Table 2-10).

Table 2-10. Land Use at Melrose Air Force Range

Land Use Category	Acreage
Support Facilities	340
Dudded Impact Area	5,050
Inert Impact Area	2,590
Restricted Area	5,078
Training Range	56,673
Total	**69,731**

Surrounding the range is restricted airspace over approximately 294,918 acres (Figure 2-6). The underlying land is generally used for cattle grazing and crop production. Crops consist of wheat, grain, sorghum, corn, barley, cotton, hay, peanuts, and potatoes. Residential uses are few and scattered. Approximately 73% of all land within the restricted areas is held in private ownership, 19% is state-owned, and 8% is owned by the AF (Table 2-11). Neither Curry County nor Roosevelt County has enacted zoning ordinances that would regulate land use surrounding MAFR.

Table 2-11. Land Use Under Restricted Airspace Surrounding Melrose Air Force Range

Land use Category	Acreage	Percent of Restricted Area
Rangeland	245,325	83
Cropland	48,294	16
Water/Wetland	767	<1
Urban/Built-up Land	577	<1
Total	**294,918**	**100**

Since 2010, MAFR has expanded to the east by more than 10,000 acres. Lands previously owned by the State and administered for grazing have been deeded to the AF for military training. This further limits impacts to surrounding landowners.

2.4.3 Current Major Impacts

Impacts to the environment at CAFB result primarily from training and operation activities. Typical impacts include noise from flight training and base operations, air emissions from flight training and base operations, disturbance to soils from construction activities, water releases, and generation of hazardous wastes during base operations.

Current AFSOC impacts principally result from electronic combat flight training, ordnance training, supply drops, and live fire training for C-130 gunships at MAFR. In addition, aircraft from other commands continue to train at MAFR, including B-1B bombers from Dyess AFB, the 150th New Mexico Air National Guard, and other transient aircraft (A-10, F-15s, F/A-18s, F-22As, German Air Force Tornados, B-52s, C130s, and various helicopters) (AFSOC 2007). Typical impacts include: noise from training flights and training ordnance use; air emissions from flight training; fire from ordnance use; and soil disturbance from range maintenance activities such as target placement, ordnance clearing, and road repair.

2.4.3.1 Air Resources, Cannon Air Force Base

CAFB is in a current attainment area under the National Ambient Air Quality Standards (AFSOC 2007). Emission impacts to air resources at CAFB result from aircraft training, base operations, and vehicular traffic. Emission sources of concern from facilities at CAFB have been identified and permitted. CAFB is permitted under a Title V operating permit (P119-R2) issued by the New Mexico Environmental Department Air Quality Bureau, 22 May 2019, which permits operation of 108 stationary emission sources throughout the base. Many of these sources are a result of the 2007 mission change, which brought the 27th Special Operations Wing to CAFB. In comparison to the previous mission, current impacts to air resources have decreased with the transfer of aircraft, decrease in the number of flights, and the change in the aircraft type flown.

2.4.3.2 Air Resources, Melrose Air Force Range

The Air Quality Control Region in which MAFR is located is currently in attainment of National Ambient Air Quality Standards (AFSOC 2007). Current impacts to air resources at MAFR primarily result from aircraft training, fugitive dust, use of portable generators to supply electrical power to remote areas, and vehicles associated with maintenance of targets and roads on the range. Live fire training at MAFR and additional construction activities may result in temporary increases in fugitive dust emission. Overall, air quality is not expected to change the attainment status of the Air Quality Control Region.

2.4.3.3 Water Resources, Cannon Air Force Base

Surface and groundwater resources at CAFB can be affected by wastewater and other discharges from base operations. All discharges on the installation are covered under a Ground Water Discharge Permit (DP-873). The stormwater program (NPDES permit coverage) is not applicable to CAFB, as jurisdictional waters of the U.S. do not exist. DP-873 covers a number of sources that could contribute to groundwater pollution (e.g., wastewater treatment plants, septic systems, fertilizer use, etc.). The New Mexico Environment Department (NMED) last issued DP-873 on 15 December 2021 and is currently active.

2.4.3.4 Water Resources, Melrose Air Force Range

At MAFR, the primary source of impact on water resources is erosion of topsoil, resulting from fires associated with flight training missions and from road maintenance. These factors also affect the shortgrass prairie ecosystem that is naturally dominant at the range.

2.4.3.5 Noise, Cannon Air Force Base

Noise issues for CAFB are summarized in the "AFSOC Assets Beddown at CAFB, New Mexico Environmental Impact Statement" (AFSOC 2007). The primary noise source is aircraft. Secondary sources are from vehicular traffic and base construction activities. Noise contours are generated that are used to restrict certain development types near the runways. For example, residential land uses are not permitted where noise would be expected to exceed 65 decibels Day-Night Average A-Weighted sound levels (USAF 2003). The 2016 AICUZ Study identifies current noise contours. Noise levels are lower under the new AFSOC mission than during the past CAFB mission.

2.4.3.6 Noise, Melrose Air Force Range

Noise impacts at MAFR result from aircraft training, ordnance drops, and C-130 live-fire target training. Noise levels could increase within the range as a result of the proposed C-130 live-fire training.

2.4.3.7 Traffic

Vehicular and pedestrian traffic at the installation is consistent with the current mission, which involves operational activities at the existing facilities. Vehicular traffic predominantly consists of personal vehicles, and pedestrian traffic primarily involves walking between facilities with some recreational walking. Aircraft traffic affects natural resources through noise, limited air pollution, and bird-aircraft strikes.

2.4.3.8 Biological Resources, Cannon Air Force Base

At CAFB, potential impacts to biological resources are limited by the small size of the remaining habitats and the lack of undisturbed native habitat remaining on Base. Currently, development associated with the new mission is not negatively impacting biological resources. All proposed actions are evaluated under the Environmental Impact Analysis Process (EIAP).

Wildlife can also cause impacts to military training. Birds or other animals that collide with aircraft can damage the aircraft and threaten aircrew safety. Wildlife can also damage base and range infrastructure.

Bird/Wildlife Aircraft Strike Hazard (BASH) is defined as the threat of aircraft collision with birds or other animals during flight operations. Although most bird strikes do not result in aircraft damage, some strikes have led to major damage and/or serious aircraft accidents. According to Bird Strike Committee USA, strikes involving birds and other wildlife (primarily mammals) result in over $600 million in damage to U.S. and civilian air traffic every year. Military aircraft used by AFSOC are more vulnerable than other DoD aircraft because many AFSOC missions require flying at low altitudes.

Historical bird-aircraft strike records are limited for the previous missions conducted by CAFB. Although aircraft types and mission profiles used previously at CAFB are not similar to AFSOC training missions, BASH data from the previous mission provides background for the potential for bird strikes in the region surrounding CAFB and MAFR.

At CAFB, there were 341 strikes from 1991 through 1996, with damage exceeding $1.9 million. Birds of prey accounted for 263 of these strikes. The months of May, September, and October saw the most strikes (USAF 1996). A BASH program was initiated for the CAFB mission in 1997. For management of wildlife associated with wildlife-aircraft strikes, CAFB maintains a depredation permit from the USFWS.

From fiscal year (FY) 2017 through FY 2021, there were 214 BASH strikes at CAFB, representing a reduction in the number of strikes with implementation of the BASH program at the installation. July, August, and September were the months with the most strikes (Swaby 2003). This period coincides with the fledging of inexperienced juvenile birds from nest sites.

Collection of bird strike data from current AFSOC mission training activities over Florida and New Mexico has begun; however, results for New Mexico are limited because of the low number of missions conducted from CAFB.

In 2016, the total cost of damages from BASH incidents at Cannon and Melrose was $146,631. There were only ten damaging strikes out of 143 total bird strikes. Strikes occurred to 112 planes, some involving multiple birds and even sometimes multiple species. Planes have hit up to six different birds in one flight. The most costly strike (2016) was caused by a chipping sparrow (very small) hitting a CV-22B; the total cost for that one strike was $75,039.

2.4.3.9 Biological Resources, Melrose Air Force Range

Current impacts to biological resources are limited on MAFR, as approximately 11% of the land on MAFR (69,731 acres) is used as an impact area (7,640 acres). Live-fire targets for training C-130 aircrews may have temporarily or permanently displaced some animals during construction and/or training activities (e.g., due to noise).

Historical bird aircraft strikes have been documented at MAFR. From 1991 through 1996, eight bird strikes were documented. The most significant bird strike hazard is associated with raptors and/or migrating waterfowl, due to their large size. After implementation of the BASH program, only three bird strikes were reported from 1997 through 2002. However, it is extremely difficult to determine if a bird has been struck over MAFR unless the pilot sees the strike. Otherwise, it is impossible to determine at what point the aircraft and the bird collided. Therefore, the number of strikes reported between 1997 and 2002 may be inaccurate. Known bird species struck over MAFR include lesser nighthawk and lark bunting.

2.4.3.10 Hazardous and Solid Wastes, Cannon Air Force Base

Potential impacts include spills and seepage of hazardous waste from dump sites on base. Hazardous wastes are generated during base operations (e.g., oils, heavy metals, etc.), stored on base, and consumed during training. Aircraft flight operations and maintenance, as well as installation maintenance, require the storage and use of many types of hazardous materials. These materials, such as flammable and combustible liquids, include acids, corrosives, caustics, glycols, compressed gases, aerosols, batteries, hydraulic fluids, solvents, paints, pesticides, herbicides, lubricants, fire retardants, photographic chemicals, alcohols, and sealants. The major contaminants identified on CAFB have been petroleum constituents, pesticides, herbicides, polychlorinated biphenyls, and heavy metals. CAFB has an active spill prevention plan, an Environmental Restoration Program (ERP) for hazardous wastes, a hazardous and solid waste management program, and an active recycling program.

There are numerous aboveground storage tanks (ASTs) located at CAFB. The tanks range in size and function from a 55-gallon diesel fuel tank used for power production to 811,000-gallon fuel storage tanks for jet fuel (USAF 2017). All ASTs have secondary containment that will protect natural resources from all but a catastrophic release of fuel. Most fuel transfers occur on paved surfaces. There are three underground storage tanks on the installation that hold 10,000 gallons of gasoline for service stations (USAF 2017). Spill prevention and cleanup are actively practiced in accordance with the Cannon AFB Final Spill Prevention and Response Plan (USAF 2017).

CAFB began its ERP in 1983, and in 1987 the base underwent a Resource Conservation and Recovery Act (RCRA) Facility Assessment as the result of an application for a RCRA Part B Permit to store hazardous waste. A total of 179 Solid Waste Management Units (SWMU) and Areas of Concern were identified. As CAFB is no longer a designated Treatment, Storage, and Disposal facility for hazardous wastes, the permit is a "Corrective Action Only" permit (#NM7572124454) for the investigation and potential remediation of the identified SWMUs and Areas of Concern. The permit is divided into three designated Tables; Table 1—sites requiring corrective action, Table 2—sites closed to Response Complete (closed with controls), and Table 3—sites closed to Site Closure (unrestricted use/unrestricted exposure). As of FY22, a total of 42 sites remain on Table 1 (13 of which are in "deferred" status), 141 sites remain on Table 2 closed to Response Complete, and 23 sites are found within Table 3 closed to Site Closure. Seven landfills closed to Response Complete undergo yearly inspections and maintenance as required; they include Landfills 1, 2, 3, 4, 5, 25, and SWMU 101. In addition, as part of the permit requirements, CAFB conducts a biennial groundwater monitoring program consisting of 24 groundwater monitoring wells, 11 of which are included in the "optimized" sampling strategy. Results from the sampling efforts are reported to NMED on a biennial

basis. CAFB submitted Corrective Action Complete Proposals to NMED for seven restoration sites in March of 2020. NMED provided an administrative completeness letter on 24 March 2020. The remaining five sites will undergo investigation and remediation as required to bring the sites to closure through the "Permit Modification Process" as stipulated in 40 CFR 270.42. CAFB will work to remove numerous sites through further investigation and remediation as required.

Hazardous waste at CAFB is managed under the installation hazardous waste management plan at 120 collection points, 75 initial accumulation points, and one 90-day accumulation point. All RCRA hazardous waste is shipped offsite on a Hazardous Waste Manifest through the local Defense Reutilization and Marketing Office (DRMO) disposal contract (Mr. Brian Essex, range biologist, SOCES/CEAN, personal communication, 2008). Asbestos-containing debris is remediated off-base by contract (Mr. Brian Essex, range biologist, SOCES/CEAN, personal communication, 2009).

Base-generated construction and demolition debris is disposed of in a small landfill in the southeast corner of the base. Solid waste is transported to the Clovis regional landfill by a contracted waste hauler.

2.4.3.11 Hazardous and Solid Wastes Melrose Air Force Range

MAFR is operated by a contractor who monitors and maintains the televised ordnance scoring system, bombing and gunnery targets, and access roads. Five ASTs are present on MAFR. Only small quantities of petroleum products are used and stored at the range.

On approximately 7,000 acres of MAFR, live bombs were used from 1952 through 1969. IAW AFMAN 13-212V1, the impact areas are off limits to everyone except explosive ordnance disposal and unexploded-ordnance-qualified personnel.

Current munitions-related wastes (metal fragments from inert ordnance, targets, training ammunition) are cleared regularly from MAFR impact areas in accordance with AFI 13-212 (Section 7.4). Tactical and conventional targets are cleared every 75 use days to a radius of 328 feet and annually to a radius of 1,000 feet. Every five years, all impact areas are cleared to their boundaries.

The CAFB Explosive Ordnance Demolition team inspects all munitions debris and renders it safe before collection. Prior to initiation of high-explosives training at MAFR, hazardous munitions waste consisted solely of a reactive material used in spotting charges.

MAFR operates under a RCRA "Corrective Action Only" permit (#NM7572124454-1) for seven identified SWMUs. The permit was granted "deferred" status by the New Mexico Environment Department in 2007 until the Range is closed, transferring, or transferred at which time the SWMUs will undergo investigation and remediation as necessary. An active groundwater monitoring program is in place at MAFR. Groundwater sampling occurs biannually with a fall and spring sampling event. MAFR has 30 groundwater monitoring wells, 18 of which are sampled during the fall or spring event. The remaining wells are used to measure static groundwater levels. Information obtained during the groundwater sampling events is reported to NMED on a yearly basis.

Scrap munitions are disposed of in accordance with DRMO regulations and a Memorandum of Agreement with DRMO, or through an option for direct commercial sales. Defensive chaff and flares are used over MAFR. Based on the findings of a 1997 Headquarters (HQ) ACC study, residual chaff and flares are not expected to release chemicals in potentially dangerous concentrations under the conditions found at MAFR (ACC 1997).

2.4.4 Potential Future Impacts

Based on the "*AFSOC Assets Beddown at Cannon Air Force Base, EIS*", future impacts to land use would be expected at both CAFB and MAFR; however, the impacts cannot be identified until facility construction is completed, training missions are finalized, and funding is appropriated. This process is expected to occur over the 5-year interval of this INRMP. Future impacts will be identified in yearly updates to this plan.

2.4.5 Natural Resources Needed to Support the Military Mission

At MAFR, large areas of open space are needed to support air-to-ground training activities. Additionally, some on-the-ground training occurs at MAFR, for which drop zones (DZs), vegetative cover, and topographic variability are needed. Land at MAFR that is needed to support the mission includes the impact area (7,640 acres); the remaining land (62,091 acres) at MAFR is used to encompass the safety footprints, and to provide various training options (e.g., DZs, landing zones, areas for ground training). DZs and landing zones require flat terrain without hazards. Suitable terrain is present for this training on the eastern half of the range. Ground training (e.g., Survival, Evasion, Resistance, and Escape training) requires varied topography. The southwestern portion of the range has the topography necessary for this training.

2.4.5.1 Soils

The soils of MAFR and CAFB are primarily of sandy or sandy-loam with moderate to high permeability. Although these soils are suited to construction due to a lack of shrink-swell potential, they are highly susceptible to the effects of wind and water erosion during both construction and ground forces training exercises. Construction on these types of soils requires extensive erosion control during construction and after completion.

2.4.5.2 Wetlands

No jurisdictional waters are found on CAFB or MAFR.

2.4.5.3 Floodplains

One-hundred-year floodplains do not occur on either CAFB or MAFR. Therefore, floodplains are not a constraint on development at either installation.

3.0 ENVIRONMENTAL MANAGEMENT SYSTEM

The AF environmental program adheres to the Environmental Management System (EMS) framework and its Plan, Do, Check, Act cycle for ensuring mission success. EO 13693, *Planning for Federal Sustainability in the Next Decade*, U.S. DoDI 4715.17, *Environmental Management Systems*, AFI 32-7001, *Environmental Management*, and international standard, ISO 14001:2004, 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 continuous 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 natural resources program are listed in the table below. Specific natural resources management-related roles and responsibilities are described in appropriate sections of this plan.

Office/Organization/Job Title (Listing is not in order of hierarchical responsibility)	**Installation Role/Responsibility Description**
Installation Commander	The Wing Commander is responsible for ensuring that installation and tenant units comply with laws and requirements associated with the management of natural resources. The Wing Commander approves the INRMP and any necessary revisions, provides appropriate funding and staffing to ensure implementation of the INRMP, controls access to and use of installation natural resources, and signs cooperative agreements entered into between the installation and other entities pursuant to the Sikes Act.
Installation Natural Resources Manager/POC	Ensures studies are done in a timely manner, and in conformance with protocol. Verifies that current data in INRMP, surveys, and integrated plans are correct and complete.
Installation Security Forces	Involved with reporting of and security at hazardous materials spills. Serve as Conservation Law Enforcement Officers (CLEO).
Installation Unit Environmental Coordinators (UECs); see AFI 32-7001 for role description	Serve as the EMS conduit between installation environmental function and their unit. Attend CFT and other working group meetings as requested. Advise the work area supervisor on any EMS and environmental policies. Manage and monitor the EMS requirements for the unit. (T-1). Provide any information required for installation environmental and sustainability performance measures. Participate and support EMS and compliance assessments. (T-1). Assist with developing corrective actions to address identified findings.
Installation Wildland Fire Program Manager	Vacant position. Coordinates and manages controlled burn prescriptions and planning. Maintains installation Wildfire Management Plan. Obtains all necessary permits. Advises and coordinates with contracted firefighters. Administers fire ecology studies and reports as warranted.

Office/Organization/Job Title (Listing is not in order of hierarchical responsibility)	**Installation Role/Responsibility Description**
Pest Manager	Sustain Government property, preventing pests from causing damage. Control of noxious vegetation, and nuisance wildlife (prairie dogs on airfield). Removal of roadkill on base, and removal of nuisance wildlife.
Conservation Law Enforcement Officer (CLEO)	None specific to conservation.
NEPA/Environmental Impact Analysis Process (EIAP) Manager	The NEPA Manager oversees and executes all installation activities pertaining to the Environmental Impact Analysis Process to ensure environmental considerations are factored into proposed activities.
National Oceanic and Atmospheric Administration (NOAA)/ National Marine Fisheries Service (NMFS)	N/A
U.S. Forest Service	N/A
U.S. Fish and Wildlife Service	Collaborates to ensure accuracy of natural resources data presented in the INRMP. Provides guidance for natural resource management goals and objectives. Reviews and concurs with 5-year revisions of the INRMP. Reviews and concurs with the effectiveness and implementation of the INRMP annually.
Base Civil Engineer (BCE)	Is responsible for the preparation, maintenance, and day-to-day implementation of the INRMP, and is the focal point for all plan actions and issues. The BCE also establishes mechanisms to review and analyze the impacts using the EIAP for all proposed actions of the INRMP, and makes recommendations based on the analysis to the Natural Resources Management Element for approval or disapproval.
New Mexico Department of Game and Fish	Collaborates to ensure accuracy of natural resources data presented in the INRMP. Provides guidance for natural resource management goals and objectives. Reviews and concurs with 5-year revisions of the INRMP. Reviews and concurs with the effectiveness and implementation of the INRMP annually.

5.0 TRAINING

AF 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.

5.1 Installation Supplement – Training

- NRMs at Category I installations must take the course, DoD Natural Resources Compliance, endorsed by the DoD Underservice Environmental Education Review Board and offered for all DoD Components by the Naval School, Civil Engineer Corps Officers School. See http://www.netc.navy.mil/centers/csfe/cecos/ for Civil Engineer Corps Officers School course schedules and registration information. Other applicable environmental management courses are offered by the Air Force Institute of Technology (http://www.afit.edu), the National Conservation Training Center managed by the USFWS (http://www.training.fws.gov), and the Bureau of Land Management Training Center (http://training.fws.gov).
- Natural resource management personnel shall attain professional registration, certification, or licensing for their related fields, and may be allowed to attend appropriate national, regional, and state conferences and training courses.
- All individuals who will be enforcing fish, wildlife and natural resources laws on AF lands must receive specialized, professional training on the enforcement of fish, wildlife, and natural resources in compliance with the Sikes Act. This training may be obtained by successfully completing the Land Management Police Training course at the Federal Law Enforcement Training Center (http://www.fletc.gov/).
- Individuals participating in the capture and handling of sick, injured, or nuisance wildlife should receive appropriate training, to include training that is mandatory to attain any required permits.
- The DoD-supported publication *Conserving Biodiversity on Military Lands—A Handbook for Natural Resources Managers* (http://dodbiodiversity.org) provides guidance, case studies and other information regarding the management of natural resources on DoD installations.

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. Per AFMAN 32-7003 professionally trained staff are to be maintained at all times to comply with Sikes Act mandates. Training for all natural resource management personnel is to be attained no less than annually. Training records are maintained IAW the Recordkeeping and Reporting section of this plan. Below are key NR management-related training requirements and programs:

- Personnel involved with pesticide use in support of the BASH program shall receive pesticide use training and certification to comply with federal and state laws or regulations.
- Use of utility terrain vehicles requires training to comply with federal and DoD instructions.
- Personnel driving on MAFR or leading other parties shall obtain Range Safety Officer training.
- Personnel supporting the BASH program at CAFB airfield must receive flight line drivers training, and specialized training in the use of firearms and pyrotechnics.

6.0 RECORDKEEPING AND REPORTING

6.1 Recordkeeping

The installation maintains required records IAW AFMAN 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.

6.1.1 Installation Supplement – Recordkeeping

Physical records are filed in Bldg. 102 CAFB in accordance with the most recent AFRIMS file system and categories prescribed by AFRIMS. Electronic records are being saved in AFRIMS and in the Air Force-Wide Environmental Management System (eDASH). Additionally, some electronic files are saved to the Squadron's SharePoint site.

6.2 Reporting

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

6.2.1 Installation Supplement –Reporting

In accordance with AFI 32-1031, Civil Engineers Operations Management, activities that may affect natural resources require one or more of the following forms submitted: Air Force Form 332 (Base Civil Engineer Work Request), AF Form 813 (Request for Environmental Analysis), AF Form 103 (Base Civil Engineering Work Clearance Request), or DD Form 1391 (Military Construction Project Data).

An annual report of depredation activities is submitted to the USFWS Migratory Bird Office. The report details species taken, location, month taken, the amount (number), and final disposition of the birds. Additionally, a report is sent to USDA Wildlife Services documenting the same activities and requesting concurrence with proposed depredation activities for the next year. Participation in Arbor Day Foundation's Tree City USA program requires documentation of compliance with their standards. This is done annually in March. Updates to the INRMP are ongoing. Reporting of changes is done annually for concurrence by the USFWS, and the NMDGF.

7.0 NATURAL RESOURCES PROGRAM MANAGEMENT

This section describes the 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

The NRM prepares, maintains, and implements the INRMP as required by the Sikes Act. The NRM provides natural resources policy guidance, technical support, and advice. She/he identifies policy deficiencies and coordinates corrections as necessary, and performs planning, programming, budgeting, and execution of natural resource requirements. The NRM assesses natural resource impacts from mission activity and proposes remedial actions. NRMs must locate, identify, and evaluate natural resource assets, participate in the Environmental, Safety, and Occupational Health Compliance Assessment and Management Program and emergency medical services audits/inspections, and maintain good relations with NR stakeholders (regulators). The NRM performs information and records management, and provides training as needed. She/he serves as a key member of the BASH working group, the Wildland Fire working group, and the IPMP development team. Additionally, the CAFB/MAFR NRM coordinates Earth Day/Arbor Day activities and maintains the Base status as a "Tree City USA."

7.1 Fish and Wildlife Management

Applicability Statement

This section applies to AF installations that manage fish and wildlife on AF property. This section **IS** applicable to CAFB.

Program Overview/Current Management Practices

CAFB and MAFR are Category I installations. Category I installations are defined as having suitable habitat for conserving and managing fish and wildlife (AFMAN 32-7003). The development of new habitat and management of existing habitat is limited by mission activities. Fish and wildlife species commonly found at CAFB and MAFR are representative of the species diversity common to the regional ecosystem. Aquatic habitat and large prairie dog populations at CAFB provide sources of food and habitat for migrating waterfowl and raptors, thereby increasing the bird aircraft strike hazard at CAFB, which negatively impacts mission requirements. At MAFR, most of the range is undeveloped and supports small and large mammal populations. Additionally, MAFR provides habitat for a variety of migratory and breeding birds. MAFR is contiguous with other surrounding undeveloped habitat, thus serving as a wildlife corridor.

CAFB works cooperatively with other agencies on an as-needed basis such as the Animal and Plant Health Inspection Service, USFWS, NMDGF, and Natural Resources Conservation Service to manage wildlife resources.

7.1.1 Cannon Air Force Base

Fish and wildlife management on CAFB primarily involves BASH reduction efforts, monitoring and surveying for listed species, protection of migratory birds, nuisance wildlife issues, pickup of dead or injured wildlife, and other cooperative conservation efforts. In recent years, CAFB has participated in a Legacy project, which is conducted jointly between the DoD and regional conservation groups, to study

BUOW migration throughout the southwestern U.S. and Mexico. CAFB also assisted with a Legacy project to study amphibian diseases on various installations throughout the U.S. A list of all wildlife species observed during surveys and monitoring programs from 2014 to present at CAFB can be found in Appendix C, Fauna of CAFB and MAFR. Channel catfish and sterile grass carp are in the golf course ponds. The catfish were stocked for past fishing tournaments and the carp were stocked in 1996 and 2017 to control algal blooms. The North Playa provides the best overall wildlife habitat on CAFB and is important for migrating and wintering waterfowl and migratory shorebirds. It also provides habitat for several amphibian, reptile, and small mammal species.

The disturbed grassland in and adjacent to the airfield provides habitat for a variety of wildlife, such as harvest mouse, coyote, thirteen-lined ground squirrel, BUOW, long-billed curlew, and various other small mammals. Landscaped areas (e.g., the golf course and base housing area) also provide important habitat for neotropical migratory birds. Past and current demands on fish/wildlife habitat are related primarily to fulfilling CAFB mission requirements. No hunting is allowed on CAFB.

As previously discussed, several important wildlife habitats are present on CAFB. Multiple-use management techniques can accommodate wildlife populations compatible with base operations. The table below (Table 7-1) discusses the primary wildlife management issues on CAFB and the respective management strategies for those issues.

Table 7-1. CAFB Fish and Wildlife Management

Primary Issues	**Management Strategies**
Limited habitat may decrease with the development of additional infrastructure associated with the AFSOC beddown. This would cause greater competition between species for remaining natural resources.	Manage remaining natural habitat to prevent impacts to the mission while promoting conservation where practical.
Large prairie dog population.	Implement the prairie dog management plan.
Bird airstrike hazards.	Update the existing 27 SOW, BASH Plan for the AFSOC mission.
Protection of migratory and wintering birds in accordance with the MBTA.	Conduct waterfowl, migratory, and wintering bird surveys at 3- to 5-year intervals.

7.1.2 Melrose Air Force Range

Habitat exists for a wide variety of wildlife on MAFR, and more than 100 species have been observed and documented since 2014. Many are game species, such as American pronghorn and mule and white-tailed deer; however, hunting is not allowed due to safety and security restrictions. The only exception is for pronghorn as part of the Pronghorn Population Management Hunt Program.

Future demands for additional land for ground training on MAFR could impact wildlife populations, depending on the type and intensity of training. If training activities continue to expand, more land on MAFR will become disturbed, which will increase the opportunity for invasive plant encroachment and establishment. Erosion may also become a factor if training decreases vegetative cover. Both of these factors could negatively impact wildlife populations. In addition, as military training intensifies, a

vegetation shift could affect wildlife, as more frequent fire intervals may cause a shift from brush to grassland. It should be noted, however, that the invasive shrub mesquite is currently predominant, and that healthy shortgrass prairies do not sustain a predominance of any woody species. The impacts of future foreseen training enhancements, including use of the 10,000 acre Land Gift, have been analyzed in the Environmental Assessment for Utilization Enhancements at MAFR, New Mexico.

Currently, general fish and wildlife management on MAFR includes avian point count surveys that will be used for an analysis of trend and annual comparisons. Additionally, active surveying and management for problematic invasive plant species is ongoing, and water guzzlers are maintained for wildlife. The table below (Table 7-2) summarizes the primary wildlife management issues on MAFR and the respective management strategies for those issues.

Table 7-2. MAFR Fish and Wildlife Management

Primary Issues	**Management Strategies**
Potential effects of increased training demands	Monitor wintering bird, breeding bird, and large mammal populations to determine abundance and population changes as range use changes.
Wildfires	Mowing, firebreaks, and prescribed fire are the primary tools to reduce fuel loads and manage vegetation communities.
Non-native, invasive, and toxic plants	Complete and implement plans to manage non-native, invasive, and toxic plants.

7.1.3 Climate Impacts to Fish and Wildlife Management

Current wildlife management issues such as invasive/pest species and BASH concerns are not likely to lessen, and may intensify in response to climate change. Changing climatic conditions present opportunities for invasive species to flourish and displace native species. Monitoring of invasive species will continue to be important and management plans should be flexible enough to adapt to changing fish and wildlife concerns (Hellmann et al. 2008). Wildlife surveys should continue on a regular basis to document climate-driven changes in fish and wildlife population numbers, diversity, and distribution. Increased likelihood of drought may reduce water sources and stress or reduce ungulate populations on base. Wildlife watering facilities (guzzlers) are effective at supplementing supplies in arid or drought-stricken regions. Legacy stock points and cattle tanks also may serve as water guzzlers for wildlife, if retaining water.

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 will also increase the chances of algal blooms, further depleting dissolved oxygen content and habitat suitability (Paerl et al. 2011). Efforts to remove invasive aquatic plants and algae from ponds should be considered and shade trees should be planted around water sources to prevent excessive heating of water (Poff et al. 2002).

Increasing temperatures and precipitation favor vectors for diseases such as mosquitoes and ticks (Süss et al. 2008). Minimization of stagnant water in and around the cantonment area will help to reduce mosquito-

related infections. Tick populations in urban settings can be minimized by keeping lawns mowed and by preventing overabundance of hosts such as deer and rodents.

7.2 Outdoor Recreation and Public Access to Natural Resources

Applicability Statement

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

Program Overview/Current Management Practices

The Sikes Act requires military installations to promote public use of outdoor recreational resources when it does not conflict with the installation mission. Outdoor recreational areas, according to AFMAN 32-7003, are classified as:

- Class I – Open Areas. Unrestricted areas on the installation where hunting, fishing, trapping, and outdoor recreation are permitted to all participants, to include the general public.
- Class II – Restricted Areas. Areas designated by the commander where hunting, fishing, trapping, and outdoor recreation are permitted to certain categories of participants, or under special conditions as defined by the commander. These areas may support diverse activities such as hunting, fishing, bird watching, walking, running, cycling, climbing, and horseback riding.
- Class III – Special Interest or Off Limit Areas: Areas with valuable archaeological, ecological, geological, historical, or scenic uses. Includes areas designated by the commander as being off limits to recreational hunting, fishing, trapping, and dispersed outdoor recreation by any person at any time. These are areas where mission security and safety concerns do not allow such use.

7.2.1 Cannon Air Force Base

CAFB has few natural areas favorable to outdoor recreational opportunities. Class I areas do not exist at CAFB. Areas considered Class II are limited to walking paths around the housing areas and cycling on the perimeter road. It is important to note that use of off-road vehicles and mountain bikes is prohibited (AFMAN 32-7003, paragraph 10.3). Prior to allowing use of off-road vehicles or bicycles of any sort, the installation must thoroughly analyze the impact of such use on soils, archaeological sites, wildlife, water quality, and other ecosystem attributes. Class III areas accessible to the public do not exist at CAFB. A golf course that military personnel and their families can use is located on CAFB.

Although activities such as walking, biking, and golfing should be able to continue under the projected climate changes, increases in temperature (up to 5.4 °F hotter) and days over 90 °F (up to 58 such days) may make outdoor recreation less pleasurable or even hazardous in certain scenarios (CEMML 2019). Potential future water usage restrictions may impact golf course quality and watering practices.

7.2.2 Melrose Air Force Range

As an active range, MAFR presents serious safety concerns that prohibit the development of outdoor recreational programs on the installation. A Pronghorn Population Management Hunt Program was established in 2021, which allows for hunting for pronghorn on the installation.

7.3 Conservation Law Enforcement

Applicability Statement

This section applies to all AF installations that maintain an INRMP, as all installations are required to provide a method for enforcement of conservation laws. The installation is required to implement this element.

Program Overview/Current Management Practices

With the lack of multiple hunting or fishing programs or public access, and with the absence of any resident threatened or endangered species, no specialized natural resources law enforcement is currently needed. Staff from the NMDGF are present during pronghorn hunts, which are a part of the Pronghorn Population Management Hunt Program. Natural resources personnel monitor range boundaries during local hunting seasons with the understanding that illegal activities will be reported to the proper authorities for enforcement. This includes the NMDGF for wildlife violations and Security Forces for trespassing violations. Additionally, five personnel are trained as Range Safety Officers and have a continuous presence on the range and will report any illegal activities as necessary.

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

Applicability Statement

This section applies to AF installations that have threatened and endangered species on AF property. This section is applicable to CAFB.

Program Overview/Current Management Practices

T&E species inventories at both CAFB and MAFR are up to date. An on-going monitoring program for listed species and SoC is in place, and surveys have been completed as scheduled. CAFB and MAFR have no current terms and conditions relating to Biological Opinions for T&E or current consultations under the ESA (Section 7). No critical habitat or habitat of concern has been designated on either CAFB or MAFR.

Notably, the southern DPS of the LEPC was designated as Endangered under the ESA by the USFWS in November 2022. There is an existing program to monitor and manage LEPC vegetation communities on MAFR. The existing vegetation community is within the suitable range for LEPC.

BTPD and BUOW annual monitoring is ongoing on both the installation and the range. The trends and assessments from this monitoring are vital to making appropriate management decisions on the range for these species while also minimizing BASH concerns to ensure mission success. Management of the BTPD is further discussed in Section 7.11.

7.4.1 Cannon Air Force Base

Based on the surveys conducted in 2015 to 2016 and 2020 to 2021, no resident threatened or endangered animal species have been documented on CAFB. Three federal SoC (one mammal and two avian) were documented on CAFB. The table below (Table 7-3) describes current primary concerns and the management strategies to alleviate those issues while maintaining mission success.

Table 7-3. CAFB Management of Species of Concern and Their Habitats

Primary Issues or Concerns	Management Strategies
Limited size of suitable habitat for species of concern (SoC)	Manage remaining natural habitat to prevent impacts to the mission while promoting conservation where practical.

SoC bird aircraft strikes	Complete and implement a wildlife hazard management plan to decrease the potential of SoC bird-aircraft strikes.
Maintaining up-to-date presence/absence lists of endangered, threatened, and candidate species, and SoC known to occur on CAFB	Conduct surveys for federal endangered, threatened, candidate and SoC at three- to five-year intervals. Develop management strategies when necessary.

7.4.2 Melrose Air Force Range

There currently are no threatened or endangered animal species that are known to be residents on MAFR; however, one endangered species, the LEPC, was documented on MAFR in 2012 and is still actively managed for. The bald eagle, a state-listed threatened species that is also protected federally by the BGEPA and MBTA, was documented once in 2012 on MAFR. Three SoC (one mammal, two avian) were found during recent T&E surveys, all of which were documented as resident/nesting species. Additionally, five federal BCCs were recorded on MAFR. One species, the golden eagle, has been observed multiple times in the northern portion of MAFR during the fall and winter. However, no nests have been detected and so no specific management plans have been developed for the species.

LEPC population and habitat assessments are ongoing on the range. Point count surveys have been conducted since 2016, resulting in no detections. Additionally, acoustic monitoring devices have been stationed at 10 locations throughout potential LEPC habitat on the MAFR. Two LEPC calls were detected on the range in 2017, but none have been detected since 2012.

A contract to improve LEPC habitat on the range was awarded and from 2020 to 2021, 34,280 acres of mesquite and 15,640 acres of cholla were treated on the range. Controlled burns from 2022 through 2024 will help eliminate dead standing cholla and mesquite stems. Natural resources staff and contractors will conduct hand treatments for small populations of these species that are outside of the treatment area when USAF herbicide training is secured. These treatments are critical to improving the quantity and quality of LEPC habitat on the range.

Rare plant species surveys have not been conducted on either MAFR or CAFB, but MAFR may have habitat for two New Mexico Rare Plane Conservation Strategy species of concern: panhandle spurge (*Euphorbia strictior*) and Warner's dodder (*Cuscuta warneri*). These species do not have federal or state listing status, but they are tracked by Natural Heritage New Mexico, and surveys would supply information about the species in case future listing decisions elevate their status. Surveys should be conducted for state-listed rare plants to help inform future species management.

Some of the primary T&E management concerns and their subsequent management strategies on MAFR are listed in the table below (Table 7-4).

Table 7-4. MAFR Management of T&E Species, Species of Concern, and Their Habitats

Primary Issues	**Management Strategies**
Maintaining breeding and brood-rearing habitat for lesser prairie chicken	Conduct yearly lesser prairie chicken habitat monitoring; use results to manage vegetation communities for lesser prairie chicken.

Potential effects of live ordnance training on lesser prairie chicken	Conduct yearly lek monitoring surveys to determine any population changes.
Maintaining current presence/absence lists of endangered, threatened, and candidate species, and Species of Concern (SoC) on MAFR	Conduct presence/absence and monitoring surveys for federal endangered, threatened, candidate, and SoC known to occur on MAFR at two-year intervals to determine population trends. Obtain funding to implement candidate species management programs when necessary.

7.4.3 Pollinator Conservation

As discussed in Section 2.3.4., all pollinators are afforded a level of protection under the Presidential memorandum, "Creating a Federal Strategy to Promote the Health of Honey Bees and Other Pollinators" (White House 2014). In addition, three protected or candidate pollinators (western bumble bee, monarch butterfly, and rufous hummingbird) have a high potential to occur on the installation have a high likelihood of occurring on the installation. In general, managing for pollinators includes ensuring that they have available food sources (usually nectar and/or pollen from flowering plants) and nesting substrates (which can include open soil, pithy plants, and abandoned rodent nests).

Species of concern may require more targeted conservation actions. Conservation recommendations for monarch butterflies in the DoD Pollinator Conservation Reference Guide (2018) include:

- Assessing monarch habitat conditions to determine priority areas for conservation in consultation with the local USFWS field office, state fish and wildlife agencies and other partners
- Increasing native milkweed and other native flowering plants in monarch breeding areas
- Increasing native flowering plants during the time of migration
- Maintaining open, sunny areas where native flowering plants thrive
- Eliminating or reducing the use of pesticides in areas with monarchs
- Eliminating invasive plants and nonnative tropical milkweed (*A. curassavica*), which is believed to promote the spread of disease in migratory monarchs
- Adjusting management activities (timing of mowing, amount of grazing, timing and size of prescribed fire units) so not to interfere with breeding

A more detailed guide to incorporating monarch conservation into military lands management, including a regional list of milkweed species, can be found in *Monarch Conservation on Department of Defense Lands in the West: Best Management Practices* (Department of Defense Legacy Resource Management Program 2021). 27 SOCES/CEIE plans to establish native milkweeds throughout the installation on low-traffic roadsides and in landscaping areas to support monarch butterflies and increase native plant diversity (see Project 2.4.17). In addition, Section 7.9 discusses how the installation incorporates pollinator conservation when planning prescribed fire activities, and Section 7.11 discusses how pollinator conservation is integrated in the pest management program.

7.4.4 Climate Impacts on Management of Threatened and Endangered Species, Species of Concern, and Habitats

Since multiple SoC on CAFB and MAFR are vulnerable to the projected changes in climate, they should continue to be of high management priority. Management actions needed to protect T&E species and other SoC will be influenced by the speed at which the climate changes, the nature of the climatic changes, and the ability of the species to respond to those changes. Climate adaptation (i.e., making changes to natural or human systems that minimize the impacts or promote the benefits of climate change) will be an important management tool for protecting T&E species from the most severe climate change impacts. However, single-species approaches to climate adaptation run the risk of interrupting ecosystem function and further imperiling other species. DoDI 4715.03 advises installations to instead employ adaptive and ecosystem-based management. As such, many current T&E management activities are appropriate for increasing resilience or facilitating adaptation to climate change. For example, an ecosystem approach that prioritizes habitat maintenance, variability, and connectivity can help support genetic and functional diversity. In turn, genetic and functional diversity can facilitate adaptation and/or help species migrate to favorable habitats.

However, given the uncertainty inherent in managing species under changing environmental conditions, additional analysis and planning is required. Research into actionable science used for biodiversity conservation in changing conditions has demonstrated that historical patterns used for management decisions are likely to be insufficient for future management challenges (Bierbaum et al. 2013). Instead, proactive approaches that anticipate change can help extend the period over which species can adapt to changing climate conditions and avoid catastrophic declines associated with stochastic events that act on an already stressed ecosystem.

Effective approaches to climate adaptation require site-specific climate projections as well as local knowledge of species and their habitats. Adaptation actions can focus on addressing changes as they occur (i.e., reactive strategies) or can seek to avoid impacts of changes (i.e., proactive strategies). In the context of T&E species with limited habitats, it may be prudent to focus on proactive strategies to avoid losses that may hinder species recovery. However, if changes in the environment are already affecting priority species, a reactive approach could still improve long-term species survival. Managers can further refine actions, whether proactive or reactive, by considering how they intend to manage change in the system. Resistance strategies seek to maintain the status quo and prevent change from affecting the species. Resilience strategies support ecosystem function without fundamental change. Realignment strategies focus on understanding that some changes will occur, and support transitioning to a new ecosystem state (Holling 1973; Millar et al. 2007).

Most depictions of the adaptive management cycle include phases for planning, acting and evaluating. Managers should explicitly address T&E species and their specific 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 DoD installations in planning for adaptation (Stein et al. 2019) and can be used to identify and address climate-related threats to SoC and their habitats. Furthermore, scenario planning and scenario-based assessment models have emerged to help decision makers take proactive management actions despite uncertainty (Banuls & Salmeron 2007).

7.5 Water Resource Protection

Applicability Statement

This section applies to AF installations that have water resources. This section **IS** applicable to CAFB.

Program Overview/Current Management Practices

The historical watersheds of CAFB consist primarily of closed drainage systems from the upland areas into the natural playa basins. The playa basins are the primary hydrologic feature of the High Plains region of New Mexico and Texas (Haukos and Smith 1994). The runoff from surrounding uplands aids in playa development through dissolution of calcium carbonate in the subsoil, while also carrying small clay-sized soil particles (less than 0.002 millimeters) into the basins. This eventually creates an almost impermeable soil layer, thereby lengthening how long water stands in the playa before loss by evapotranspiration or infiltration. This interaction of hydrogeologic processes makes playas important for Ogallala Aquifer recharge, wildlife habitat, and sites of diverse plant communities in areas once dominated by shortgrass and midgrass prairies, which in many areas have been replaced by intensive agriculture. These natural water storage characteristics have also led to the widespread use of playas for stormwater storage, irrigation supply, livestock watering, and recreational activities, as exemplified by the playas on CAFB and MAFR.

7.5.1 Cannon Air Force Base

The historical playa watershed system of CAFB has been affected by the construction of roads, flight lines, and industrial and residential buildings. The playa lake basins have all been affected by past excavation or fill activities. Additionally, the playas now receive large quantities of water from channelized drainage systems from the cantonment area and Chavez West housing area (golf course ponds), the flight line (South Playa), and the Munitions Storage area. Although it is impossible to restore the playa watershed systems to conditions prior to human impact, it is important to maintain compliance with discharge regulations, enhance the natural functions of watersheds, and decrease erosion and sedimentation on CAFB. No water quality testing has been completed for stormwater entering playas at CAFB.

7.5.2 Melrose Air Force Range

The watershed systems of MAFR include closed-basin playa watersheds and intermittent drainages. The playa basin watersheds are scattered throughout MAFR in areas with relatively level topography on the eastern portion of the property, and canyon-type topography on the western portion. Intermittent drainages include Cañada del Tule, Sheep Canyon, Chapmans Draw, and several other small, associated draws and arroyos. The Cañada del Tule carries runoff from the southeastern half of MAFR, from the southern boundary, flowing northeastward through the range. The Cañada del Tule ephemeral draw is the longest drainage on MAFR and contains several on-channel earthen impoundments. Sheep Canyon flows from the Mesa (the eastern half of the range) in a northeasterly direction to the impact area. Most of the runoff from the land adjacent to the canyon is captured by one of the several on-channel impoundments. The Mesa drainages include Sheep Canyon, which flows easterly across the Target Area. Most of the ephemeral drainages on MAFR were historically impounded to provide water sources for livestock. No water quality testing has been completed for stormwater entering playas at MAFR. The table below (Table 7-5) discusses the primary water resource protection issues on MAFR and associated management strategies.

Table 7-5. MAFR Water Resource Protection Management

Primary Issues	Management Strategies
Decreased watershed values. Large areas dominated by mesquite and cholla are decreasing ecosystem diversity effectively degrading native shortgrass prairie. This leads to decreased infiltration, and increased sediment transport.	Continue long-term vegetation monitoring through the LCTA surveys to identify areas of concern. When necessary, develop management plans to decrease erosion and sedimentation.

Potential sedimentation deposition at the mouths of Sheep Canyon and Canada del Tule.	Continue control of mesquite and other invasive species.

7.6 Wetland Protection

Applicability Statement

This section applies to AF installations that have existing wetlands on AF property. This section **IS** applicable to CAFB.

Program Overview/Current Management Practices

CAFB and MAFR practice maximum avoidance to minimize impacts to wetlands from training and construction activities. Installation waters have been determined to be non-jurisdictional; however, impacts will be documented and mitigated. Permits and plans are current and updates will be made as needed to existing permits and plans.

7.7 Grounds Maintenance

Applicability Statement

This section applies to AF installations that perform ground maintenance activities that could impact natural resources. This section **IS** applicable to CAFB.

Program Overview/Current Management Practices

Grounds maintenance is conducted on a regular basis at CAFB, using the 2021 Sustainable Landscape Development Plan found in Tab 3. The urban areas, as well as the airfield and safety zones, are maintained with mowers, trimmers, and other standard equipment. On MAFR, tractors with shredders, mowers, and other power equipment are used to maintain fire breaks, roadways, and other used areas. The impact area is "maintained" through constant use of munitions and subsequent fires. Other areas of the range are left as natural habitat (USAF 2016).

CAFB is making efforts to reduce its water usage across the installation as water resources become a prominent issue. One of the steps being taken is to cease watering landscaped and turf areas. Plant and landscaped species that are not on the approved list of landscaped species (Appendix E, Suggested Landscape Plants) will need to be replaced with species on the list. This replacement is necessary to avoid possible safety and natural resources issues when existing species are unable to survive the reduced watering, increasing the likelihood of individual trees falling or dropping large branches. A quick transition from the existing plants maintained by consistent watering to drought-tolerant native species will be critical for the success of wildlife on the installation, the safety of individuals and personnel, and the aesthetic appearance of the installation. Additionally, invasive tree species should be removed when feasible. Facility managers and offices, such as facilities and golf course management, should consult with the NRM to ensure adequate compliance with this installation objective. Additionally, any plant or tree being removed during nesting season should be checked for cavity nesting birds before removal. The table below (Table 7-6) discusses the primary ground maintenance issues on CAFB and associated management strategies.

Table 7-6. CAFB Ground Maintenance Management

Primary Issues	Management Strategies
Converting landscaped and turfed areas from pre-existing, non-native plants that require substantial amounts of water to drought-tolerant, native species.	Work closely with base personnel to ensure pre-existing, non-native plants are being replaced with plants on the suggested landscape plants list.
Reduce risks to personnel, civilians, and wildlife from dying plant species.	Quicky and effectively remove non-native plant species and individuals that appear to be dying or dead.

7.8 Forest Management

Applicability Statement

This section applies to AF installations that have forested lands on AF property. This section **IS NOT** applicable to CAFB.

Program Overview/Current Management Practices

N/A

7.9 Wildland Fire Management

Applicability Statement

This section applies to AF 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 CAFB.

Program Overview/Current Management Practices

CAFB and MAFR completed a Wildland Fire Management Plan (WFMP) in 2022 that can be found in Tab 1. The overall goals of the plan are below:

- The first priority of all fire management activities on USAF lands is the safety of the installation residents, the public, adjacent landowners, and firefighters.
- Provide an acceptable level of wildfire protection for all USAF lands, reducing potential threats to life, property, and natural and cultural resources.
- Reduce wildland fuel loads to within their normal range of variation to minimize risk of catastrophic wildfire on MAFR.
- Provide strategic, logistical, and "boots on the ground" wildland fire support to ensure preparedness.
- Leverage interagency partnerships and technical expertise.
- Train personnel to nationally recognized National Wildfire Coordinating Group standards to prevent injury and loss of life and build response capabilities.
- Collect, analyze, and communicate key wildland fire data for ecological benefits and risk to mission.

Wildland fires are an important consideration, especially on MAFR. CAFB personnel are committed to mitigating the risk of devastating wildfire to USAF and surrounding property. Goals for prescribed fire and fuel treatment that are detailed in the WFMP are below.

- Reduce wildland fuel loads, minimize the risk of catastrophic wildfire, and create zones of defensible space for firefighters utilizing firebreaks for suppression.
- Minimize the potential impacts of smoke to air quality.
- Provide experience and training for USAF firefighters in fuels reduction, fire behavior, and fire weather so that they are better prepared to suppress wildland fires.

The goals for both CAFB and MAFR outlined above will be met through the following objectives:

- Use prescribed fire or other treatments such as mowing and to treat fuels and reinforce firebreaks.
- Monitor fuel conditions such as level of curing and fuel depth to determine the best applicable fuel treatment.
- Use herbicides and/or mechanical treatment to control exotic invasive or nuisance species. (Mowing is currently the primary method for grass control around MAFR.)
- Effectively use all available options for wildland fire management at MAFR, with prescribed fire and mowing as the primary tools for treating wildland fuels.

Currently, prescribed burning and hazardous fuels mitigation is done through a contract in conjunction with the Air Force Fire Emergency Services.

Prescribed fires play a significant role in natural resource management with the ability to quickly shift habitat types and manage invasives. Aerial herbicide applications from 2019 to 2021 were the first step toward controlling invasive native mesquite and cholla infestations and restoring healthy grassland habitat at MAFR. Rotational burning of these sites at three- to five-year intervals will be used to maintain control of invasive shrubs and regenerate degraded grasslands. Fire management is also an important consideration for LEPC, and although burning will improve habitat conditions, no more than 20 to 30% of each management unit should be burned annually, and rotational burning should be no more frequent than every three to five years to allow vegetation recovery. Similarly, fire can be used as a tool for creating and maintaining pollinator habitat, but the amount, frequency, intensity, and timing of burns need to be considered so the management does not reduce or eliminate pollinator populations (Air Force Pest Management Board 2018). Communication and consultation from the installation's NRM and wildland fire personnel is vital to ensure a reduction in fire risk while maintaining successful natural resource management. The table below (Table 7-7) discusses the primary wildland fire management issues on the installation and the respective management strategies for those issues.

Table 7-7. CAFB/MAFR Wildland Fire Management

Primary Issues	Management Strategies
The current WFMP addresses the laws, regulations, responsibilities, and appropriate training and responses for CAFB, and it must be implemented, as well as updated to address changing conditions or mission requirements.	Continue to implement and update the WFMP. Work closely with state and local officials to determine the most advantageous strategies for prescribed fire to enhance habitat and reduce fuel load risks.
Vegetation change as a result of terminating grazing leases.	Continue the LCTA monitoring program to assess the effects of fire and changing vegetation resulting from the removal of grazing on MAFR.

7.9.1 Climate Impacts on Wildland Fire Management

Wildfire activity at CAFB and MAFR is expected to increase in the future due to climate change. Large and intense wildfires in eastern New Mexico are influenced by the availability of dense vegetation, with high vegetation production years generally representing the highest fire hazard. Climate projections suggest minor decreases or roughly static precipitation in December through March. However, they all also indicate large increases in springtime precipitation, with monthly increases of up to 81% and averaging 30% across all projections in the months of April through June. Projected increases in springtime rain coincide with spring green-up and may lead to additional vegetation growth, likely resulting in increased fuel loads and associated fire likelihood and intensity. The fuels produced in the spring would be available to burn for about a year. As a result, the fire hazard is likely to be elevated for months, or possibly a year or more after substantial springtime rains. This could portend a future with multiple-year streaks of high fuel loads and fire danger. A prime example of what a wet year can do to fire potential occurred in 2005, not just at MAFR, but throughout the desert southwest. The 2005 Floyd fire burned in November, more than six months after the heavy spring rains.

Exacerbating the situation is a projected decrease in summer monsoon moisture. Projected increases of minimum, average, and maximum temperature combined with decreases in precipitation will produce a drier, more fire-prone climate.

Climate-driven shifts in vegetation may limit the spread of low intensity fires. Projections indicate a possible shift away from grasslands and toward shrublands, reducing continuous surface fuels and limiting fire-spread. However, such a transition would not preclude high-intensity fires. Shrublands represent higher fuel loads and a greater vertical distribution of fuels, which often encourage higher fire intensity.

Changes in precipitation and temperature may cause a more pronounced fire season. Less projected precipitation and higher temperatures during summer months may cure fuels more consistently, making them more likely to burn. Higher temperatures often preheat and dry fuels, increasing the likelihood of ignition and the intensity and vigor of the fire, and decreasing the likelihood of containment (Gutierrez et al. 2021).

7.10 Agricultural Outleasing

Applicability Statement

This section applies to AF installations that have arable or pastoral lands on AF property. This section **IS NOT** applicable to CAFB.

Program Overview/Current Management Practices

N/A

7.11 Integrated Pest Management Program

Applicability Statement

This section applies to all AF installations that maintain an INRMP, as all installations are required to develop an IPMP. The installation is required to implement this element.

Program Overview/Current Management Practices

The CAFB IPMP, found in Tab 6, guides and informs pest management on the installation with a focus on the control of pest species such as pigeons, mosquitoes, flies, and crawling insects (e.g., cockroaches). These species must be controlled to protect AF property and personnel and, in the case of pigeons, to lower the probability for BASH incidents.

Another problematic species addressed by the pest management group at CAFB is the BTPD. Management of BTPD populations is problematic due to its role as both a pest and as a keystone species. BTPD populations commonly experience population cycles of collapse and rebound due to drought and disease. At one time, there were 17 active populations on MAFR and limited numbers on CAFB. Today, after the impacts of a sylvatic plague outbreak, a much smaller number of prairie dogs is found on MAFR. However, the populations on both MAFR and CAFB have increased in the past five years, free from disease outbreak. More specifically, the population on CAFB has increased significantly, with sizeable populations throughout areas near the airfield. Thus, moderate to large populations are essential to buffer the BTPD against periodic drought and disease events. However, this relationship between raptors, BUOWs, and BTPDs, and their population dynamics creates a significant BASH concern on the installation. Controlling this species is complicated as it is identified as a SGCN in the State Wildlife Action Plan for New Mexico (NMDGF 2016).

Invasive species, particularly plants, are under the purview of the integrated pest management program; however, invasive plant species are also of particular interest to natural resources personnel due to erosion and degradation of important natural habitats resulting from a transition to a monoculture habitat with a reduction in root mass. Invasive species recognized as noxious (species with the potential to negatively impact the state's environment or economy and targeted for control or eradication) in New Mexico are classified by the Department of Agriculture into three lists. The Noxious Weed Management Act of 1998 defines the lists as follows: (1) Class A species are not currently present and preventing infestation is a high priority; (2) Class B species are limited to portions of the state and should be contained to stop further spread; and (3) Class C species are widespread and control should be determined at the local level based on feasibility and level of infestation. Invasive plant species surveys should include these state-listed noxious species, and any detections should be targeted for treatments. Invasive species that are problematic on CAFB and MAFR include additional species not listed as noxious. These include the native honey mesquite and cholla cactus, as well as weeping lovegrass and King Ranch bluestem (*Bothriochloa ischaemum* var. *songarica*).

7.11.1 Cannon Air Force Base

CAFB's current Pest Management Program offers a self-help program that provides roach bait stations, mouse traps, fly swatters, ant bait stations, rodent glue boards, and Round-Up herbicide. The IPMP provides strategies to address ten categories of pests:

- *Vertebrate Pests*. Pests in this category may include mice, prairie dogs, skunks, coyotes, pigeons, snakes, and stray and feral cats. Due to the wide variety and beneficial ecological roles of these species groups, control methods and procedures vary.
- *Disease Vectors*. Certain insects transmit diseases to people and animals. The plan addresses flies, fleas, and mosquitoes (carrying West Nile virus). Fly strips and fly swatters are issued by the self-help store, and larvicides are used to control mosquito larva.
- *General Household and Nuisance Pests*. These pests include cockroaches, ants, spiders, wasps, hornets, bees, gophers, and mice. Building occupants are encouraged to use good sanitation practices to minimize pests, and the Pest Management Section addresses infestations beyond the capabilities of the occupants. Non-chemical methods are generally used to control these pests.
- *Structural Pests*. Annual building inspections have found no termites on the base to date. Preventive methods such as pre-construction treatment and use of pre-treated wood are encouraged.
- *Weed and Vegetation Control*. Priority areas for weed control include the flight line and fence lines. Nonselective herbicides such as Round-Up are used along with grading, trimming, and mowing.
- *Stored-Products Pests*. Currently, there are no stored-products pests of concern on CAFB.
- *Ornamental Plants and Turf Pests*. Currently, CAFB has one significant ornamental pest, the fall webworm. These pests have caused unsightly damage to poplar trees, as well as raised concern for safety of personnel and property. This pest favors several tree species on the installation. Facility managers are responsible for tackling the pest in the early stages; however, pest management will apply pesticides if major infestations have occurred.
- *Pests of Natural Resources*. Currently, the pest management plan only recognizes one significant natural resource pest, the fall webworm described in the ornamental plants and turf category.
- *Golf Course Pests*. Many golf course pests, such as skunks, ground squirrels, fall webworms, and roaches, have already been discussed in other categories. The golf course is responsible for managing all insect pests and for requesting assistance with vertebrate pests from 27 SOCES Pest Management.
- *Miscellaneous Pests*. These include ticks, beetles, gnats, pill bugs, and worms. Non-chemical methods are encouraged for pests in this category. All pests in this category are handled and controlled by facility managers and housing occupants.

One current concern on CAFB is the presence of prairie dogs near the flight line area. This is potentially significant because they attract birds of prey such as hawks, falcons, and eagles, which increases the potential for BASH incidents (Tab 2 - Bird/Wildlife Aircraft Strike Hazard (BASH) Plan). A prairie dog control plan was implemented in 2005; however, control efforts may be improved by routine updates to the plan. Routine updates will reflect the most recent installation population estimates, identify key areas where prairie dog towns pose mission hazards and require control, and where towns pose no mission hazard and are allowed to persist. Based on survey data from 2016 to 2021, BTPD populations are increasing. New or intensified control methods may be needed if population number or town size increases continue to occur in hazard areas such as the flight line.

Another associated concern is the presence of BUOWs along the flight line. BUOWs use abandoned prairie dog burrows for nesting. The BUOW is protected by both the MBTA and by New Mexico statute 17-2-14

(NMSA 1978). The MBTA provides for a year-round closed season for non-game birds and prohibits the taking of migratory birds, nests, and eggs, except as permitted by the USFWS.

BUOWs generally maintain a series of burrows, forming a complex, one of which is the nest burrow used for incubation. Other holes are used as auxiliary burrows. USFWS guidance regarding protection of BUOWs is as follows. Complexes can be identified by first locating sentry owls adjacent to the entrances of nest burrows. Nest burrows are indicated by the presence of duff or divots. Once the nest burrows are identified and marked, adult owls can be flushed to their auxiliary burrows. Using this method, the minimum number of burrows used by a breeding pair in their home range can be located. All burrows comprising the complex should be marked and protected from destruction. The CAFB Natural Resources program has followed and will continue to follow USFWS guidance for protection of BUOWs.

CAFB is also taking active steps to reduce the use of chemical pesticides and herbicides to manage pest problems, especially in the context of BTPDs and BUOWs. Non-chemical solutions (predatory insects, owl decoys, water drawdowns, elimination of non- jurisdictional "puddles", etc.) to pest management problems are considered and used whenever possible to avoid exposure of humans and wildlife to poisonous or toxic chemicals. CAFB will prioritize the use of non-chemical (poison) solutions to reduce BTPD populations in hazardous areas such as the flightline. Non-chemical solutions may include adverse habitat manipulation, such as growing native shrubs or erecting drift fencing which obstruct their line-of-sight. These manipulations should deter BTPDs from the area since visual obstructions raise their vulnerability to predators. CAFB will coordinate with USFWS and NMDGF to establish mutually acceptable non-chemical solutions to reducing BTPD populations in hazardous areas. The table below (Table 7-8) discusses the primary integrated pest management issues on CAFB and associated management strategies.

Until effective non-chemical BTPD management strategies have been realized, it is likely that BTPD poisoning may continue. To mitigate the potential of accidental BUOW poisoning, CAFB will conduct management strategies included in Table 7-8 below.

Table 7-8. CAFB Integrated Pest Management

Primary Issues	Management Strategies
Prairie dogs may provide food sources to raptors and their towns attract BUOWs that use unoccupied holes for shelter and nesting, causing increased risk of bird/aircraft strike incidents.	Assess the populations of prairie dogs and BUOWs on CAFB. Implement the prairie dog control plan directed at key critical areas. Conduct a thorough wildlife hazard assessment to determine where the highest BUOW/aircraft strike risks occur and if necessary, develop mitigation measures. Use USFWS guidance to protect BUOWs prior to pest management treatment of prairie dogs in the vicinity of the flight line.
Accidental poisoning of BUOWs.	Pest Management and Wing Safety will coordinate with the 27 SOCES Natural Resources Section to ensure that the burrowing owl is not present in the area selected to be treated. Fumigating burrows with Fumitoxin pellets will be done in strict accordance with label requirements and only when burrows have been monitored to ensure burrowing owls have not inhabited abandoned sites. Each burrow will be monitored to determine the existence of such birds before treatment.
Invasive species exist on CAFB.	Conduct a comprehensive invasive species survey on CAFB. Develop and implement an invasive species control plan.

7.11.2 Melrose Air Force Range

The primary pest management concerns on MAFR are invasive plant species, including mesquite, cholla, weeping lovegrass, and King Ranch bluestem. The invasive grass species are rapidly spreading and becoming a more prominent issue. An invasive species survey and control plan for MAFR is critical to successful natural resource management and mission success. The primary issues and their respective management strategies can be found in the table below (Table 7-9).

Invasive plant species control efforts include aerial treatments for mesquite and cholla beginning in 2019 on MAFR. Mesquite treatments applied in 2019 resulted in greater than 70% kill rate. Approximately 16,640 acres of mesquite were treated aerially on MAFR with the herbicide Sendero in 2020. During the summer of 2020, 1,000 acres of mesquite were treated with Sendero and 15,640 acres of cholla were treated with Surmount. The 2021 treatment completed the invasive species contract for the aerial treatment of 49,920 acres of mesquite (34,280 acres) and cholla (15,640 acres) on MAFR. These herbicide treatments

will be followed with prescribed burns planned for implementation in 2022 and 2023 to remove the dead standing mesquite and retard regrowth of stump-sprouts. In addition, hand treatments of small mesquite populations across MAFR should continue indefinitely. Herbicide Training for natural resource staff would allow for hand treatments to be completed in a timely manner and help prevent re-establishment of treated infestations.

One current concern on MAFR is the presence of prairie dogs near the flight line area near the Bobcat Landing Zone. This is potentially significant because they attract birds of prey such as hawks, falcons, and eagles, which increases the potential for BASH incidents. Additionally, burrowing activity may damage infrastructure on or near the Landing Zone.

Table 7-9. MAFR Integrated Pest Management

Primary Issues	Management Strategies
Controlling mesquite and cholla on MAFR.	Continue to apply treatments to mesquite and cholla with follow-up prescribed fires. Combat smaller areas of the invasives with appropriately licensed personnel. Continuously monitor population trends.
Increasing prevalence of invasive grass species.	Conduct a comprehensive invasive species survey on MAFR. Develop and implement an invasive species control plan that includes these species.

7.11.3 Pollinators and Pest Management

Pesticides used to control unwanted species can have negative impacts on non-target organisms, including pollinators. A memorandum issued by the Office of the Under Secretary of Defense to the Assistant Secretaries on September 5, 2014 directed the Assistant Secretaries to use current best management practices to protect pollinators and their habitats, including minimizing the use of pesticides in sensitive habitats to the extent possible. Furthermore, AFI 1053, *Integrated Pest Management Program*, requires that the IPMP implements Integrated Pest Management (IPM) strategies to reduce pollution and other risk factors from pest control. IPM is a science-based approach to pest management that combines physical, biological, cultural, and chemical tools in a way that improves pest control while minimizing impacts on beneficial species and reducing costs (Air Force Pest Management Board 2018). Implementing IPM helps maintain a balanced ecosystem that supports pollinators and other beneficial insects.

In accordance with AFMAN 32-7003, natural resource and pest management personnel should coordinate to ensure that the INRMP and IPMP are mutually supportive. These documents must also be coordinated with USFWS and NMDGF (AFMAN 32-7003). As described in Project 3.2.4 of the Management Goals, Objectives, and Projects (Section 8.0), the natural resources management team at Cannon will review the installation IPMP and ensure that it includes the appropriate considerations for non-target organisms. The DoD Pollinator Conservation Reference Guide recommends a two-tiered approach that first eliminates the use of pesticides when possible, then targets the use of pesticides to the specific pest problem when pesticides are necessary to achieve management goals. When pesticides must be used, impacts on pollinators can be reduced through the selection of an appropriate pesticide, formulation, method and timing of application, and by establishing buffers between applications and pollinator habitats.

7.12 Bird/Wildlife Aircraft Strike Hazard (BASH)

Applicability Statement

This section applies to AF installations that maintain a BASH program to prevent and reduce wildlife related hazards to aircraft operations. This section **IS** applicable to CAFB.

Program Overview/Current Management Practices

The existing BASH plan has been revised to address the new AFSOC mission and is located in Tab 2. The *AFSOC Assets Beddown at Cannon AFB, New Mexico EIS* (AFSOC 2007) states that the number of aircraft to be transferred to CAFB is estimated to be 108. As outlined in the EIS, the 27 FW was deactivated and the F-16 aircraft were relocated; however, the Air National Guard F-16s, transient active-duty F-16s, and other aircraft will continue to use MAFR for training. An annual estimate of 200 F-16 airfield operations (e.g., landing or takeoff) at CAFB are projected to continue in support of F-16 training after an AFSOC beddown. New aircraft potentially using and/or transferring to CAFB include AC-130 Gunships, MC-130H Combat Talon II, MC-130P Combat Shadow, MC-130W Combat Knife, C-130E Hercules, C-47 Skytrain, UH-1 Huey helicopters, CV-22 Osprey, MQ-1 Predator, and other non-standard aircraft. Annual airfield operations, if transfers are made, will go from the current 48,348 operations to 55,696. Although the number of operations will not significantly increase, many operations will be flown at low altitudes or during nighttime (10:00 p.m. to 7:00 a.m.) hours. Most bird strikes (75%) occur below 500 feet (FAA 2009) and avoidance is more difficult at night when birds cannot be seen (IBSC 2005).

Currently, CAFB has a BASH program to determine the wildlife hazards present on CAFB and MAFR and how to mitigate them. Unfortunately, historical strike data is lacking for the current mission, and as a result, good data is not available to develop sound management and mitigation practices.

7.12.1 Cannon Air Force Base

Bird strikes at CAFB may be more probable than at MAFR due to aircraft take-off and landings. In addition, urban pest species, such as pigeons, doves, and blackbirds, which flock in high numbers and are susceptible to collisions, are found throughout the airfield and surrounding area. Raptors are also present at CAFB, often over the runway or approach/departure zones hunting for prey. The prairie dog population discussed in Section 7.11 is a major attractant for these birds. Additionally, the playas on the installation are a significant source of waterfowl activity. Some actions, such as removing the trees surrounding the playas, may reduce BASH risk as the habitat becomes less attractive for some species. The table below (Table 7-10) discusses the primary BASH issues on CAFB and associated management strategies.

Table 7-10. CAFB Bird/Wildlife Aircraft Strike Hazard Management

Primary Issues	Management Strategies
Bird-aircraft strikes have been documented on aircraft involved in the AFSOC mission at CAFB. A new wildlife hazard management plan is needed to address and manage changes in aircraft types and flight levels associated with the new AFSOC mission.	Develop a wildlife hazard management plan for CAFB.
A large BTPD population within the airfield has the potential to attract foraging hawks and vultures to the airfield, resulting in a potential increase in bird aircraft strike hazard.	Evaluate current wildlife deterrent measures in use and implement new strategies where possible.
BTPD have altered airfield habitats to benefit and potentially increase the population of ground-foraging birds (killdeer, mourning doves, horned larks).	Improve bird strike reporting and data maintenance.
BTPD burrows attract BUOW, creating another potential hazard for aircraft.	Conduct a thorough wildlife hazard assessment to determine where the highest risks occur and develop mitigation measures. BTPD control and removal should focus near runways and other critical areas.

7.12.2 Melrose Air Force Range

MAFR is much more challenging in terms of wildlife hazard management than CAFB. Not only is the area much larger but wildlife deterrent techniques such as cracker shells and air cannons cannot be used, due to safety restrictions within the impact area. In addition, bird strikes that may occur in the area are at an altitude preventing effective use of deterrent devices. The Avian Hazard Advisory System or specifically dedicated avian radar devices may be the only viable option for bird detection and avoidance over the range. The table below (Table 7-11) discusses the primary BASH issues on MAFR and associated management strategies.

Table 7-11. MAFR Bird/Wildlife Aircraft Strike Hazard Management

Primary Issues	Management Strategies
Bird aircraft strikes have been documented on aircraft involved in the AFSOC mission at CAFB. A new wildlife hazard management plan is needed to address and manage changes in aircraft types and flight levels associated with the new AFSOC mission.	Conduct a thorough wildlife hazard assessment to determine where the highest risks occur and develop necessary mitigation measures.
Detecting and controlling wildlife at MAFR is difficult due to size and safety limitations.	Evaluate current wildlife deterrent measures in use and implement new strategies where possible, including use of avian radar systems or other remote sensing technologies.

7.13 Coastal Zone and Marine Resources Management

Applicability Statement

This section applies to AF installations that are located along coasts and/or within coastal management zones. This section **IS NOT** applicable to CAFB.

Program Overview/Current Management Practices

N/A

7.14 Cultural Resources Protection

Applicability Statement

This section applies to AF installations that have cultural resources that may be affected by natural resource management activities. This section **IS** applicable to CAFB.

Program Overview/Current Management Practices

There are four eras of human activity in the vicinity of CAFB: Paleo-Indian (ca. 10,500 to 5,500 BC); Archaic (5,500 BC to AD 200); Ceramic (200 AD to 1800 AD); and Historic (1800 to present; USAF 1996d).

The Paleo-Indian Era is characterized by tool assembly and large, frequently fluted lance points associated with a hunting culture dependent on Pleistocene mammals. Blackwater Draw, located only a few miles south of the installation, is a significant site for the Paleo-Indian Era (USAF 1996d). Relics of the Archaic Period indicate prehistoric groups that practiced more extensive use of resources. Archaic people developed more diverse tools and smaller projectile points (USAF 1996d). The Ceramic Era is distinguished by the occurrence of brownware pottery, small projectile points, and a more stationary lifestyle with limited horticulture. The land surrounding MAFR is within the eastern edge of Puebloan Culture in New Mexico (USAF 1996). The Historic Era introduced manufactured goods and domestic animals. A variety of cultures were active in the area, including Querecho, Comanche, Kiowa, Lipan Apache, Spanish, Mexican, and Anglo- American. Intensive settlement by European-based cultures did not begin until the late 19th century (USAF 1996).

Surveys for cultural resources have been conducted at CAFB and MAFR since 1981. Much of CAFB is developed and extensively disturbed. A basic cultural resource survey has been completed for MAFR. Some 238 sites were identified, primarily lithic scatters and old homestead ranches. About half of these sites are not significant. The remainder are either eligible for National Register of Historic Places (NRHP) listing or require further study (USAF 1996).

Several buildings at CAFB are more than 50 years old. Most of these facilities were built during or immediately following World War II. One is considered potentially eligible for the NRHP. A number of buildings from this period have been demolished and replaced with new facilities following consultation with the New Mexico State Historic Preservation Officer. As older buildings become potentially eligible for the NRHP, the installation will continue to consider their significance, consult with the New Mexico State Historic Preservation Officer, and take actions to preserve any facilities determined to be exemplary.

The Natural Resources programs have no known adverse effects on identified Cultural Resources. Prescribed burns for vegetation control and fuels reduction are accomplished under the wildland fire program. These areas are evaluated for the presence of known cultural resources prior to burning. Mechanical means of fuel reduction (e.g., shredding) are also used and preferred to burning to prevent any adverse effects to potential unidentified cultural resources. Mechanical means of plant removal (e.g., grubbing) are used for invasive species control, with project areas first evaluated to identify archaeological sites. Cropland areas have the biggest disturbance factor, but were previously evaluated for the presence of cultural resources with none identified. In the event that future mission changes impact the Natural

Resources program, the changes will be evaluated for effects on cultural resources and mitigated appropriately to provide minimal mission impact while also protecting the cultural resources.

The ICRMP is meant to protect and preserve known cultural resources; this plan can be found in Tab 4. Implementation of natural resources program activities are monitored to ensure protection of existing and newly discovered archaeological resources and historic sites. The ICRMP should be consulted prior to implementation of mission or natural resources management activities.

7.15 Public Outreach

Applicability Statement

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

Program Overview/Current Management Practices

Public outreach events are conducted by members of CAFB's Asset Management Flight. These events primarily occur in association with the installation's Arbor Day/Earth Day celebration, and typically involve educational activities at local schools and libraries; tours of the wastewater treatment plant; and information booths on subjects such as recycling, responsible energy use, and local wildlife. The Environmental Element procures promotional items to give out to the public such as reusable shopping bags, coloring books, and t-shirts promoting environmental awareness. Trees are planted for Arbor Day and for promotion of Earth Day. Natural resources personnel deal directly with local farmers and ranchers to develop leasing contracts, establish stocking rates, and negotiate terms of each contract.

7.16 Climate Change Vulnerabilities

Vulnerability to climate change generally refers to the extent to which a species, habitat, ecosystem, place, or project is susceptible to harm from climate change impacts (Stein et al. 2014). By this definition, species and systems that are more vulnerable will experience greater harm, while less vulnerable species and systems will be less affected or even benefit from climate change. Based on installation-specific climate change projections (CEMML 2019), CAFB and MAFR may be vulnerable to the following changes:

- Significant increases in average annual temperature, ranging from 2.3–5.4 °F above the historical baseline;
- Significant increases in days over 90 °F, ranging up to 58 additional days;
- Possible shifts in vegetation species diversity and seasonal distributions due to changes in temperature, precipitation, and disturbance regimes (e.g., fire, flood, drought);
- Increased frequency and intensity of wildland fire;
- Increased regulatory burden due to habitat loss for T&E species or SoC;
- Increases in temperature and wind velocity leading to unsafe environmental conditions for the launch of current and planned weapons and equipment, resulting in increased maintenance requirements, requirements for new equipment, or decreased launch capacity (DoD 2021);
- Increased drought potential (Glick et al. 2011);
- Potential loss of future training areas that may be needed in light of a changing geopolitical landscape and base realignment.

CAFB and MAFR's mission as a year-round U.S. Special Operations Command training area requires mission-critical infrastructure and a diverse assemblage of vegetation communities to provide varied and realistic training opportunities. The primary threat to the military mission due to climate change is the

potential for shifts in vegetation communities at MAFR due to changes in temperature, precipitation, and wildfire frequency and intensity. Shifting natural communities would result in the loss of training diversity and realism. Additionally, such shifts may displace or harm protected species, leading to an increased regulatory environment.

An increase in the number or severity of wildfires could have major effects on the military mission, such as damaging equipment or infrastructure, along with preventing personnel access. Smoke from wildfires may interfere with training operations such as the launch of aircraft, use of the MAFR, or other flight operations.

Significant increases in average annual temperature and extreme temperatures may have negative effects on operations at CAFB and MAFR. Increases in temperature lead to high cooling and maintenance costs, in addition to creating a greater energy and air pollution burden. They also may lead to decreased soldier safety during mission operations due to lower morale, heat stroke, or exhaustion.

In addition to these direct effects, climate change has the potential to disrupt the acquisition and transportation of materials required for the maintenance, construction, and storage of the equipment required for these systems (DoD 2021).

7.17 Geographic Information Systems (GIS)

Applicability Statement

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

Program Overview/Current Management Practices

GIS is a computer-based system designed to capture, store, manipulate, analyze, and display geo-referenced map data on a computer. GIS is a multi-use tool that supports the INRMP, IDP, Comprehensive Range Plan, ICRMP, BASH plan, project site selection, and other decision-making actions. CEMML provides AF-wide GIS support for natural resource management. Current layers include buildings, roads, utilities, water bodies, airfield pavements, land use, vegetation, wetlands, and prairie dog towns for both CAFB and MAFR. The vegetation and prairie dog layers constantly change so consistent updates are needed to reflect these changes.

Primary Issues

- GIS provides for cost effective monitoring of ecosystem changes and enhances management capabilities, but has not been fully implemented at the base.
- Vegetation layers have not been created for CAFB and those developed for MAFR were updated in 2018-2019.

8.0 MANAGEMENT GOALS AND OBJECTIVES

The installation establishes long-term, expansive goals and supporting objectives to manage and protect natural resources while supporting the military mission. Goals express a vision for a desired condition for the installation's natural resources and are the primary focal points for INRMP implementation. Objectives indicate a management initiative or strategy for specific long or medium range outcomes and are supported by projects. Projects are specific actions that can be accomplished within a single year. Also, in cases where off-installation land uses may jeopardize AF missions, this section may list specific goals and objectives aimed at eliminating, reducing, or mitigating the effects of encroachment on military missions. These natural resources management goals have been formulated by INRMP preparers from an assessment of the natural resources, their current condition, mission requirements, and management issues previously identified. Below are the integrated goals for the entire natural resources program.

The installation goals and objectives are displayed in the "Installation Supplement" section below in a format that facilitates an integrated approach to natural resource management. By using this approach, measurable objectives can be used to assess the attainment of goals. Individual work tasks support INRMP objectives. The projects are key elements of the annual work plans and are programmed into the conservation budget, as applicable based on available funding.

Installation Supplement – Management Goals and Objectives

GOAL 1 MAINTAIN A PROACTIVE AND WELL-TRAINED NR PROGRAM TO SUPPORT THE RAPIDLY CHANGING MILITARY MISSION AND INTEGRATE EFFECTIVE NR MANAGEMENT WITH TRAINING RANGE SUSTAINMENT.

Objective 1.1 ***Support military mission objectives through a proactive and responsive natural resources analysis and consultation process.***

Project 1.1.1 Annually review 100% of submitted Air Force Form 813s and NEPA documents for natural resources concerns, attend meetings/site visits, and provide comments to EIAP.

Project 1.1.2 Ensure effective collaboration with regulatory agencies through timely completion of annual INRMP reviews and five-year updates.

Objective 1.2 ***Whenever possible, coordinate with partners to maintain or expand military training options and leverage expertise for NR management.***

Project 1.2.1 Evaluate the lands surrounding MAFR for their potential to contribute to habitat integrity and natural resources sustainment as well as meet military mission expansion goals, and work to develop partnerships that could expand military training opportunities.

Objective 1.3 ***Maintain established relationships with stakeholders and ensure regulatory compliance.***

Project 1.3.1 Establish or maintain USFWS and NMDGF contacts and coordinate with these agencies annually to ensure strong working relationships, regulatory compliance, and to promote a stable regulatory environment.

Project 1.3.2 Annually review the USFWS and NMDGF lists of Species of Greatest Conservation Need, SOC, proposed species, and T&E species. Schedule survey needs for newly added species relevant to

the installation that may reasonably fall under protected status in the future.

Project 1.3.3 If federally listed T&E species are found on the installation, or an occurring species is upgraded to T&E status, engage in ESA Section 7(a)(2) consultations with the USFWS for recovery of T&E species on CAFB and MAFR.

Project 1.3.4 Where appropriate, prepare annual reports summarizing the findings of surveys with comparisons year-over-year to determine trends and fluctuations of populations as well as recommendations for management. Provide to USFWS and NMDGF.

Project 1.3.5 Ensure infrastructure and land development plans on the installation consider special status species and their associated habitats by maintaining communication with project planning personnel.

Project 1.3.6 Regularly update and develop the INRMP to reflect newly occurring species and species status updates, as needed.

Objective 1.4 ***Annually review GeoBase and INRMP component plans and evaluate the need for updates with current natural resources information to support management.***

Project 1.4.1 Conduct surveys, when necessary, to update natural resources, GIS coverage. .

Project 1.4.2 Update the Wildland Fire Management Plan every five years or as needed to compensate for mission changes.

Project 1.4.3 Update the Weed Management Plan for CAFB and the Invasive Species Management Plan for MAFR every five years or as needed to adapt management and reprioritize control targets.

Project 1.4.4 Partner with Grounds Maintenance to enhance landscaping for natural resources and maintenance benefit, such as increasing native plants, providing pollinator habitat, and developing low-water, low-maintenance landscaping options, and update the 2021 Sustainable Landscape Development Plan accordingly.

Objective 1.5 ***Ensure mission success by supporting a well-trained NR staff.***

Project 1.5.1 Secure USAF Herbicide Training for three staff members by 2023 to facilitate small-scale treatment of invasive plant infestations.

Project 1.5.2 Adapt existing training on best management practices for protecting pollinators and their habitat to the local conditions and available resources, and provide to NR and IPM staff annually.

GOAL 2 MANAGE NATIVE WILDLIFE AND PLANT SPECIES USING AN ECOSYSTEM-MANAGEMENT APPROACH WHILE SUPPORTING FLIGHT AND GROUND-BASED TRAINING AND ENSURING MISSION SUCCESS.

Objective 2.1 ***Monitor and manage for LEPC habitat and populations on the MAFR while supporting range operations.***

Project 2.1.1 Conduct population and habitat assessments and monitoring for the LEPC by September of each year.

Project 2.1.2 Conduct annual LEPC habitat evaluations and monitoring to aid in managing vegetation communities for LEPC and to update the LEPC Management Plan.

Project 2.1.3 Using the LEPC Management Plan, expand the amount of LEPC preferred habitat (mixed grassland) acreage on MAFR.

Project 2.1.4 If surveys detect LEPC, conduct a population assessment in coordination with USFWS and NMDGF to aid in management decisions.

Project 2.1.5 Prepare annual reports summarizing the data collected and make recommendations for species management.

Objective 2.2 ***Monitor and maintain the current BUOW populations to ensure regulatory compliance.***

Project 2.2.1 Conduct prairie dog and BUOW population assessments for CAFB and MAFR with an annual report due in September AFBs Prairie Dog Management Plan.

Project 2.2.2 Coordinate with USFWS and NMDGF regarding assessments and plan updates.

Project 2.2.3 Monitor the use of BTPD tunnel complexes for nesting to monitor population trends and to monitor the risk for aircraft strikes.

Project 2.2.4 If BUOW presence impedes mission safety due to vicinity to aircraft, to the point possible, coordinate with the USFWS and NMDGF to translocate individuals to regions of suitable habitat.

Objective 2.3 ***Monitor and manage the local BTPD population.***

Project 2.3.1 Annually survey and monitor the local BTPD populations including the size and locations of BTPD towns.

Project 2.3.2 In the event of a significant population decrease, test BTPD populations for sylvatic plague to shift management decisions if positive.

Project 2.3.3 Update the Prairie Dog Control Plan for CAFB and MAFR based on the results of population assessments.

Project 2.3.4 Promote BTPD population growth and town expansion in the MAFR, but enact control measures if expanding populations threaten range infrastructure or personnel safety.

Project 2.3.5 Coordinate with USFWS and NMDGF to establish mutually acceptable non-chemical solutions to reduce BTPD populations in hazardous areas.

Objective 2.4 ***Manage and monitor the local native wildlife and plant populations to inform management decisions.***

Project 2.4.1 Conduct biennial status species surveys on MAFR and every five years on CAFB.

Project 2.4.2 Prepare a final report summarizing the data collected from surveys and make recommendations for future management.

Project 2.4.3	Review all previous surveys to identify data gaps that warrant more survey work, such as non-detected species that have likelihood to occur on base.
Project 2.4.4	Conduct a survey of MAFR and CAFB for New Mexico rare plant species, especially panhandle spurge and Warner's dodder, and develop management strategies as needed.
Project 2.4.5	Conduct breeding bird surveys on established routes in June and July of each fiscal year.
Project 2.4.6	Conduct migratory bird surveys on established routes in mid-April through May and October of each fiscal year.
Project 2.4.7	Conduct bald and golden eagle surveys to document presence, breeding, and population trends on installation.
Project 2.4.8	Coordinate with the USFWS migratory bird office to determine the feasibility and utility of conducting wintering grassland bird surveys.
Project 2.4.9	Conduct wintering grassland bird surveys if determined useful from Project 2.4.7.
Project 2.4.10	Prepare annual reports summarizing the findings of the surveys with comparisons year over year to determine trends and fluctuations of bird populations as well as recommendations for management.
Project 2.4.11	Periodically, on a three-to-five year time interval, conduct surveys for waterfowl, shorebirds, amphibians, reptiles, and mammals in playa habitat to monitor local wildlife populations and ensure adequate management.
Project 2.4.12	Enter all applicable avian data collected from surveys into the Avian Knowledge Network (AKN).
Project 2.4.13	Within two years, conduct a utility risk assessment on both properties.
Project 2.4.14	Maintain multiple wildlife water tanks (guzzlers) on MAFR to support local wildlife.
Project 2.4.15	Survey CAFB and MAFR for bat species using acoustic monitoring devices to establish the presence of bat species and inform management decisions. If a protected species is detected, perform targeted surveys and develop a management plan for that species.
Project 2.4.16	Coordinate with the USFWS New Mexico to identify conservation measures and adaptive management practices if a canyon bat (*Parastrellus hesperus*) or tricolored bat (*Perimyotis subflavus*) if detected during acoustic surveys.
Project 2.4.17	Establish native milkweeds throughout the installation on low-traffic roadsides and in landscaping areas to support monarch butterflies and increase native plant diversity.
Project 2.4.18	Coordinate with the USFWS New Mexico to design and implement survey of existing pollinator habitat and key pollinator species present on CAFB and MAFR.

Objective 2.5 ***Reduce the risk of wildlife aircraft strike hazards on CAFB to ensure personnel safety and mission success.***

Project 2.5.1 Annually reassess and update the BASH plan to take into consideration the development and expansion of MAFR, especially any development that would provide a source of water for wildlife such as waterfowl.

Project 2.5.2 Assist with the implementation of an updated BASH plan.

Project 2.5.3 Conduct removal outside of the migratory bird nesting period of trees found in playas on CAFB, to reduce the number of species that are drawn to the habitat.

Project 2.5.4 Develop a wildlife hazard management plan that mitigates wildlife hazards to the maximum extent.

Project 2.5.5 Increase staffing to include a BASH Program Manager.

Objective 2.6 ***Advise and monitor the removal and replacement of non-native landscape plant species on CAFB.***

Project 2.6.1 Conduct and map a tree and shrub survey on CAFB.

Project 2.6.2 Replace non-native landscape plant species on the installation with drought-resistant suggested landscape plants.

GOAL 3 PRESERVE INTACT LANDSCAPES, VEGETATION, AND WETLANDS AT CAFB AND MAFR TO SUSTAIN NATURAL RESOURCES AND SUPPORT FLIGHT- AND GROUND-BASED TRAINING UNDER A CHANGING CLIMATE.

Objective 3.1 ***Optimize the wildland fire management program by using prescribed burning and monitoring to reduce the potential for wildfires to escape MAFR, benefit listed and native species habitat, and sustain the military mission.***

Project 3.1.1 Continue operations as identified in the 2014 Wildland Fire Management Plan.

Project 3.1.2 Establish a fire ecology program within 27 SOCES.

Project 3.1.3 Conduct surveys and use LCTA information to determine fuel loads throughout MAFR. Data will be analyzed for fire hazard vulnerability determination.

Project 3.1.4 Continue the established LCTA monitoring program for assessing the effect of fire on MAFR.

Project 3.1.5 Conduct prescribed burns during the dormant season 2021/2022 on the areas treated for mesquite in 2019 and during the dormant season 2023/2024 on the areas treated for mesquite in 2021 to remove dead standing mesquite.

Project 3.1.6 Continue prescribed burns on approximately 50-hectare parcels in mesquite and cholla infestations on a five-year rotation, considering the benefits of heterogeneous grassland habitat and desirable fire return intervals to pollinator and grassland bird species habitat.

Project 3.1.7 Develop a decision-making framework for determining the conditions

under which munitions-ignited fires can be managed for resource improvement or instead should be extinguished to prevent resource or infrastructure damage. Update the WFMP accordingly.

Objective 3.2 ***Develop and implement invasive species control plans and treat and monitor known invasive species infestations on MAFR and CAFB using an adaptive management approach.***

Project 3.2.1 Inventory the invasive and noxious plants present on MAFR and CAFB.

Project 3.2.2 Using data acquired from the inventory to develop a Weed Management Plan for CAFB and an Invasive Species Management Plan for MAFR. Plans should provide metrics for evaluation of success.

Project 3.2.3 Implement the most effective management strategies to the maximum extent practical.

Project 3.2.4 Review the IPMP and provide recommendations to ensure it follows pollinator-friendly practices, as described in the DoD Pollinator Conservation Reference Guide (Armed Forces Pest Management Board 2018).

Project 3.2.5 Survey and report successful progress using the metrics in the IPMP.

Project 3.2.6 Apply follow-up herbicide treatments to aerially treated mesquite and cholla infestations using hand control treatment annually.

Project 3.2.7 Conduct hand control treatments of mesquite throughout MAFR annually.

Project 3.2.8 Conduct surveys of weeping lovegrass and King Ranch bluestem infestations in 2022/2023 and develop landscape-scale treatment protocols for implementation in 2023/2024.

Project 3.2.9 Treat areas with weeping lovegrass and King Ranch bluestem annually, and establish monitoring protocols capable of determining treatment efficacy. Adapt treatments based on monitoring results.

Project 3.2.10 Prevent establishment of new infestations by evaluating former agricultural sites and erosion problem areas for restoration using re-seeding, then develop an appropriate native seed mix and perform test seeding in small-scale experimental plots. If successful, scale up the seeding efforts to larger sites.

Objective 3.3 ***Monitor and re-survey water and wetland resources to identify areas of management concern and potential current and future impacts to those resources.***

Project 3.3.1 Survey areas of water resources at MAFR and CAFB, including playas and ephemeral channel areas, to update installation wetland delineations.

Project 3.3.2 Add updated wetlands survey results to installation GIS databases.

Project 3.3.3 Develop management activities and plans for protecting and enhancing the natural and human impacted wetlands of MAFR and

CAFB under scenarios of lowered groundwater/effluent water availability and a changing climate.

9.0 INRMP IMPLEMENTATION, UPDATE, AND REVISION PROCESS

9.1 Natural Resources Management Staffing and Implementation

The INRMP is prepared in cooperation with and is signed by the Regional Director of the USFWS and the Director of the NMDGF. The coordination and approval process for INRMP implementation and revision is summarized as follows.

The Sikes Act also requires that INRMPs be implemented. "Implementation" anticipates the execution of all "must fund" projects and activities in accordance with specific timeframes identified in the INRMP. "Must fund" projects and activities are those required to meet recurring natural resources conservation management requirements or current compliance needs. Not all projects listed in an INRMP are necessarily "must funds." INRMPs also include projects and actions that, based upon the availability of funding, also would (further) enhance an installation's natural resources.

As defined in the OSD Policy memo, dated 10 October 2002 (*Updated Guidance for Implementation of the Sikes Act Improvement Act)*, an INRMP is considered implemented if an installation:

- Actively requests, receives, and uses funds for "must fund" projects and activities;
- Ensures that sufficient numbers of professionally trained natural resources management staff are available to perform all of the tasks required by the INRMP;
- Coordinates annually with all cooperating Resource Agency offices; and
- Documents specific INRMP action accomplishments undertaken each year.

The INRMP for CAFB/MAFR requires approval of the 27 Special Operations Wing Commander. The INRMP is coordinated through the Special Operations Mission Support Group Commander, BCE (Special Operations Civil Engineer Squadron Commander), the Environmental Program Managers (SOCES/CEIE), the Special Operations Support Squadron, Wing Plans and Programs, the Judge Advocate, and Public Affairs. HQ, Air Force Special Operations Command, Environmental (AFSOC/A7AV) and the Judge Advocate (AFSOC/JA) review the document. Prior to the implementation of specific projects or actions in the INRMP, the appropriate environmental impact analysis (i.e., EIS, Environmental Assessment, or Categorical Exclusion) is performed, as required by NEPA.

The USFWS and the Director of the NMDGF's review and sign the INRMP. The wing commander subsequently signs and implements the INRMP. The CAFB Natural Resources Program Management involves implementation of projects in this INRMP and the integration of mission specific management plans. A list of the management plans related to the CAFB natural resources program along with the office of primary responsibility and contact information is in the following table (Table 9-1).

Table 9-1. List of Management Plans and Contact Information Related to the Natural Resources Program

Plan	Date	Person	Office	Phone
BASH Plan	June 2020	Col Robert Masaitis	27 SOW SE/SE	575-784-4075
Installation Development Plan	April 2016	Ron Lancaster	27 SOCES/CEI	575-784-1146
CAFB GEOBASE Strategic Plan	Oct. 2017	Sean Sinclair	27 SOCES/CE	575-784-2829

Comprehensive Range Plan	Oct. 2014	Scott Daggett	27 SOAOS/RMO	575-784-1122
Cultural Resources Management Plan	May 2023	Charles Dixon	27 SOCES/CEIE	575-904-6731
Facility Response Plan	March 2013	Gene Smith	27 SOCES/CEIE	575-904-6735
Golf Course Env. Management Plan	Feb. 2015	Craig Brooks	27 SOFSS/FSCG	575-784-2800
Integrated Pest Management Plan	May 2023	TSgt Shana Neal	27 SOCES/CEOIE	575-784-2882
CAFB Sustainable Landscape Development Plan	Feb 2022	Charles Dixon	27 SOCES/CEIE	575-904-6731
Inter-Tribal Relation Plan	May 2023	Charles Dixon	27 SOCES/CEIE	575-904-6731
Sustainable Landscape Development Plan	Oct. 2021	Charles Dixon	27 SOCES/CEIE	
Wildland Fire Management Plan	Jan. 2022	Richard Dolphin	27 SOAOS/RMO	575-489-3499

9.2 Monitoring INRMP Implementation

The 27th Special Operations Wing is the main organization at CAFB. Within the Mission Support Group (under the Wing) are several Squadrons, including the Civil Engineer Squadron. The Environmental Element falls under Installation Management of the Squadron. Sufficient qualified SMEs are employed to manage the various environmental disciplines for which the Environmental Element is responsible. A qualified natural resources staff is maintained.

The NR Program maintains a qualified Natural Resources Management Specialist augmented by the civilian interdisciplinary team within the Environmental Element. Additionally, private contractors with expert specialties are used to support the NR program. For the foreseeable future, Texas A&M is contracted to support CAFB / MAFR with myriad natural resources support activities.

The onus of INRMP compliance is upon the Natural Resources Program Manager. Staffing is currently adequate with one Natural Resources Program Manager and cooperative agreements administered through AFCEC. Additionally, other SMEs within the Environmental Element routinely contribute to the NR program. Charles Dixon, Ph.D. has over 30 years in the field with expertise in botany, ecology, rangeland science, ornithology, wildlife biology, land management, and studied the lesser prairie chicken in NM as part of a long-term study of their life history and habitat use.

9.3 Annual INRMP Review and Update Requirements

According to AFMAN 32-7003, INRMPs are to be “living documents,” incorporating all aspects of natural resources management and ensuring that they are compatible with each other and with the CAFB mission.

Periodic assessment is a necessary part of the natural resources process that evaluates program status, measures progress, and identifies new management issues, concerns, goals, and objectives.

Section 101(b)(2) of the Sikes Act (16 U.S.C. 670a[b][2]) states that each INRMP "must be reviewed as to operation and effect by the parties thereto on a regular basis, but not less often than every five years." The requirement to "review" the INRMPs "on a regular basis, but not less often than every five years" does not mean that the INRMP necessarily needs to be revised and republished every five years. The Sikes Act specifically directs that the INRMPs be reviewed "as to operation and effect," emphasizing that the review is intended to determine whether existing INRMPs are current and are being implemented to meet the requirements of the Sikes Act and contribute to the conservation and rehabilitation of natural resources on military installations.

These reviews must be performed by the Base, NMDGF, and the USFWS. This means that no less frequently than every five years, all three parties to the INRMP must complete a review of the INRMP. Although not expressly required by the Sikes Act, the outcome of this joint review should be documented in a memorandum or letter summarizing the rationale for the conclusions the parties have reached. Although the Sikes Act specifies that a formal review must be completed no less often than every five years, DoD guidance specifies that INRMPs shall be reviewed annually with the cooperation of the USFWS and state fish and wildlife agencies. These annual reviews will facilitate "adaptive management" by providing an opportunity for the parties to review the goals and objectives of the plan and management programs, as well as the schedule for undertaking proposed actions. These annual reviews are required to ensure the INRMP (1) accommodates changes in the military mission and natural resources management objectives; (2) incorporates lessons learned from Base projects, regional activities, or scientific studies; (3) incorporates agreements with regulatory agencies; and (4) ensures the continued usefulness of this plan. Additionally, the annual review is required to verify that:

- All "must fund" projects and activities have been budgeted for and implementation is on schedule;
- All required professionally trained natural resources positions are filled or are in the process of being filled;
- Projects and activities for the upcoming year have been identified and included in the INRMP;
- All required federal, state and installation coordination have occurred; and
- All significant changes to the installation's mission requirements or its natural resources have been identified.

10.0 ANNUAL WORK PLAN

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 AF 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 Air Force 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 on Invasive Species. However, the INRMP signatories would not contend that the INRMP is not being implemented if not accomplished within 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 support long-term compliance with specific requirements within natural resources law; but is not directly tied to specific compliance within the proposed year of execution.

Table 10-1. Annual Work Plan

Resource Category	Goal	Objective	Occurrence	FY	OPR	Funding Source	Priority Level	PB28 Code*	Standard Title*	Project Number	Description
All	1	1.4	As Needed	23-27	27 SOCES/CEIE	Installation	Medium			1.4.1	Conduct surveys, when necessary, to update natural resources, GIS coverage.
All	1	1.4	As Needed	23-27	27 SOCES/CEIE	Installation	Medium			1.4.2	Update the Wildland Fire Management Plan every five years or as needed to compensate for mission changes.
All	1	1.5	Annually	23-27	27 SOCES/CEIE	Installation	Medium			1.5.2	Adapt existing training on best management practices for protecting pollinators and their habitat to the local conditions and available

Table 10-1. Annual Work Plan

Resource Category	Goal	Objective	Occurrence	FY	OPR	Funding Source	Priority Level	PB28 Code*	Standard Title*	Project Number	Description
											resources, and provide to NR and IPM staff annually.
All	2	2.1	Annually	23-27	27 SOCES/CEIE	AFCEC	High			2.1.1	Conduct population and habitat assessments and monitoring for the LEPC by September of each year.
All	2	2.1	Annually	23-27	27 SOCES/CEIE	Installation	High			2.1.5	Prepare annual reports summarizing the data collected and make recommendations for species management.
All	2	2.2	Annually	23-27	27 SOCES/CEIE	AFCEC	High			2.2.1	Conduct prairie dog and BUOW population assessments for CAFB and MAFR with an annual report due in September AFBs Prairie Dog Management Plan.
All	2	2.2	Annually	23-27	27 SOCES/CEIE	Installation	Medium			2.2.2	Coordinate with federal and state agencies regarding assessments and plan updates.
All	2	2.3	As Needed	23-27	27 SOCES/CEIE	Installation	Medium			2.3.3	Update the Prairie Dog Control Plan for CAFB and MAFR based on the results of population assessments.
All	2	2.3	As Needed	23-27	27 SOCES/CEIE	Installation	Medium			2.3.5	Coordinate with USFWS and NMDGF to establish mutually acceptable non-chemical solutions to reduce BTPD populations in hazardous areas.

Table 10-1. Annual Work Plan

Resource Category	Goal	Objective	Occurrence	FY	OPR	Funding Source	Priority Level	PB28 Code*	Standard Title*	Project Number	Description
All	2	2.4	Biennially	23-27	27 SOCES/CEIE	AFCEC	High			2.4.1	Conduct biennial status species surveys on MAFR and every five years on CAFB.
All	2	2.4	Biennially	23-27	27 SOCES/CEIE	Installation	Medium			2.4.2	Prepare a final report summarizing the data collected from biennial status species surveys and make recommendations for future management.
All	2	2.4	Biennially	23-27	27 SOCES/CEIE	Installation	Medium			2.4.3	Review all previous surveys to identify data gaps that warrant more survey work, such as non-detected species that have likelihood to occur on base.
All	2	2.4	Annually	23-27	27 SOCES/CEIE	AFCEC	Medium			2.4.4	Conduct breeding bird surveys on established routes in June and July of each fiscal year.
All	2	2.4	Annually	23-27	27 SOCES/CEIE	AFCEC	Medium			2.4.5	Conduct migratory bird surveys on established routes in mid-April through May and October of each fiscal year.
All	2	2.4	Annually	23-27	27 SOCES/CEIE	Installation	Medium			2.4.6	Prepare annual reports summarizing the findings of the surveys with comparisons year over year to determine trends and fluctuations of bird populations as well as recommendations for management.

Table 10-1. Annual Work Plan

Resource Category	Goal	Objective	Occurrence	FY	OPR	Funding Source	Priority Level	PB28 Code*	Standard Title*	Project Number	Description
All	2	2.4	Annually	23-27	27 SOCES/CEIE	Installation	Medium			2.4.7	Conduct bald and golden eagle surveys to document presence, breeding, and population trends on installation.
All	2	2.4	One-time	23-27	27 SOCES/CEIE	Installation	Medium			2.4.8	Coordinate with the USFWS migratory bird office to determine the feasibility and utility of conducting wintering grassland bird surveys.
All	2	2.4	Annually	23-27	27 SOCES/CEIE	Installation	Medium			2.4.9	Conduct wintering grassland bird surveys if determined useful from Project 2.4.7.
All	2	2.4	As needed	23-27	27 SOCES/CEIE	Installation	Medium			2.4.16	Coordinate with the USFWS New Mexico to identify conservation measures and adaptive management practices if a canyon bat (*Parastrellus hesperus*) or tricolored bat (*Perimyotis subflavus*) if detected during acoustic surveys.
All	2	2.5	One-time	23-27	27 SOCES/CEIE	Installation	High			2.5.4	Develop a wildlife hazard management plan that mitigates wildlife hazards to the maximum extent.
All	2	2.5	As needed	23-27	27 SOCES/CEIE	Installation	Low			2.5.5	Increase staffing to include a BASH Program Manager.

Table 10-1. Annual Work Plan

Resource Category	Goal	Objective	Occurrence	FY	OPR	Funding Source	Priority Level	PB28 Code*	Standard Title*	Project Number	Description
All	3	3.1	One-time	23-27	27 SOCES/CEIE	Installation	Low			3.1.2	Establish a fire ecology program within 27 SOCES.
All	3	3.1	As Needed	23-27	27 SOCES/CEIE	AFCEC	Medium			3.1.3	Conduct surveys and use LCTA information to determine fuel loads throughout MAFR. Data will be analyzed for fire hazard vulnerability determination.
All	3	3.1	As Needed	23-27	27 SOCES/CEIE	Installation	Medium			3.1.4	Continue the established LCTA monitoring program for assessing the effect of fire on MAFR.
All	3	3.2	Every five years	23-27	27 SOCES/CEIE	AFCEC	Medium			3.2.1	Inventory the invasive and noxious plants present on MAFR and CAFB.
All	3	3.2	As Needed	23-27	27 SOCES/CEIE	Installation	Medium			3.2.2	Using data acquired from the inventory to develop a Weed Management Plan for CAFB and an Invasive Species Management Plan for MAFR. Plans should provide metrics for evaluation of success.
All	3	3.2	As Needed	23-27	27 SOCES/CEIE	Installation	Medium			3.2.3	Implement the most effective management strategies to the maximum extent practical.
All	3	3.2	As Needed	23-27	27 SOCES/CEIE	Installation	Medium			3.2.5	Survey and report successful progress using the metrics in the IPMP.

11.0 REFERENCES

11.1 Standard References (Applicable to all AF installations)

- AFMAN 32-7003, *Environmental Conservation*
- Sikes Act
- eDASH Natural Resources Program Page
- Natural Resources Playbook
- DoDI 4715.03, *Natural Resources Conservation Program*
- AFI 32-1015, *Integrated Installation Planning*
- AFI 32-10112, *Installation Geospatial Information and Services (IGI&S)*

11.2 Installation References

- Adams, R. A. 2010. Bat reproduction declines when conditions mimic climate change projections for western North America. Ecology 91:2437–2445.
- Air Combat Command (ACC). 1995. Biological survey report, North Playa Lake, Cannon Air Force Base, New Mexico. U.S. Air Force, Joint Base Langley-Eustis, Virginia, USA.
- Air Combat Command (ACC). 1996. Delineations of jurisdictional waters of the United States, including wetlands, on Cannon Air Force Base and Melrose Air Force Range, New Mexico. Biological Survey Report, North Playa Lake. U.S. Air Force, Joint Base Langley-Eustis, Virginia, USA.
- Air Combat Command (ACC). 2005. Endangered, threatened, candidate, and sensitive bird species and birds of conservation concern survey report. U.S. Air Force, Joint Base Langley-Eustis, Virginia, USA.
- Air Combat Command (ACC). 2007. Update on endangered, threatened, candidate, sensitive, and conservation concern species, Melrose Air Force Range, New Mexico. U.S. Air Force, Joint Base Langley-Eustis, Virginia, USA.
- Air Force Special Operations Command (AFSOC). 2007. AFSOC assets beddown at Cannon Air Force Base, New Mexico, Environmental Impact Statement. U.S. Air Force.
- Anderson, J. B., and L. P. Brower. 1996. Freeze-protection of overwintering monarch butterflies in Mexico: critical role of the forest as a blanket and an umbrella. Ecological Entomology 21:107–116.
- Armed Forces Pest Management Board. 2018. DoD Pollinator Conservation Reference Guide. Office of the Under Secretary of Defense (Acquisitions and Sustainment), Silver Spring, Maryland, USA. https://www.acq.osd.mil/eie/afpmb/docs/techguides/tg9.pdf
- Arnett, E. B., W. K. Brown, W. P. Erickson, J. K. Fiedler, B. L. Hamilton, T. H. Henry, A. Jain, G. D. Johnson, J. Kerns, R. R. Koford, et al. 2008. Patterns of bat fatalities at wind energy facilities in North America. Journal of Wildlife Management 72:61–78.
- Askins, R. A., F. Chavez-Ramirez, B. C. Dale, C. A. Haas, J. R. Herkert, F. L. Knopf, and P. D. Vickery. 2007. Conservation of grassland birds in North America: Understanding ecological processes in different regions. Ornithological Monographs 64:1–46. https://doi.org/10.2307/40166905
- Banuls, V. A., and J. L. Salmeron. 2007. A Scenario-Based Assessment Model—SBAM.

Technological Forecasting and Social Change 74(6):750–762. https://doi.org/10.1016/J.TECHFORE.2006.05.015

- Barve, N., A. J. Bonilla, J. Brandes, J. C. Brown, N. Brunsell, F. V. Cochran, R. J. Crosthwait, J. Gentry, L. M. Gerhart, T. Jackson, et al. 2012. Climate-change and mass mortality events in overwintering monarch butterflies. Revista Mexicana de Biodiversidad 83:817–824.
- Bat Conservation International. 2022*d*. Tricolored bat. Bat profiles. https://www.batcon.org/bat/perimyotis-subflavus-2/. Accessed 13 Sep 2022.
- Batalden, R. V., K. Oberhauser, and A. T. Peterson. 2007. Ecological niches in sequential generations of eastern North American monarch butterflies (Lepidoptera: Danaidae): the ecology of migration and likely climate change implications. Environmental Entomology 36:1365–1373.
- Beauprez, G. M. 2016. Survey for active lesser prairie-chicken leks: Spring 2016. Federal Aid in Wildlife Restoration Project Report, W-138-R-13. New Mexico Department of Game and Fish, Raton, New Mexico, USA.
- Beauprez, G. M., and S. Liley. 2022. Survey for active lesser prairie-chicken leks: Spring 2022. New Mexico Department of Game and Fish, Raton, New Mexico, USA.
- Bechard, M. J., C. S. Houston, J. H. Sarasola, and A. S. England. 2010. Swainson's hawk (*Buteo swainsoni*). Birds of the world online. https://birdsoftheworld.org/bow/species/swahaw/cur/introduction. Accessed 16 February 2023.
- Beck, L., and J. Wanstall. 2020. Noxious and troublesome weeds of New Mexico. New Mexico State University, College of Agricultural, Consumer and Environmental Sciences, Las Cruces, USA. https://pubs.nmsu.edu/_circulars/CR698/. Accessed 16 February 2023.
- Bellar, C. A., and A.D. Maccarone. 2002. The effects of prairie habitat loss and land-use changes on loggerhead shrike populations in Kansas. Transactions of the Kansas Academy of Science 105(1):51–65. https://doi.org/10.1660/0022-8443(2002)105[0051:teophl]2.0.co;2
- Berry, M. E., C. E. Bock, and S. L. Haire. 1998. Abundance of diurnal raptors on open space grasslands in an urbanized landscape. Condor 100(4):601–608. https://doi.org/10.2307/1369742
- Bierbaum, R., J. B. Smith, A. Lee, M. Blair, L. Carter, F. S. Chapin, P. Fleming, S. Ruffo, M. Stults, S. McNeeley, E. Wasley, and L. Verduzco. 2013. A comprehensive review of climate adaptation in the United States: More than before, but less than needed. Mitigation and Adaptation Strategies for Global Change 18(3):361–406. https://doi.org/10.1007/s11027-012-9423-1
- Blair, J., J. Nippert, and J. Briggs. 2014. Grassland ecology. Pages 389–423 *in* R. K. Monson, editor. Ecology and the environment. Springer, New York, New York, USA. https://doi.org/10.1007/978-1-4614-7501-9_14
- Blus, L. J., C. J. Henny, and A. J. Krynitsky. 2020. Organochlorine-induced mortality and residues in long-billed curlews from Oregon. Condor 87(4):563–565. https://doi.org/10.2307/1367968
- Borgman, C. C., and B. O. Wolf. 2016. The indirect effects of climate variability on the reproductive dynamics and productivity of an avian predator in the arid Southwest. Oecologia 180:279–291.
- Both, C., C. A. M. Van Turnhout, R. G. Bijlsma, H. Siepel, A. J. Van Strien, and R. P. B. Foppen. 2010. Avian population consequences of climate change are most severe for long-distance migrants in seasonal habitats. Proceedings of the Royal Society B: Biological Sciences

277(1685):1259–1266. https://doi.org/10.1098/rspb.2009.1525

- Brockway, D. G., R. G. Gatewood, and R. B. Paris. 2007. Restoring fire as an ecological process in shortgrass prairie ecosystems: Initial effects of prescribed burning during the dormant and growing seasons. Journal of Environmental Management 65(2):135–152.
- Brower, L. P., G. Castilleja, A. Peralta, J. Lopez-Garcia, L. Bojorquez-Tapia, and S. Diaz. 2002. Quantitative changes in the forest quality in a principal overwintering area of the monarch butterfly in Mexico, 1971–1999. Conservation Biology 16:346–359.
- Brower, L. P., O. R. Taylor, E. H. Williams, D. A. Slayback, R. R. Zubieta, and M. I. Ramirez. 2012. Decline of monarch butterflies overwintering in Mexico: is the migratory phenomenon at risk? Insect Conservation and Diversity 5:95–100.
- Buchanan, D. E. and W. J. Ross. 1958. Soil survey of Curry County, New Mexico. U.S. Department of Agriculture, Soil Conservation Service, Washington, D.C., USA.
- Center for Biological Diversity, and Defenders of Wildlife. 2016. Petition to list the tricolored bat *Perimyotis subflavus* as threatened or endangered under the Endangered Species Act. Tucson, Arizona, USA. https://www.biologicaldiversity.org/species/mammals/tricolored_bat/pdfs/TricoloredBatPetition_06-14-2016.pdf. Accessed 13 Jun 2023.
- Center for Environmental Management of Military Lands (CEMML). 2019. Climate change summaries for incorporation into installation INRMPs, Cannon Air Force Base, Melrose Air Force Range. Colorado State University, Fort Collins, USA.
- Center for Environmental Management of Military Lands (CEMML). 2023. Appendix E: Cannon Air Force Base and Melrose Air Force Range threatened and endangered species vulnerability and adaptation. Colorado State University, Fort Collins, USA.
- Coates, P. S., K. B. Howe, M. L. Casazza, and D. J. Delehanty. 2014. Landscape alterations influence differential habitat use of nesting buteos and ravens within sagebrush ecosystem: Implications for transmission line development. Condor 116(3):341–356. https://doi.org/10.1650/CONDOR-13-126.1
- Collister, D. M., and S. Wilson. 2007. Contributions of weather and predation to reduced breeding success in a threatened northern loggerhead shrike population. Avian Conservation and Ecology 2(2). https://doi.org/10.5751/ace-00193-020211
- Colorado Division of Wildlife. 2003. Conservation plan for grassland species in Colorado. State of Colorado, Department of Natural Resources, Denver, USA.
- Copeland, H. E., A. Pocewicz, and J. M. Kiesecker. 2011. Geography of energy development in western North America: Potential impacts on terrestrial ecosystems. *In* D.E. Naugle, editor. Energy development and wildlife conservation in western North America. Island Press, Washington, D.C., USA. https://doi.org/10.5822/978-1-61091-022-4_2
- Cornman, A. M. 2014. A white paper on the northern long-eared bat, forest management, and threat Interactions. Natural Resources Report No. 2014-2. Little River Band of Ottawa Indians, Manistee, Michigan, USA. https://www.researchgate.net/publication/317094298_A_white_paper_on_the_northern_long-eared_bat_forest_management_and_threat_interactions. Accessed 13 Jun 2023.
- Crossley, M. S., T. D. Meehan, M. D. Moran, J. Glassberg, W. E. Snyder, and A. K. Davis. 2022. Opposing global change drivers counterbalance trends in breeding North American monarch

butterflies. Global Change Biology 28:4726–4735.

- Cruz-McDonnell, K. K., and B. O. Wolf. 2016. Rapid warming and drought negatively impact population size and reproductive dynamics of an avian predator in the arid Southwest. Global Change Biology 22(1):237–253. https://doi.org/10.1111/gcb.13092
- Cully, J. F., and E. S. Williams. 2001. Interspecific comparisons of sylvatic plague in prairie dogs. Journal of Mammalogy 82(4):894–905. https://doi.org/10.1644/1545-1542(2001)082<0894:ICOSPI>2.0.CO;2
- Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, M. P. Nenneman, and B. R. Euliss. 2002. Effects of management practices on grassland birds: Northern harrier. U.S. Geological Survey, Northern Prairie Wildlife Research Center, Jamestown, North Dakota, USA.
- Degenhardt, W.G., C.Painter and A. Price. 1996. Amphibians and Reptiles of New Mexico. University of New Mexico Press, Albuquerque. 431 pp.
- DeGraaf, R. M., V. E. Scott, R. H. Hamre, L. Ernst, and S. H. Anderson. 1991. Forest and rangeland birds of the United States: Natural history and habitat use. U.S. Department of Agriculture, Forest Service, Washington, D.C., USA.
- Department of Defense Legacy Resource Management Program. 2021. Monarch Conservation on Department of Defense Lands in the West: Best management practices. Project NR 19-001. https://www.denix.osd.mil/legacy/denix-files/sites/33/2021/07/NR-19-001_BMPs_FINAL-508-Comp.pdf
- Department of Defense (DoD), Office of Undersecretary of Defense (Acquisition and Sustainment). 2021. Department of Defense draft climate adaptation plan. Submitted to National Climate Task Force and Federal Chief Sustainability Officer, Washington, D.C., USA. https://media.defense.gov/2021/Oct/07/2002869699/-1/-1/0/DEPARTMENT-OF-DEFENSE-CLIMATE-ADAPTATION-PLAN.PDF. Accessed 16 February 2023.
- DeSante, D. F., and T. L. George. 1994. Population trends in the landbirds of western North America. Studies in Avian Biology 15:173–190.
- Desmond, M. J., and J. A. Savidge. 1996. Factors influencing burrowing owl (*Speotyto cunicularia*) nest densities and numbers in western Nebraska. American Midland Naturalist 136(1):143–148.
- Desmond, M. J., J. A. Savidge, and K. M. Eskridge. 2000. Correlations between burrowing owl and black-tailed prairie dog declines: A 7-year analysis. The Journal of Wildlife Management 64(4):1067–1075.
- Dick-Peddie, W. A. 1999. New Mexico vegetation, past, present, and future. University of New Mexico Press, Albuquerque, USA.
- Drost, C. A., and R. C. McCluskey. 1992. Extirpation of alternative prey during a small rodent crash. Oecologia 92(2):301–304.
- Duebbert, H. F., and J. T. Lokemoen. 1977. Upland nesting of American bitterns, marsh hawks, and short-eared owls. U.S. Fish and Wildlife Publications Service, 248. U.S. Department of Interior, Fish and Wildlife Service, Washington, D.C., USA.
- Dugger, B. D., and K. M. Dugger. 2002. Long-billed curlew (*Numenius americanus*). *In* A. F. Poole and F. B. Gill, editors. Birds of North America. Cornell Lab of Ornithology, Cornell University, Ithaca, New York, USA. https://birdsoftheworld.org/bow/species/lobcur/1.0/introduction. Accessed 16 February 2023.

- Dukes, J. S., and H. A. Mooney. 1999. Does global change increase the success of biological invaders? Tree 14(4):135–139. https://doi.org/http://dx.doi.org/10.1016/S0169-5347(98)01554-7
- Dundas, H., and J. Jensen. 1995. Burrowing owl status and conservation. Bird Trends 4:21–22.
- Dunning, J. J., , R. J. Bowers, S. Suter, and C. Bock. 2020. Cassin's sparrow (*Peucaea cassinii*), version 1.0. *In* P. Rodewald, editor. Birds of North America. Cornell Lab of Ornithology, Cornell University, Ithaca, New York, USA.
- Eads, D. A., and J. L. Hoogland. 2017. Precipitation, climate change, and parasitism of prairie dogs by fleas that transmit plague. Journal of Parasitology 103(4):309–319. https://doi.org/10.1645/16-195
- Eads, D. A., D. E. Biggins, D. H. Long, K. L. Gage, and M. F. Antolin. 2016. Droughts may increase susceptibility of prairie dogs to fleas: Incongruity with hypothesized mechanisms of plague cycles in rodents. Journal of Mammalogy 97(4):1044–1053. https://doi.org/10.1093/jmammal/gyw035
- Ehrlich, P., D. S. Dobkin, and D. Wheye. 1988. The birder's handbook: A field guide to the natural history of North American birds. Simon and Schuster, New York, New York, USA.
- Enderson, J. H. 1964. A study of the prairie falcon in the central Rocky Mountain region. Auk 81(3):332–352.
- Evans, D. L. 1982. Status reports on twelve raptors. Scientific report no. 238. U.S. Department of Interior, Fish and Wildlife Service, Washington, D.C., USA.
- Facka, A. N., G. W. Roemer, V. L. Mathis, M. Kam, and E. Geffen. 2010. Drought leads to collapse of black-tailed prairie dog populations reintroduced to the Chihuahuan Desert. Journal of Wildlife Management 74(8):1752-1762.
- Farmer, C. J., L. J. Goodrich, E. R. Inzunza, and J. P. Smith. 2008. Conservation status of North America's birds of prey. *In* K. L. Bildstein, J. Smith, and E. Ruelas, editors. State of North America's birds of prey. Series in Ornithology 3:303–415. Nuttall Ornithological Club and American Ornithologists Union, Cambridge, Massachusetts, USA.
- Fellows, S., and S. Jones. 2009. Status assessment and conservation action plan for the long-billed curlew (*Numenius americanus*). U.S Fish and Wildife Service Publications, 476. U.S. Department of Interior, Fish and Wildlife Service,Washington, D.C., USA.
- Fellows, S., K. Stone, S. Jones, N. Damude, and S. Brown. 2001. Central Plains / Playa Lakes regional shorebird conservation plan. U.S. Department of Interior, Fish and Wildlife Service,Washington, D.C., USA.
- Forcey, G. M., G. M. Linz, W. E. Thogmartin, and W. J. Bleier. 2007. Influence of land use and climate on wetland breeding birds in the prairie pothole region of Canada. Canadian Journal of Zoology 85(3):421–436.
- Fritts, S. R., B. A. Grisham, R. D. Cox, C. W. Boal, D. A. Haukos, P. McDaniel, C. A. Hagen, and D. U. Greene. 2018. Interactive effects of severe drought and grazing on the life history cycle of a bioindicator species. Ecology and Evolution 8(18):9550–9562. https://doi.org/10.1002/ece3.4432
- Froehly, J. L., A. K. Tegeler, and D. S. Jachowski. 2020. Nest site selection by loggerhead shrike (*Lanius ludovicianus*) in a fragmented landscape. Wilson Journal of Ornithology 132(1):61–71. https://doi.org/10.1676/1559-4491-132.1.61
- Gardali, T., N. E. Seavy, R. T. Digaudio, and L. A. Comrack. 2012. A climate change

vulnerability assessment of California's at-risk birds. PLOS ONE 7(3):29507. https://doi.org/10.1371/journal.pone.0029507

- Gent, P. R., G. Danabasoglu, L. J. Donner, M. M. Holland, E. C. Hunke, S. R. Jayne, D. M. Lawrence, R. B. Neale, R., P. J. Rasch, M. Vertenstein, P. H. Worley, Z.-L. Yang, and M. Zhang. 2011. The Community Climate System Model version 4. Journal of Climate 24(19):4973–4991. https://doi.org/https://doi.org/10.1175/2011JCLI4083.1
- Gilgert, W., and M. Vaughan. 2011. The value of pollinators and pollinator habitat to rangelands: Connections among pollinators, insects, plant communities, fish, and wildlife. Rangelands 33(3):14–19.
- Gillihan, S. W., D. J. Hanni, S. A. Hutchings, T. Toombs, and T. Vercauteren. 2001. Sharing your land with short-grass prairie birds. Rocky Mountain Bird Observatory, Fort Collins, Colorado, USA.
- Gilmer, D. S., D. L. Evans, P. M. Konrad, and R. E. Stewart. 1985. Recoveries of ferruginous hawks banded in south-central North Dakota. Journal of Field Ornithology 56:184–187.
- Glick, P., B. A. Stein, and N. A. Edelson. 2011. Scanning the conservation horizon. National Wildlife Federation, Reston, Virginia, USA.
- Grassel, S. M., J. L. Rachlow, and C. J. Williams. 2016. Reproduction by black-tailed prairie dogs and black-footed ferrets: Effects of weather and food availability. Western North American Naturalist 76(4):405–416. https://doi.org/10.3398/064.076.0403
- Grisham, B. A., C. W. Boal, D. A. Haukos, D. M. Davis, K. K. Boydston, C. Dixon, and W. R. Heck. 2013. The predicted influence of climate change on lesser prairie-chicken reproductive parameters. PLOS ONE 8(7):e68225. https://doi.org/10.1371/journal.pone.0068225
- Gutierrez, A. A., S. Hantson, B. Langenbrunner, B. Chen, Y. Jin, M. L. Goulden, and J. T. Randerson. 2021. Wildfire response to changing daily temperature extremes in California's Sierra Nevada. Science Advances 7(47).
- Hagen, C. A., and K. M. Giesen. 2020. Lesser prairie-chicken (*Tympanuchis pallidicinctus*), version 1.0. *In* A. F. Poole, editor. Birds of the world. Cornell Lab of Ornithology, Cornell University, Ithaca, New York, USA.
- Hall, R. S., R. L. Glinski, D. H. Ellis, J. M. Ramakka, and D. L. Base. 1988. Ferruginous hawk. Proceedings of the Southwest Raptor Management Symposium and Workshop. National Wildlife Federation, Reston, Virginia, USA.
- Hamerstrom, F., F. N. Hamerstrom, and C. Burke. 1985. Effect of voles on mating systems in a central Wisconsin population of harriers. Wilson Bulletin 97(3):332–346.
- Haukos, D. A. and L. M. Smith. 1994. The importance of playa wetlands to biodiversity of the southern Great Plains. Landscape and Urban Planning 28:83–98. Elsevier Science.
- Hellmann, J. J., J. E. Byers, B. G. Bierwagen, and J. S. Dukes. 2008. Five potential consequences of climate change for invasive species. Conservation Biology 22(3):534–543. https://doi.org/10.1111/j.1523-1739.2008.00951.x
- Hibbard, K. A., G. A. Meehl, P. M. Cox, and P. Friedlingstein. 2007. A strategy for climate change stabilization experiments. Eos 88(20):217–221. https://doi.org/10.1029/2007EO200002
- Holling, C. S. 1973. Resilience and stability of ecological systems. Annual Review of Ecology and Systematics 4(1):1–23. https://doi.org/10.1146/annurev.es.04.110173.000245
- Hoving, C. L., Y. M. Lee, P. J. Badra, and B. J. Klatt. 2013. Changing climate, changing wildlife:

A vulnerability assessment of 400 species of greatest conservation need and game species in Michigan. Wildlife Division Report No. 3564. State of Michigan, Department of Natural Resources, Lansing, USA.

- Hull, J. M., R. Anderson, M. Bradbury, J. A. Estep, and H. B. Ernest. 2008. population structure and genetic diversity in Swainson's hawks (*Buteo swainsoni*): Implications for conservation. Conservation Genetics 9(2):305–316. https://doi.org/10.1007/s10592-007-9342-y
- Humple, D. L., and A.L. Holmes. 2006. Effects of a fire on a breeding population of loggerhead shrikes in sagebrush steppe habitat. Journal of Field Ornithology 77(1):21–28. https://doi.org/10.1111/j.1557-9263.2006.00004.x
- Hurrell, J. W., M. M. Holland, P. R. Gent, S. Ghan, J. E. Kay, P. J. Kushner,… S. Marshall. 2013. The community earth system model: A framework for collaborative research. Bulletin of the American Meteorological Society 94(9):1339–1360. https://doi.org/10.1175/BAMS-D-12-00121.1
- Institute of Renewable Natural Resources (IRNR). 2016*a*. Bald and golden eagle aerial surveys. Prepared for Cannon Air Force Base and Melrose Air Force Range, New Mexico. Texas A&M, College Station, USA.
- Institute of Renewable Natural Resources (IRNR). 2016*b*. Federal candidate species and federal species of management concern plans. Prepared for Cannon Air Force Base and Melrose Air Force Range, New Mexico. Texas A&M, College Station, USA.
- Institute of Renewable Natural Resources (IRNR). 2016*c*. Lesser Prairie chicken management plan. Prepared for Cannon Air Force Base and Melrose Air Force Range, New Mexico. Texas A&M, College Station, USA.
- Institute of Renewable Natural Resources (IRNR). 2016*d*. Lesser prairie chicken population monitoring report. Prepared for Cannon Air Force Base and Melrose Air Force Range, New Mexico. Texas A&M, College Station, USA.
- Institute of Renewable Natural Resources (IRNR). 2016*e*. Migratory and breeding bird survey report. Prepared for Cannon Air Force Base and Melrose Air Force Range, New Mexico. Texas A&M, College Station, USA.
- Institute of Renewable Natural Resources (IRNR). 2016*f*. Western burrowing owl and black-tailed prairie dog assessment. Prepared for Cannon Air Force Base and Melrose Air Force Range, New Mexico. Texas A&M, College Station, USA.
- James, P. C., and R. H. M. Espie. 1997. Current status of the burrowing owl in North America: an agency survey. Pages 3–5 *in* J. L. Lincer and K. Steenhof, editors. The burrowing owl: Its biology and management. Journal of Raptor Research Report No. 9. Raptor Research Foundation, Topeka, Kansas, USA.
- Jarzyna, M. A., B. Zuckerberg, A. O. Finley, and W. F. Porter. 2016. Synergistic effects of climate and land cover: Grassland birds are more vulnerable to climate change. Landscape Ecology 31(10): 2275–2290. https://doi.org/10.1007/s10980-016-0399-1
- Jones, G., D. S. Jacobs, T. H. Kunz, M. R. Willig, and P. A. Racey. 2009. Carpe noctem: the importance of bats as bioindicators. Endangered Species Research 8:93–115.
- Kantrud, H. A., and K. F. Higgins. 1992. Nest and nest site characteristics of some ground-nesting, non-passerine birds of northern grasslands. Prairie Naturalist 24(2):67–84.
- Klute, D. S., L. W. Ayers, M. T. Green, W. H. Howe, S. L. Jones, J. A. Shaffer, S. R. Sheffield,

and T. S. Zimmerman. 2003. Status assessment and conservation plan for the western burrowing owl in the United States. U. S. Department of Interior, Fish and Wildlife Service, Northern Prairie Wildlife Research Center, Jamestown, North Dakota, USA.

- Kotliar, N.B., Baker, B.W., Whicker, A.D. and Plumb, G., 1999. A critical review of assumptions about the prairie dog as a keystone species. Environmental Management 24(2):177-192.
- Kunz, T. H., E. B. Arnett, B. M. Cooper, W. P. Erickson, R. P. Larkin, T. Mabee, M. L. Morrison, M. D. Strickland, and J. M. Szewczak. 2007. Assessing impacts of wind-energy development on nocturnally active birds and bats: a guidance document. Journal of Wildlife Management 71:2449–2486.
- Kurta, A., L. Winhold, J. O. Whitaker, and R. Foster. 2007. Range expansion and changing abundance of the eastern pipistrelle (Chiroptera: Vespertilionidae) in the Central Great Lakes region. American Midland Naturalist 157:404–411.
- Lambert, K. T. A. and P. G. McDonald. 2014. A low-cost, yet simple and highly repeatable system for acoustically surveying cryptic species. Austral Ecology 39:779–785.
- Langwig, K. E., J. R. Hoyt, K. L. Parise, J. Kath, D. Kirk, W. F. Frick, J. T. Foster, and A. M. Kilpatrick. 2015. Invasion dynamics of white-nose syndrome fungus, midwestern United States, 2012–2014. Emerging Infectious Diseases 21:1023–1026.
- Langwig, K. E., W. F. Frick, J. R. Hoyt, K. L. Parise, K. P. Drees, T. H. Kunz, J. T. Foster, and A. M. Kilpatrick. 2016. Drivers of variation in species impacts for a multi-host fungal disease of bats. Philosophical Transactions of the Royal Society B: Biological Sciences 371:20150456.
- Luce, R. J. 2003. A multi-state conservation plan for the black-tailed prairie dog (*Cynomys ludovicianus*) in the United States—An addendum to the black-tailed prairie dog conservation assessment and strategy, November 3, 1999. Interstate Black-tailed Prairie Dog Conservation Team, Sierra Vista, Arizona, USA. https://cpw.state.co.us/Documents/WildlifeSpecies/SpeciesOfConcern/BlackTailedPrairieDog/PDF/BTPD_Final.pdf. Accessed 16 February 2023.
- Lynn, J. 2006. Cassin's sparrow (*Aimophila cassinii*): A technical conservation assessment. U.S. Department of Agriculture, Forest Service,Washington, D.C., USA. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5182053.pdf. Accessed 16 February 2023.
- Marcy, R. B. 1850. Report of a reconnaissance of the route from Ft. Smith to Santa Fe. Senate Exec. Doc. 64, 31st Congress, 1st Session. U.S. Congress, Washington, D.C., USA.
- Marques, T. A., L. Thomas, S. W. Martin, D. K. Mellinger, J. A. Ward, D. J. Moretti, D. Harris and P. L. Tyack. 2013. Estimating animal population density using passive acoustics. Biological Reviews 88:287–309.
- Matthews, S., R. O'Connor, L. R. Iverson, and A. M. Prasad. 2004. Atlas of climate change effects in 150 bird species of the Eastern United States. General Technical Report NE-318. U.S. Department of Agriculture, Forest Service, Northeastern Research Station, Upper Darby, Pennsylvania, USA.
- Michaels, H., and J. Cully. 2019. Landscape and fine scale habitat associations of the loggerhead shrike. Wilson Bulletin 110(4):474–482.
- Millar, C. I., N. L. Stephenson, and S. L. Stephens. 2007. Climate change and forests of the future: Managing in the face of uncertainty. Ecological Applications 17(8):2145–2151.

https://doi.org/10.1890/06-1715.1

- Miller, B., G. Ceballos, and R. Reading. 1994. The prairie dog and biotic diversity. Conservation Biology 8(3):677–681. https://doi.org/10.1046/j.1523-1739.1994.08030677.x
- Moss, R. H., J. A. Edmonds, K. A. Hibbard, M. R. Manning, S. K. Rose, D. P. van Vuuren, … T. J. Wilbanks. 2010. The next generation of scenarios for climate change research and assessment. Nature 463(7282):747–756. https://doi.org/10.1038/nature08823
- Moss, R. H., M. Babiker, S. Brinkman, E. Calvo, T. Carter, J. Edmonds, … M. Zurek. 2008. Technical summary: Towards new scenarios for analysis of emissions, climate change, impacts and response strategies. Intergovernmental Panel on Climate Change, Geneva, Switzerland. https://doi.org/10.1086/652242
- Mulhern, D. W., and C. J. Knowles. 1995. Black-tailed prairie dog status and future conservation planning. Pages 19–20 *in* Proceedings of Symposium for Conserving Biodiversity on Native Rangelands. U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado, USA.
- Murphy, R. K. 2010. Diets of nesting Swainson's hawks in relation to land cover in Northwestern North Dakota. Prairie Naturalist 42(3):89–99.
- Nasman, K., T. Rintz., G. DiaDonato, and F. Kulzer. 2022. Western EcoSystems Technology. Range-wide population size of the lesser prairie chicken: 2012 to 2022. Prepared for Western Association of Fish and Wildlife Agencies, Boise, Idaho, USA.
- National Audubon Society. 2011. Christmas bird count historical results. New York, New York, USA.
- Natural Resources Conservation Service (NRCS). 2010. Wildlife watering facilities. Biology Technical Note No. 23. U.S. Department of Agriculture, Washington, D.C., USA.
- Natural Resources Institute (NRI). 2019*a*. Western burrowing owl and black-tailed prairie dog assessment. Prepared for Cannon Air Force Base and Melrose Air Force Range, New Mexico. Texas A&M, College Station, USA.
- Natural Resources Institute (NRI). 2019*b*. Task 1: Lesser prairie chicken surveys. Natural Resources Support for Cannon AFB and Melrose AFR, New Mexico. Prepared for Cannon Air Force Base and Melrose Air Force Range, New Mexico. Texas A&M, College Station, USA.
- Natural Resources Institute (NRI). 2021*a*. Task 1: Lesser prairie chicken surveys. Natural Resources Support for Cannon AFB and Melrose AFR, New Mexico. Prepared for Cannon Air Force Base and Melrose Air Force Range, New Mexico. Texas A&M, College Station, USA.
- Natural Resources Institute (NRI). 2021*b*. Task 4: Migratory bird surveys. Natural Resources Support for Cannon AFB and Melrose AFR, New Mexico. Prepared for Cannon Air Force Base and Melrose Air Force Range, New Mexico. Texas A&M, College Station, USA.
- Natural Resources Institute (NRI). 2021*c*. Task 2: Threatened and endangered species assessment. Natural Resources Support for Cannon AFB and Melrose AFR, New Mexico. Prepared for Cannon Air Force Base and Melrose Air Force Range, New Mexico. Texas A&M, College Station, USA.
- Natural Resources Institute (NRI). 2021*d*. Task 2: Western burrowing owl and black-tailed prairie dog surveys. Natural Resources Support for Cannon AFB and Melrose AFR, New Mexico. Prepared for Cannon Air Force Base and Melrose Air Force Range, New Mexico. Texas A&M, College Station, USA.

- NatureServe. 2022*a*. Black-tailed prairie dog (*Cynomys ludovicianus*). NatureServe Explorer 2.0. https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.100941/Cynomys_ludovicianus. Accessed 16 February 2023.
- NatureServe. 2022*b*. Cassin's sparrow (*Peucaea cassinii*). NatureServe Explorer 2.0. https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.102862/Peucaea_cassinii. Accessed 16 February 2023.
- NatureServe. 2022b. Tricolored bat (*Perimyotis subflavus*). NatureServe Explorer. https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.102580/Perimyotis_subflavus. Accessed 18 Jul 2022.
- NatureServe. 2022*c*. Lesser prairie-chicken (*Tympanuchus pallidicinctus*). NatureServe Explorer 2.0. https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.101816/Tympanuchus_pallidicinctus. Accessed 16 February 2023.
- NatureServe. 2022h. Monarch (*Danaus plexippus plexippus*). NatureServe Explorer. https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.108245/Danaus_plexippus. Accessed 28 Feb 2019.
- New Mexico Department of Game and Fish (NMDGF). 2016. State Wildlife Action Plan for New Mexico. New Mexico Department of Game and Fish, Santa Fe, New Mexico, USA.
- New Mexico Department of Game and Fish (NMDGF). 2020. Threatened and endangered species of New Mexico 2020 biennial review. New Mexico Department of Game and Fish, Wildlife Management and Fisheries Management Divisions, Raton, USA.
- Ng, J., M. D. Giovanni, M. J. Bechard, J. K. Schmutz, and P. Pyle. 2020. Ferruginous hawk (*Buteo regalis*), version 1.0. *In* P. G. Rodewald, editor. Birds of the world. Cornell Lab of Ornithology, Cornell University, Ithaca, New York, USA.
- Oberhauser, K., and A. T. Peterson. 2003. Modeling current and future potential wintering distributions of eastern North American monarch butterflies. Proceedings of the National Academy of Sciences of the United States of America 100:14063–14068.
- Olendorff, R. R. 1993. Status, biology, and management of ferruginous hawks: A review. U.S. Department of Interior, Bureau of Land Management, Raptor Research and Technical Assistance Center, Washington, D.C., USA.
- Oring, L. W. 2006. Long-billed curlew symposium. Wader Study Group Bulletin 109:30.
- Paerl, H. W., N. S. Hall, and E. S. Calandrino. 2011. Controlling harmful cyanobacterial blooms in a world experiencing anthropogenic and climatic-induced change. Science of the Total Environment 409(10):1739–1745. https://doi.org/10.1016/j.scitotenv.2011.02.001
- Parmenter, R.R., Yadav, E.P., Parmenter, C.A., Ettestad, P. and Gage, K.L., 1999. Incidence of plague associated with increased winter-spring precipitation in New Mexico. The American Journal of Tropical Medicine and Hygiene 61(5):814-821.
- Peterson, T. A. 2003. Projected climate change effects on Rocky Mountain and Great Plains birds: Generalities of biodiversity consequences. Global Change Biology 9(5):657–655.
- Plumpton, D. L., and Andersen, D. E. 1997. Habitat use and time budgeting by wintering ferruginous hawks. Condor 99(4):888–893. https://doi.org/10.2307/1370139
- Poff, N. L., M. M. Brinson, and J. W. Day. 2002. Aquatic ecosystems and climate change: potential impacts on inland freshwater and coastal wetland ecosystems in the United States.

Prepared for the Pew Center on Global Climate Change, Philadelphia, Pennsylvania, USA. https://doi.org/10.1039/b211160h

- Pollock, J., R. A. Miller, and J. D. Carlisle. 2014. Abundance and productivity of long-billed curlews (*Numenius americanus*) in the long-billed curlew Habitat Area of Critical Environmental Concern of southwest Idaho. 2014 Annual Report. Boise State University, Intermountain Bird Observatory, Idaho, USA.
- Porro, C. M., M. J. Desmond, J. A. Savidge, F. Abadi, K. K. Cruz-McDonnell, J. L. Davis, R. L. Griebel, R. T. Ekstein, and N. H. Rodríguez. 2020. Burrowing owl (*Athene cunicularia*) nest phenology influenced by drought on nonbreeding grounds. Auk 137(2):1–17. https://doi.org/10.1093/auk/ukaa008
- Preston, C. R. 1998. Ferruginous hawk. Colorado breeding bird atlas. Colorado Bird Atlas Partnership, Denver, Colorado, USA.
- Ray, J. D., N. E. McIntyre, M. C. Wallace, A. P. Teaschner, and M. G. Schoenhals. (2016). Factors influencing burrowing owl abundance in prairie dog colonies on the southern high plains of Texas. Journal of Raptor Research 50(2):185–193. https://doi.org/10.3356/rapt-50-02
- Robbins, J. 2020. With temperature rising, can animals survive the heat stress? Yale Environment 360, Yale School of the Environment, Yale University, New Haven, Connecticut, USA.
- Rogers, T. L., M. B. Ciaglia, H. Klinck and C. Southwell. 2013. Density can be misleading for low-density species: Benefits of passive acoustic monitoring. PLOS ONE 8(1):e52542.
- Ross, B. E., D. Haukos, C. Hagen, and J. Pitman. 2016. The relative contribution of climate to changes in lesser prairie-chicken abundance. Ecosphere 7(6):1–11.
- Ruth, J. 2000. Cassin's sparrow (*Aimophila cassinii*) status assessment and conservation plan. U.S. Fish and Wildlife Publications. U.S. Department of Interior, Fish and Wildlife Service,Washington, D.C., USA.
- Sauer, J. R., W. A. Link, and J. E. Hines. 2020. The North American breeding bird survey, analysis results 1966–2019. U.S. Geological Survey Data Release. U.S. Department of Interior, U.S. Geological Survey,Washington, D.C., USA.
- Savage, L. T., R. M. Reich, L. M. Hartley, P. Stapp, and M. F. Antolin. 2011. Climate, soils, and connectivity predict plague epizootics in black-tailed prairie dogs (*Cynomys ludovicianus*). Ecological Applications 21(8):2933–2943.
- Scott, A., K. Contreras, M. Stevenson, K. L. Hudman, and J. G. Kopachena. 2022. Survival of eggs to third instar of late-summer and fall-breeding monarch butterflies (*Danaus plexippus*) and queen butterflies (*Danaus gilippus*) in north Texas. Journal of Insect Conservation 27:233–248.
- Shane, T. G. 2000. Lark bunting (*Calamospiza melanocorys*). In A. F. Poole and F. B. Gill, editors. Birds of the world. Cornell Lab of Ornithology, Cornell University, Ithaca, New York, USA. https://birdsoftheworld.org/bow/species/larbun/cur/introduction
- Sherwin, H. A., W. I. Montgomery, and M. G. Lundy. 2013. The impact and implications of climate change for bats. Mammal Review 43:171–182.
- Slater, G. L., and C. Rock. 2005. Northern harrier (*Circus cyaneus*): A technical conservation assessment. U.S. Department of Agriculture, Forest Service, Rocky Mountain Region, Lakewood, Colorado, USA. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5182007.pdf. Accessed 16 February 2023.
- Smith, G. A., and M. V. Lomolino. 2004. Black-tailed prairie dogs and the structure of avian

communities on the shortgrass plains. Oecologia 138(4):592–602. https://doi.org/10.1007/s00442-003-1465-3

- Smith, K. G., S. R. Wittenberg, R. B. Macwhirter, and K. L. Bildstein. 2011. Northern harrier (*Circus cyaneus*), version 2.0. *In* A. F. Poole, editor. Birds of North America. Cornell Lab of Ornithology, Cornell University, Ithaca, New York, USA.
- Sohl, T. L. 2014. The relative impacts of climate and land-use change on conterminous United States Bird species from 2001 to 2075. PLOS ONE 9(11):e112251. https://doi.org/10.1371/journal.pone.0112251
- Solari, S. 2018. *Perimyotis subflavus*. IUCN Red List of Threatened Species 2018. International Union for the Conservation of Nature, Gland, Switzerland. https://www.iucnredlist.org/species/17366/22123514. Accessed 6 Jun 2023.
- Steenhof, K. 2020. Prairie falcon (*Falco mexicanus*), version 1.0. *In* A. F. Poole, editor. Birds of the World. Cornell Lab of Ornithology, Cornell University, Ithaca, New York, USA.
- Stein, B. A., D. M. Lawson, P. Glick, C. M. Wolf, and C. Enquist. 2019. Climate adaptation for DoD natural resource managers: A guide to incorporating climate considerations into Integrated Natural Resource Management Plans. National Wildlife Federation, Reston, Virginia, USA.
- Stein, B. A., P. Glick, N. Edelson, and A. Staudt (Eds.). 2014. Climate-smart conservation: Putting adaptation principles into practice. National Wildlife Federation, Reston, Virginia, USA.
- Stevens, A. F. J., E. M. Bayne, and T. I. Wellicome. 2011. Soil and climate are better than biotic land cover for predicting home-range habitat selection by endangered burrowing owls across the Canadian prairies. Biological Conservation 144(5):1526–1536. https://doi.org/10.1016/j.biocon.2010.10.032
- Süss, J., C. Klaus, F. W. Gerstengarbe, and P. C. Werner. 2008. What makes ticks tick? Climate change, ticks, and tick-borne diseases. Journal of Travel Medicine 15(1):39–45. https://doi.org/10.1111/j.1708-8305.2007.00176.x
- Swaby, Lt. D. 2003. BASH data for FY 1997 to 2002. Department of Air Force, Cannon AFB HQ AFSC/SEFW, New Mexico, USA.
- Texas Parks and Wildlife Department. 2022. Black-tailed prairie dog (*Cynomys ludovicianus*). State of Texas, Austin, USA. http://www.tpwd.state.tx.us/huntwild/wild/species/prairie/. Accessed 16 February 2023.
- U.S. Air Force (USAF) 2002. General plan for Cannon Air Force Base and Melrose Air Force Range, New Mexico. Cannon Air Force Base, New Mexico. USA.
- U.S. Air Force (USAF) 2003. Integrated Natural Resource Management Plan for Cannon Air Force Base and Melrose Air Force Range, New Mexico. 27th Fighter Wing, Cannon Air Force Base, New Mexico, USA.
- U.S. Air Force (USAF). 1996. Bird Aircraft Strike Hazard report for Cannon Air Force Base, New Mexico. Cannon Air Force Base, New Mexico, USA.
- U.S. Air Force (USAF). 2000a. Bird Aircraft Strike Hazard (BASH) procedures plan 91-212. 27th Fighter Wing, Cannon Air Force Base, New Mexico, USA.
- U.S. Air Force (USAF). 2000b. Force structure change environmental assessment for Cannon Air Force Base, New Mexico. Air Combat Command, Joint Base Langley-Eustis, Virginia, USA.
- U.S. Air Force (USAF). 2001. Defensive training initiative environmental assessment for Cannon Air Force Base and Melrose Air Force Range, New Mexico. Cannon Air Force Base, New

Mexico, USA.

- U.S. Air Force (USAF). 2016. Final environmental assessment for utilization enhancements at Melrose Air Force Range, New Mexico. Special Operations Command, Hurlburt Field, Florida, USA.
- U.S. Air Force (USAF). 2017. Cannon Air Force Base final spill prevention and response plan for petroleum/animal/vegetable oils, fuels, and lubricants. Cannon Air Force Base, New Mexico, USA.
- U.S. Census Bureau. 2020. Population finder: Melrose, New Mexico. U.S. Department of Commerce, Suitland, Maryland, USA. https://www.census.gov/search-results.html?searchType=webandcssp=SERPandq=Melrose%20village,%20New%20Mexico. Accessed 16 February 2023.
- U.S. Census Bureau. 2021. Quick facts: population finder: Clovis and Curry County, New Mexico. U.S. Department of Commerce, Suitland, Maryland, USA. https://www.census.gov/quickfacts/fact/table/currycountynewmexico,cloviscitynewmexico/PST045221. Accessed 16 February 2023.
- U.S. Department of Agriculture (USDA). 1967. Soil survey of Roosevelt County, New Mexico. Washington, D.C., USA.
- U.S. Department of Agriculture (USDA). 2017a. Ecological site description, gravelly. USDA-ARS Jornada Experimental Range, Natural Resources Conservation Service, New Mexico State University. https://edit.jornada.nmsu.edu/catalogs/esd/035X/R035XG114NM. Accessed 16 February 2023.
- U.S. Department of Agriculture (USDA). 2017b. Ecological site description, shallow. USDA-ARS Jornada Experimental Range, Natural Resources Conservation Service, New Mexico State University. https://edit.jornada.nmsu.edu/catalogs/esd. Accessed 16 February 2023.
- U.S. Department of Agriculture (USDA). 2017c. Ecological site description, shallow plains. USDA-ARS Jornada Experimental Range, Natural Resources Conservation Service, New Mexico State University. https://edit.jornada.nmsu.edu/catalogs/esd. Accessed 16 February 2023.
- U.S. Department of Agriculture (USDA). 2017d. Ecological site description, very shallow. USDA-ARS Jornada Experimental Range, Natural Resources Conservation Service, New Mexico State University. https://edit.jornada.nmsu.edu/catalogs/esd. Accessed 16 February 2023.
- U.S. Fish and Wildlife Service (USFWS). 2009. Endangered and threatened wildlife and plants; 12-month finding on a petition to list the black-tailed prairie dog as threatened or endangered. U.S. Department of Interior, Fish and Wildlife Service, Washington, D.C., USA. Federal Register 74(231):63343–63366. https://www.federalregister.gov/d/E9-28852. Accessed 16 February 2023.
- U.S. Fish and Wildlife Service (USFWS). 2017. U.S. Air Force pollinator conservation reference guide. Air Force Civil Engineer Center, Lackland, Texas, USA.
- U.S. Fish and Wildlife Service (USFWS). 2021a. Endangered and threatened wildlife and plants; lesser prairie-chicken; threatened status with section 4(d) rule for the northern distinct population segment and endangered status for the southern distinct population segment. U.S. Department of Interior, Fish and Wildlife Service, Washington, D.C., USA. Federal Register 86(103):29432–29482.
- U.S. Fish and Wildlife Service (USFWS). 2021b. Species status assessment report for the lesser prairie-chicken (*Tympanuchus pallidicinctus*), Version 2.2. U.S. Department of Interior, Fish and

Wildlife Service, Washington, D.C., USA. https://ecos.fws.gov/ServCat/DownloadFile/200539. Accessed 16 February 2023.

- U.S. Fish and Wildlife Service (USFWS). 2021c. Birds of Conservation Concern 2021. Migratory Bird Program, USFWS.Van Tighem, K. 1967. Destruction of the prairie falcon at Calgary, Alberta. Blue Jay 25(3).
- U.S. Forest Service [USFS]. 2015. Conservation and management of monarch butterflies: a strategic framework. U.S. Department of Agriculture, Washington, D.C., USA. https://www.fs.usda.gov/sites/default/files/media/types/publication/field_pdf/508%5B3%5D_Monarch.pdf. Accessed 10 Jan 2023.
- USFWS. 2020. Monarch (*Danaus plexippus*) species status assessment report, version 2.1. U.S. Department of Interior, Washington, D.C., USA.
- Venier, L. A., S. B. Holmes, G. W. Holborn, K. A. Mcilwrick and G. Brown. 2012. Evaluation of an automated recording device for monitoring forest birds. Wildlife Society Bulletin 36:30–39.
- Walker, A., K. S. Oberhauser, E. M. Pelton, and J. M. Pleasants. 2022. *Danaus plexippus*. IUCN Red List of Threatened Species 2022. International Union for the Conservation of Nature, Gland, Switzerland. https://www.iucnredlist.org/species/159971/219149911. Accessed 6 Jun 2023.
- Wellicome, T. I., Holroyd, G. L., Scalise, K., and E. R. Wiltse. 1997. The effects of predator exclusion and food supplementation on burrowing owl (*Speotyto cunicularia*) population change in Saskatchewan. Pages 487–497 *in* Duncan, J. R., D. H. Johnson, and T. H. Niccolls, editors. Biology and conservation of owls of the Northern Hemisphere. U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station, St. Paul, Minnesota, USA.
- Western Association of Fish and Wildlife Agencies. 2022. Southern Great Plains Crucial Habitat Assessment Tool. https://www.sgpchat.org/. Accessed 16 February 2023.
- Western Region Climate Center. 2009. Climate summary for Clovis, New Mexico (1910-2005). https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?nmclov. Accessed 16 February 2023.
- White House. 2014. Presidential memorandum—Creating a federal strategy to promote the health of honey bees and other pollinators. Office of the Press Secretary. https://obamawhitehouse.archives.gov/the-press-office/2014/06/20/presidential-memorandum-creating-federal-strategy-promote-health-honey-b. Accessed 16 February 2023.
- Whitford, W. G., A. G. de Soyza, J. W. Van Zee, J. E. Herrick, and K. M. Havstad. 1998. Vegetation, soil, and animal indicators of rangeland health. Environmental Monitoring and Assessment 51:179200.
- Wiggins, D. 2005. Loggerhead shrike (*Lanius ludovicianus*): A technical conservation assessment. U.S. Department of Agriculture, Forest Service, Rocky Mountain Region, Fort Collins, Colorado, USA. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5182049.pdf. Accessed 16 February 2023.
- Wilsey, C., L. Taylor, B. Bateman, C. Jensen, N. Michel, A. Panjabi, and G. Langham. 2019. Climate policy action needed to reduce vulnerability of conservation-reliant grassland birds in North America. Conservation Science and Practice 1(4):e21. https://doi.org/10.1111/csp2.21
- Yang, L. H., K. Swan, E. Bastin, J. Aguilar, M. Cenzer, A. Codd, N. Gonzalez, T. Hayes, A. Higgins, X. Lor, et al. 2022. Different factors limit early- and late-season windows of opportunity for monarch development. Ecology and Evolution 12(7):e9039.

- Yosef, D. 2020. Loggerhead shrike (*Lanius ludovicianus*), version 1.0. *In* A. F. Poole and F. B. Gill, editors. Birds of the world. Cornell Lab of Ornithology, Cornell University, Ithaca, New York, USA.
- Zipkin, E. F., and K. S. Oberhauser. 2012. Tracking climate impacts on the migratory monarch butterfly. Global Change Biology 18:3039–3049.
- Zylstra, E. R., N. Neupane, and E. F. Zipkin. 2022. Multi-season climate projections forecast declines in migratory monarch butterflies. Global Change Biology 28:6135–6151.

12.0 ACRONYMS

12.1 Standard Acronyms (Applicable to all AF installations)

- eDASH Acronym Library
- Natural Resources Playbook – Acronym Section
- U.S. EPA Terms & Acronyms

12.2 Installation Acronyms

°F	Degrees Fahrenheit
27 SOCES	27th Special Operations Civil Engineering Squadron
27 SOCES/CEP	27th Special Operations Civil Engineering Squadron/Programs Flight
ACC	Air Combat Command
AF	Air Force
AFB	Air Force Base
AFCEC	Air Force Civil Engineering Center
AFI	Air Force Instruction
AFMAN	Air Force Manual
AFPD	Air Force Policy Directive
AFRIMS	Air Force Records Management System
AFSOC	Air Force Special Operations Command
AFSOC/A7AV	Air Force Special Operations Command, Environmental
AFSOC/JA	Air Force Special Operations Command, Judge Advocate
AICUZ	Air Installation Compatible Use Zone
APZ	Accident Potential Zone
AST	Aboveground Storage Tank
BASH	Bird Aircraft Strike Hazard
BCC	Birds of Conservation Concern
BGEPA	Bald and Golden Eagle protection Act
BTPD	Black-tailed prairie dog
BUOW	Burrowing Owl
CAFB	Cannon Air Force Base
CCVA	Climate Change Vulnerability Assessment
CEMML	Center for Environmental Management of Military Lands
CFR	Code of Federal Regulations
CHAT	Crucial Habitat Assessment Tool
CLEO	Conservation Law Enforcement
CSU CEMML	Colorado State University Center for Environmental Management of Military Lands
CWA	Clean Water Act
CZ	Environmental Directorate
DoD	Department of Defense
DoDI	Department of Defense Instruction
DPS	Distinct Population Segment
DRMO	Defense Reutilization and Marketing Office
DZ	Drop Zone
EIAP	Environmental Impact Analysis Process

EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EMS	Environmental Management System
EO	Executive Order
EPA	Environmental Protection Agency
ERP	Environmental Restoration Program
ESA	Endangered Species Act
FW	Fighter Wing
FY	Fiscal Year
GIS	Geographic Information System
GSU	Geographically Separate Unit
HF	Harvested Furbearer
HQ	Headquarters
ICRMP	Integrated Cultural Resources Management Plan
IDP	Installation Development Plan
INRMP	Integrated Natural Resources Management Plan
IPCC	Intergovernmental Panel on Climate Change
IPMP	Integrated Pest Management Plan
LCTA	Land Condition Trend Analysis
LEPC	Lesser Prairie Chicken
MAFR	Melrose Air Force Range
MBTA	Migratory Bird Treaty Act
NEPA	National Environmental Policy Act
NMDGF	New Mexico Department of Game and Fish
NMED	New Mexico Environment Department
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NR	Natural Resources
NRHP	Natural Register of Historic Places
NRM	Natural Resources Manager
OSD	Office of the Secretary of Defense
PRECIP	Annual Average Precipitation
RCP	Representative Concentration Pathway
RCRA	Resource Conservation and Recovery Act
RSAF	Republic of Singapore Air Force
SGCN	Species of Greatest Conservation Need
SME	Subject Matter Expert
SoC	Species of Concern
SOCES/CE	Special Operations Civil Engineering Squadron, Civil Engineering Wing
SOCES/CEIE	Special Operations Civil Engineer Squadron Environmental Program Managers
SOF	Special Operations Forces
SOW	Special Operations Wing
ST	Sensitive Taxon
SWMU	Solid Waste Management Units
T&E	Threatened and Endangered

TAVE	Average Annual Temperature
TFW	Tactical Fighter Wing
USACE	United States Army Corps of Engineers
U.S.C.	United States Code
USFWS	United States Fish and Wildlife Service
USSOCOM	United States Special Operations Command
WFMP	Wildland Fire Management Plan

13.0 DEFINITIONS

13.1 Standard Definitions (Applicable to all AF installations)

Natural Resources Playbook – Definitions Section

13.2 Installation Definitions

N/A

14.0 APPENDICES

14.1 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.
Defense Appropriations Act of 1991, P.L. 101511; 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 11987, Exotic Organisms	Agencies shall restrict the introduction of exotic species into the natural ecosystems on lands and waters which they administer.
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 (U.S. EPA) authority to conduct reviews and inspections to monitor Federal facility compliance with pollution control standards.

Federal Public Laws and Executive Orders	
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, Exotic and 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 U.S. Fish and Wildlife Service (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.
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 public lands to protect the quality of scientific, scenic, historical, ecological, environmental, and archaeological resources and values; as well as to preserve and protect certain lands in their natural condition for fish and wildlife habitat. This Act 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 U.S. 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.

Federal Public Laws and Executive Orders	
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.
National Environmental Policy Act of 1969 (NEPA), as amended; P.L. 91-190, 42 U.S.C. § 4321 et seq.	Requires Federal agencies to use 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.

Federal Public Laws and Executive Orders	
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 Integrated Natural Resources Management Plan and public access to natural resources, and allows collection of nominal hunting and fishing fees. NOTE: AFMAN 32-7003 sec 3.9. Staffing. 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.

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.

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.
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.

USAF Instructions and Directives	
32 CFR Part 989, as amended, and AFI 32-7061, Environmental Impact Analysis Process	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.
AFI 32-7062, Air Force Comprehensive Planning	Provides guidance and responsibilities related to the USAF comprehensive planning process on all USAF-controlled lands.
AFMAN 32-7003, Integrated Natural Resources Management	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.
AFI 32-7065, Cultural Resources Management	This instruction implements AFPD 32-70 and 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.
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 3270 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.

14.2 Appendix B. Common Fauna and Habitat Associations

Class	Species	Scientific	Short Grass Prairie	Mesquite scrubland	Sandsage/ Soapweed Yucca	Sand hill	Canyon	Prairie dog town	Former prairie dog town	Woodland	Former homestead	HMA	Cropland	Managed	Disturbed	Urban	Playas	Ephemeral Streams	Habitats Used
Amphibian	New Mexico spadefoot toad	*Spea multiplicata*	x					x	x								x	x	5
Amphibian	barred tiger salamander	*Ambystoma tigrinum*															x	x	2
Amphibian	green toad	*Bufo debilis*															x	x	2
Amphibian	Woodhouse toad	*Bufo woodhousei*								x							x	x	3
Bird	common nighthawk	*Chordeiles minor*	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	15
Bird	mourning dove	*Zenaida macroura*	x	x	x	x	x	x	x	x	x	x	x	x	x	x			14
Bird	Swainson's hawk	*Buteo swainsoni*	x	x	x	x	x	x	x		x	x	x	x	x			x	13
Bird	northern harrier	*Circus Cyaneus*	x	x	x	x	x	x	x		x	x	x				x	x	12
Bird	raven	*Corvus spp.*	x	x	x	x	x	x	x		x	x	x					x	11
Bird	meadowlark	*Sturnella spp.*	x	x	x	x		x	x			x	x	x	x				10
Bird	scaled quail	*Callipepla squamata*	x	x	x	x	x					x	x		x			x	10
Bird	Cassin's sparrow	*Aimophila cassinii*	x	x	x	x		x	x								x		7
Bird	horned lark	*Eremophila alpestris*	x					x	x			x	x	x	x				7
Bird	lark bunting	*Calamospiza melanocorys*	x	x	x	x		x	x										6
Bird	killdeer	*Charadrius vociferus*	x					x	x				x	x			x		6
Bird	long-billed curlew	*Numenius americanus*	x					x	x				x	x			x		6
Bird	burrowing owl	*Athene cunicularia*	x					x	x										3
Bird	red-winged blackbird	*Agelaius phoeniceus*								x	x	x					x	x	5
Bird	barn swallow	*Hirundo rustica*									x					x	x	x	4
Bird	American robin	*Turdus migratorius*								x		x		x		x			4
Bird	great horned owl	*Bubo virginianus*					x			x	x			x					4
Bird	great-tailed grackle	*Quiscalus mexicanus*								x	x			x		x			4
Bird	ladder-backed woodpecker	*Picoides scalaris*								x	x			x		x			4
Bird	northern flicker	*Colaptes auratus*								x	x			x		x			4
Bird	western kingbird	*Tyrannus verticalis*								x	x		x	x					4
Bird	Mississippi kite	*Ictinia mississippiensis*												x		x	x		3
Bird	lark sparrow	*Chondestes grammacus*		x								x							2
Bird	white-crowned sparrow	*Zonotrichia leucophrys*								x		x		x					3
Bird	American avocet	*Recurvirostra americana*															x	x	2
Bird	Canada goose	*Branta canadensis*												x			x		2
Bird	Eurasian collared doves	*Streptopelia decaocto*								x				x		x			3
Bird	house sparrows	*Passer domesticus*												x		x			2
Bird	ring-necked pheasants	*Phasianus colchicus*											x		x				2
Bird	American coot	*Fulica americana*															x		1
Bird	American widgeon	*Anas americana*															x		1
Bird	black-crowned night heron	*Nycticorax nycticorax*															x		1
Bird	blue-winged teal	*Anas discors*															x		1

Class	Species	Scientific	Short Grass Prairie	Mesquite scrubland	Sandsage/ Soapweed Yucca	Sand hill	Canyon	Prairie dog town	Former prairie dog town	Woodland	Former homestead	HMA	Cropland	Managed	Disturbed	Urban	Playas	Ephemeral Streams	Habitats Used
Bird	double-crested cormorant	*Phalacrocorax auritus*															x		1
Bird	eared grebe	*Podiceps nigricollis*															x		1
Bird	great blue heron	*Ardea herodias*															x		1
Bird	green-winged teal	*Anas crecca*															x		1
Bird	mallard	*Anas platyrhynchos*															x		1
Bird	northern shoveler	*Anas clypeata*															x		1
Bird	ring-necked duck	*Aythya collaris*															x		1
Bird	ruddy duck	*Oxyura jamaicensis*															x		1
Bird	rock wren	*Salpinctes obsoletus*					x												0
Mammal	coyote	*Canis latrans*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	16
Mammal	mule deer	*Odocoileus hemionus*	x	x	x	x	x	x	x			x	x	x	x		x	x	14
Mammal	white footed mice	*Peromyscus leucopus*	x	x	x		x	x	x	x	x	x	x	x	x	x		x	14
Mammal	desert cottontail	*Sylvilagus audubonii*	x	x	x	x		x	x	x	x	1	x	x	x			x	14
Mammal	black-tailed jackrabbit	*Lepus californicus*	x	x	x	x		x	x			x		x	x			x	10
Mammal	deer mouse	*Peromyscus maniculatur*	x	x			x	x	x	x	x		x		x			x	10
Mammal	western harvest mouse	*Reithrodontomys montanus*	x	x	x			x	x	x			x					x	9
Mammal	thirteen-lined ground squirrel	*Spermophilus tridecumlineatus*	x			x		x	x					x				x	7
Mammal	pronghorn antelope	*Antilocapra americana*	x	x				x	x				x					x	6
Mammal	hispid pocket mouse	*Chaetodipus hispidus*	x	x				x	x	x								x	6
Mammal	plains pocket gopher	*Geomys bursarius*	x					x	x					x					4
Mammal	plains pocket mouse	*Perognathus flavescens*	x				x	x	x										4
Mammal	silky pocket mouse	*Perognathus flavus*	x			x		x	x										4
Mammal	northern grasshopper mouse	*Onychomys leucogaster*	x					x	x	x									4
Mammal	black-tailed prairie dog	*Cynomys ludovicianus*	x					x											2
Mammal	common raccoon	*Procyon lotor*					x			x	x	x	x		x	x	x	x	9
Mammal	hispid cotton rat	*Sigmodon hispidus*					x			x	x			x	x			x	6
Mammal	striped skunk	*Mephitis mephitis*								x	x	x						x	4
Mammal	house mouse	*Mus musculus*											x	x		x			3
Mammal	southern plains woodrat	*Neotoma micropus*		x			x			x	x								4
Mammal	porcupine	*Erethizon dorsatum*								x	x								2
Mammal	Ord's kangaroo rat	*Dipodomys ordii*				x													1
Reptile	bullsnake	*Pituophis melanoleucas*	x	x	x	x	x	x	x	x	x	x			x			x	13
Reptile	prairie rattlesnake	*Crotalus viridis*	x	x	x	x	x	x	x	x	x	x			x			x	12
Reptile	western coachwhip	*Masticophis flagellum*	x	x	x	x	x	x	x	x	x	x			x			x	12
Reptile	ornate box turtle	*Terrapene ornata*	x	x	x	x	x	x	x	x		x			x			x	11
Reptile	six-lined racerunner	*Cnemidophorus sexlineatus*	x	x	x	x	x	x	x					x				x	9
Reptile	plains hognose	*Heterodon nasicus*	x	x	x		x	x	x		x	x					x	x	10
Reptile	many-lined skink	*Eumeces multivirgatus*	x	x	x	x	x	x	x	x								x	9
Reptile	Texas horned lizard	*Phrynosoma cornutum*	x	x	x	x		x	x									x	7
Reptile	side-blotched lizard	*Uta stansburiana*	x		x	x	x	x	x									x	7
Reptile	prairie lizard	*Sceloporus undulatus*	x	x	x		x	x	x										6
Reptile	mud turtle	*Kinosternon flavescens*															x		1
		# using habitat	**39**	**29**	**26**	**24**	**24**	**38**	**37**	**29**	**25**	**24**	**21**	**28**	**19**	**14**	**31**	**34**	
		% using habitat	50.00	37.18	33.33	30.77	30.77	48.72	47.44	37.18	32.05	30.77	26.92	35.90	24.36	17.95	39.74	43.59	

14.3 Appendix C. Fauna of CAFB and MAFR

Fauna Observed During Surveys and Monitoring Programs from 2014 to 2016

Cannon Air Force Base and Melrose Air Force Range

Class	Species	Common Name
Amphibia	*Ambystoma mavortium*	Barred Tiger Salamander
Amphibia	*Spea multiplicata*	New Mexico Spadefoot Toad
Amphibia	*Anaxyrus woodhousii*	Woodhouse Toad
Aves	*Recurvirostra americana*	American Avocet
Aves	*Falco sparverius*	American Kestrel
Aves	*Turdus migratorius*	American Robin
Aves	*Spizelloides arborea*	American Tree Sparrow
Aves	*Myiarchus cinerascens*	Ash-throated Flycatcher
Aves	*Hirundo rustica*	Barn Swallow
Aves	*Tyto alba*	Barn Owl
Aves	*Himantopus mexicanus*	Black-necked stilt
Aves	*Passerina caerulea*	Blue Grosbeak
Aves	*Anas discors*	Blue-winged Teal
Aves	*Icterus bullockii*	Bullock's Oriole
Aves	*Campylorhynchus brunneicapillus*	Cactus Wren
Aves	*Peucaea cassinii*	Cassin's Sparrow
Aves	*Corvus cryptolecucus*	Chihuahuan Raven
Aves	*Spizella pallida*	Clay-colored Sparrow
Aves	*Spizella passerina*	Chipping Sparrow
Aves	*Chordeiles minor*	Common Nighthawk
Aves	*Toxostoma curvirostre*	Curved-billed Thrasher
Aves	*Junco hyemalis*	Dark-eyed Junco
Aves	*Streptophelia decaocto*	Eurasian Collared Dove
Aves	*Buteo regalis*	Ferruginous Hawk
Aves	*Aquila chrysaetos*	Golden Eagle
Aves	*Bubo virginianus*	Great Horned Owl

Class	Species	Common Name
Aves	*Quiscalus mexicanus*	Great-tailed Grackle
Aves	*Geococcyx californianus*	Greater Roadrunner
Aves	*Cartharsus guttatus*	Hermit Thrush
Aves	*Eremophila alpestris*	Horned Lark
Aves	*Charadrius vociferus*	Killdeer
Aves	*Dryobates scalaris*	Ladder-backed Woodpecker
Aves	*Calamospiza melanocorys*	Lark Bunting
Aves	*Chondestes grammacus*	Lark Sparrow
Aves	*Spinus psaltria*	Lesser Goldfinch
Aves	*Tringa flavipes*	Lesser Yellowlegs
Aves	*Lanius lodovicianus*	Loggerhead Shrike
Aves	*Anas platyrhynchos*	Mallard
Aves	*Falco columbarius*	Merlin
Aves	*Ictinia mississippiensis*	Mississippi Kite
Aves	*Zenaida macroura*	Mourning Dove
Aves	*Colinus virginianus*	Northern Bobwhite Quail
Aves	*Circus cyaneus*	Northern Harrier
Aves	*Mimus polyglottos*	Northern Mockingbird
Aves	*Falco mexicanus*	Prairie Falcon
Aves	*Falco peregrinus*	Peregrine Falcon
Aves	*Melanerpes erythrocephalus*	Red-headed Woodpecker
Aves	*Agelaius phoeniceus*	Red-winged Blackbird
Aves	*Salpinctes obsoletus*	Rock Wren
Aves	*Regulus calendula*	Ruby-crowned Kinglet
Aves	*Aimophila ruficeps*	Rufous-crowned Sparrow
Aves	*Oreoscoptes montanus*	Sage Thrasher
Aves	*Grus canadensis*	Sandhill Crane
Aves	*Passerculus sandwichensis*	Savannah Sparrow
Aves	*Sayornis saya*	Say’s Phoebe

Class	Species	Common Name
Aves	*Callipepla squamata*	Scaled Quail
Aves	*Tyrannus forficatus*	Scissor-tailed Flycatcher
Aves	*Asio flammeus*	Short-eared Owl
Aves	*Melospizia melodia*	Song Sparrow
Aves	*Pipilo maculatus*	Spotted Towhee
Aves	*Buteo swainsoni*	Swainson's Hawk
Aves	*Cathartes aura*	Turkey Vulture
Aves	*Pooecetes gramineus*	Vesper Sparrow
Aves	*Sialia mexicana*	Western Bluebird
Aves	*Athene cunicularia hypugaea*	Western Burrowing Owl
Aves	*Tyrannus verticalis*	Western Kingbird
Aves	*Sturnella neglecta*	Western Meadowlark
Aves	*Znotrichia leucophrys*	White Crowned Sparrow
Aves	*Zenaida asiatica*	White-winged Dove
Aves	*Cardellina pusilla*	Wilson's Warbler
Aves	*Sphyrapicus varius*	Yellow-bellied Sapsucker
Aves	*Xanthocephalus*	Yellow-headed Blackbird
Aves	*Setophaga coronata*	Yellow-rumped Warbler
Mammalia	*Taxidea taxus*	American Badger
Mammalia	*Lepus californicus*	Black-tailed Jackrabbit
Mammalia	*Cynomys ludovicianus*	Black-tailed Prairie Dog
Mammalia	*Lynx rufus*	Bobcat
Mammalia	*Canis latrans*	Coyote
Mammalia	*Sylvilagus audubonii*	Desert Cottontail
Mammalia	*Urocyon cinereoargenteus*	Gray Fox
Mammalia	*Sigmodon hispidus*	Hispid Cotton Rat
Mammalia	*Chaetodipus hispidus*	Hispid Pocket Mouse
Mammalia	*Mus musculus*	House Mouse
Mammalia	*Odocoileus hemionus*	Mule Deer

Class	Species	Common Name
Mammalia	*Odocoileus virginianus*	White-tailed Deer
Mammalia	*Peromyscus manicualtus*	North American Deer Mouse
Mammalia	*Onychomys leucogaster*	Northern Grasshopper Mouse
Mammalia	*Dipodomys ordii*	Ord's Kangaroo Rat
Mammalia	*Reithrodontomys montanus*	Plains Harvest Mouse
Mammalia	*Geomys bursarius*	Plains Pocket Gopher
Mammalia	*Perognathus flavescens*	Plains Pocket Mouse
Mammalia	*Antilocapra americanus*	Pronghorn
Mammalia	*Perognathus flavus*	Silky Pocket Mouse
Mammalia	*Neotoma micropus*	Southern plains woodrat
Mammalia	*Spermophilus spilosoma*	Spotted Ground Squirrel
Mammalia	*Mephitis mephitis*	Striped Skunk
Mammalia	*Spermophilus tridecemlinatus*	Thirteen-lined ground squirrel
Mammalia	*Reithrodontomys megalotis*	Western Harvest Mouse
Mammalia	*Peromyscus leucopus*	White-footed Mouse
Mammalia	*Neotoma albigula*	White-throated Woodrat
Reptilia	*Pituophis catenifer*	Bullsnake
Reptilia	*Aspidoscelis exsanguis*	Chihuahuan Spotted Whiptail
Reptilia	*Crotaphytus collaris*	Common Collared lizard
Reptilia	*Uta stansburiana*	Common Side-blotched Lizard
Reptilia	*Terrepene ornata luteola*	Desert box turtle
Reptilia	*Plestiodon obsoletus*	Great Plains Skink
Reptilia	*Holbrookia maculate*	Lesser Earless Lizard
Reptilia	*Sistrurus catenatus*	Massasauga Rattlesnake
Reptilia	*Crotalus viridis*	Prairie Rattlesnake
Reptilia	*Phrynosoma cornutum*	Texas Horned Lizard
Reptilia	*Masticophis flagellum*	Western Coachwhip
Reptilia	*Crotalus atrox*	Western Diamondback Rattlesnake

Class	Species	Common Name
Reptilia	*Kinosternon flavescens*	Yellow Mud Turtle

14.4 Appendix D. Invasive and Noxious Plants of East-Central New Mexico

Invasive and Noxious Plants of East-Central New Mexico

Common Name	Scientific Name	County of Occurrence		
		Roosevelt	Curry	Bordering County
Russian knapweed	*Acroptilon repens* (L.) DC.	No	No	Yes
Tree of heaven	*Ailanthus altissima*	Yes	Yes	No
Camelthorn	*Alhagi maurorum* Medik.	No	No	Yes
Cheatgrass	*Bromus tectorum*	No	No	Yes
Hoary cress	*Cardaria draba* (L.) Desv.	No	No	Yes
Musk thistle	*Carduus nutans* L.	No	No	Yes
Purple starthistle	*Centaurea calcitrapa* L.	No	No	Yes
Malta starthistle	*Centaurea melitensis* L.	No	No	Yes
Yellow starthistle	*Centaurea solstitialis* L.	No	No	Yes
Canada thistle	*Cirsium arvense* (L.) Scop.	No	No	Yes
Bull thistle	*Cirsium vulgare* (Savi) Ten.	Yes	No	Yes
Field bindweed*	*Convolvulus arvensis* L.	Yes	Yes	No
Russian olive	*Elaeagnus angustifolia* L.	Yes	No	Yes
Halogeton	*Halogeton glomeratus* (M. Bieb.) C.A. Mey	No	No	Yes
Perennial pepperweed	*Lepidium latifolium* L.	No	No	Yes
Oxeye daisy	*Leucanthemum vulgare*	Yes	No	Yes
Scotch thistle	*Onopordum acanthium* L.	Yes	No	Yes
African rue	*Peganum harmala* L.	No	No	Yes
Saltcedar*	*Tamarix* L.	Yes	Yes	Yes
Siberian elm*	*Ulmus pumila* L.	Yes	Yes	Yes

* Known to occur on CAFB or MAFR

14.5 Appendix E. Suggested Landscape Plants

Botanical Name	Common Name	Native/Indigenous	Evergreen/Deciduous	Mature Height (feet)	Mature Width (feet)	Min. Planting Size	Irrigation Requirements	Barrier	Screen	Accent	Street Tree	AT/FP	Golf Course
Trees													
Acacia farnesiana	Huisache	N	ED	25	25	15	L			♦		♦	
Acer glabrum 'Neomexicanum"	Rocky Mtn. maple	N	D	35	30	3"	M				♦	♦	♦
Cercis canadensis	Eastern redbud	I	D	20	20	15	ML			♦		♦	♦
Chilopsis linearis	Desert willow	N	D	20	15	15	ML				♦	♦	
Cupressus arizonica	Arizona cypress	N	E	65	45	15	L		♦				♦
Fraxinus velutina 'Modesto'	Modesto Ash	N	D	50	40	5	M				♦	♦	♦
Juniperus deppeana	Alligator juniper	N	E	20	15	15	L	♦	♦				♦
Juniperus scopulorum	Rocky Mtn. juniper	N	E	35	15	15	L	♦	♦				♦
Magnolia grandiflora	Southern magnolia	I	E	50	30	15	M		♦				
Picea pungens	Blue spruce	N	E										
Pinus edulis	Pinyon pine	N	E	15	10	15	L		♦			♦	
Pinus eldarica	Afghan pine	I	E	45	25	15	L	♦	♦		♦		♦
Pinus thunbergiana	Japanese black pine	I	E	20	15	15	M			♦		♦	
Platanus acerifolia	London plane tree	I	D	65	65	5	M				♦	♦	♦
Quercus shumardii	Shumard red oak	I	D	50	40	15	L					♦	♦

Botanical Name	Common Name	Native/Indigenous	Evergreen/Deciduous	Mature Height (feet)	Mature Width (feet)	Min. Planting Size	Irrigation Requirements	Barrier	Screen	Accent	Street Tree	AT/FP	Golf Course
Quercus texanum	Texas oak	I	D	25	25	15	L				♦	♦	
Salix matsudana 'Navaho'	Globe Navajo Willow	I	D	20	20	5	M						♦
Shrubs													
Aucuba japonica	Aucuba	I	E	4	5	1	M		♦	♦			
Berberis fendleri	Colorado barberry	N	E	6	6	5	M	♦			♦		
Berberis thunbergerii	Japanese barberry	I	ED	3	4	5	M	♦			♦	♦	
Buxus japonicum	Japanese boxwood	I	E	4	4	1	L		♦		♦		
Cercocarpus montanus	Mountain Mahogany	N	D	12	12	5	L		♦				
Cotoneaster spp.	Cotoneaster	I	ED	V	V	5	M				♦		
Dasylirion wheeleri	Sotol/Desert Spoon	N	E	12	8	5g	L	♦	♦	♦	♦	♦	♦
Ericameria laricifolia	Turpentine bush	N	E	3	2	1	L					♦	
Fouquieria splendens	Ocotillo	N	D	15	15	7	L			♦	♦	♦	
Gaura coccinea	Scarlet gaura	N	E	3	2	1	L					♦	
Hesperaloe parviflora	Red yucca	I	E	3	4	1	L				♦	♦	

Botanical Name	Common Name	Native/Indigenous	Evergreen/Deciduous	Mature Height (feet)	Mature Width (feet)	Min. Planting Size	Irrigation Requirements	Barrier	Screen	Accent	Street Tree	AT/FP	Golf Course
Ilex vomitoria	Yaupon holly	N	E	15	15	5	L		♦		♦		♦
Juniperus chinensis 'Armstrong'	Armstrong juniper	I	E	5	5	5	L	♦	♦		♦		
Juniperus chinensis 'Pfitzerana'	Pfitzer juniper	I	E	5	6	5	L	♦	♦		♦		
Juniperus chinensis 'Sea Green'	Sea green juniper	I	E	6	8	5	L	♦	♦		♦		
Mahonia haematocarpa	Algerita	N	E	5	5	5	L	♦	♦	♦	♦		
Mahonia repens	Creeping mahonia	N	E	1	1.5	5	L			♦		♦	
Nandina domestica spp.	Heavenly bamboo	I	E	V	V	1	L	♦	♦	♦	♦		
Raphiolepis indica spp.	Indian hawthorn	I	E	V		5	M						
Rosa banksiae	Tombstone rose	I	ED	12	V	1	L			♦			
Salvia greggii	Autumn sage	N	E	3	3	1	L			♦		♦	
Salvia spp.	Sage varieties	NI	E	3	3	1	L			♦	♦	♦	
Sophora secundiflora	Texas mntn laurel	N	E	15	15	15	L		♦			♦	♦
Spirea spp.	Bridal wreath, etc.	I	ED	V	V	5	M		♦	♦			

Botanical Name	Common Name	Native/Indigenous	Evergreen/Deciduous	Mature Height (feet)	Mature Width (feet)	Min. Planting Size	Irrigation Requirements	Barrier	Screen	Accent	Street Tree	AT/FP	Golf Course
Viburnum opulus 'Roseum'	Snowball	I	D	10	12	5	M		♦				
Yucca elata	Soaptree	N	E			1	L	♦		♦		♦	
Yucca recurvifolia	Pendulous yucca	I	E			1	L	♦		♦		♦	
Perennials													
Baileya multiradiata	Desert marigold	N				1							
Aquilegia spp.	Colorado columbine	N				1							
Ratibida columnifera	Coneflower	N				1							
Hemerocallis spp.	Daylily	I				1							
Castilleja integra	Indian paintbrush	N				1							
Psilostrophe tagetina	Paperflower	N				1							
Penstemon spp.	Penstemon	N				1							
Groundcovers													
Dalea greggii	Gregg Dalea	N	E	.75	3	1	L			♦		♦	
Euonymus fortunei	Creeping euonymus	I	E	.75	2	1	L			♦		♦	
Juniperus horizontalis 'Bar Harbor'	Bar Harbor juniper	I	E	1.5	3	3	L				♦		

Botanical Name	Common Name	Native/Indigenous	Evergreen/Deciduous	Mature Height (feet)	Mature Width (feet)	Min. Planting Size	Irrigation Requirements	Barrier	Screen	Accent	Street Tree	AT/FP	Golf Course
Juniperus horizontalis 'Wiltonii'	Wilton carpet juniper	I	E	1	3	3	M					♦	
Juniperus sabina 'Broadmoor'	Broadmoor juniper	I	E	2	5	5	M	♦			♦		
Juniperus sabina 'Tamariscifolia'	Tam juniper	I	E	3	5	5	M	♦			♦		
Sedum spp.	Stonecrop	NI	E	.75	2	1	L			♦		♦	
Grasses													
Bouteloua gracilis	Blue grama	N										♦	♦
Buchloe dactyloides	Buffalo grass	N									♦	♦	♦
Cynodon dactylon	Bermuda grass	I	D								♦	♦	♦
Cynodon spp. hybrids	Tifdwarf, Tifsport, etc.	I	D								♦	♦	♦
Festuca caesia	Blue fescue	I	E									♦	♦
Aristida purpurea var. *longiseta*	Purple threeawn	N	ED									♦	♦
Festuca caesia	Blue fescue	I	E							♦		♦	♦
Aristida purpurea var. longiseta	Purple threeawn	N	ED							♦		♦	♦

14.6 Appendix F. Melrose Air Force Range Plant List 2015 & 2016

Scientific Name	Common Name
Agropyron spp.	Wheatgrass
Ambrosia psilostachya	Western ragweed
Amphiachyris dracunculoides	Prairie broomweed
Andropogon gerardii	Big bluestem
Andropogon hallii	Sand bluestem
Aristida oligantha	Prairie threeawn
Aristida purpurea var. *longiseta*	Purple threeawn
Artemisia bigelovii	Bigelow sage
Artemisia filifolia	Sand sagebrush
Artemisia ludoviciana	White sagebrush
Aster spp.	Undifferentiated aster species
Astragalus spp.	Milkvetch/locoweed spp.
Baccharis pteronioides	Yerba de pasmo
Bassia scoparia	Kochia
Berlandiera lyrata	Chocolate daisy
Bothriochloa ischaemum var. *songarica*	Yellow bluestem/King Ranch bluestem
Bouteloua curtipendula	Side oats grama
Bouteloua eriopoda	Black grama
Bouteloua gracilis	Blue grama
Bouteloua hirsuta	Hairy grama
Bouteloua laguroides	Silver bluestem
Buchloe dactyloides	Buffalograss
Chaetopappa ericoides	Rose heath
Chamaecrista leptadenia	Sensitive partridge pea
Chamaesyce geyeri (Euphorbia geyeri)	Geyer's sandmat
Chamaesyce lata (Euphorbia lata)	Hoary sandmat
Chenopodium berlandieri	Pitseed goosefoot
Chenopodium spp.	Goosefoot
Chloacantha spinosa	Spiny cloracantha
Chloris barbata (Chloris inflata)	Swollen fingergrass
Chloris cucullata	Hooded windmill grass
Chloris verticillata	Tumble windmill grass
Chysopis villosa	Hoary false goldenaster
Cirsium ochrocentrum	Yellowspine thistle
Commelina erecta	Whitemouth dayflower
Conyza coulteri	Coulter horseweed
Crepis occidentalis	Largeflower hawksbeard
Croton pottsii	Leatherweed
Croton texensis	Texas croton
Cryptantha crassisepala	Thicksepal catseye
Curcubita foetidissima	Buffalo gourd/Missouri gourd
Cylindropuntia davisii	Thistle cholla
Cylindropuntia imbricata	Tree cholla
Cyperus esculentus	Yellow nutsedge

Scientific Name	Common Name
Cyperus spp.	Undifferentiated sedge species
Dalea aurea	Golden prairie clover
Dalea formosa	Featherplume
Descurainia pinnata	Tansymustard
Desmanthus cooleyi	Cooley's bundleflower
Digitaria cognata	Fall witchgrass
Dysphania spp.	Dysphania (Mexican tea/wormseed)
Echinocereus reichenbachii	Lace hedgehog cactus
Echinocereus rigidissimus	Rainbow hedgehog cactus
Echinocereus spp.	Hedgehog cactus
Engelmannia peristenia	Englemann's daisy
Ephedra torreyana	Torrey's jointfir/mormon-tea
Eriogonum abertianum	Abert's buckwheat
Eriogonum annuum	Annual buckwheat
Eriogonum havardii	Havard's buckwheat
Eriogonum spp.	Undifferentiated buckwheat species
Erioneuron pilosum	Hairy tridens
Evolvulus sericeus	Silver dwarf morning-glory
Evolvus nuttallianus	Shaggy dwarf morning-glory
Frankenia jamesii	James' seaheath
Gaillardia multiceps	Onion blanketflower
Gaillardia pulchella	Indian blanket
Gaillardia spp.	Blanketflower
Gaura coccinea	Scarlet gaura
Glandularia wrightii/ Glandularia bipinnatifida	Davis Mountain mock vervain
Grindellia sqarrosa	Curly-cup gumweed
Gutierrezia sarothrae	Broom snakeweed
Helianthus annuus	Common sunflower
Helianthus petiolaris	Prairie sunflower
Heliotropium convolvulaceum	Wide-flower heliotrope
Hesperostipa neomexicana	New Mexico needlegrass
Hoffmannseggia glauca	Indian rushpea
Hymenopappus filifolius	Fine-leaf woolywhite
Hymenopappus flavescens	Yellow woolywhite
Hymenoxys odorata	Bitter rubberweed
Krameria lanceolata	Trailing rhatany
Lepidium spp.	Undifferentiated pepperweed species
Lesquerella fendleri	Fendler's bladderpod
Leucelene ericoides	Rose heath
Linum aristatum	Bristle flax
Lycurus phleoides	Wolfstail
Machaeranthera pinnatifida	Spiny aster
Machaeranthera tanacetifolia	Tahoka daisy
Melampodium leucanthum	Plains blackfoot
Mentzelia strictissima	Grassland blazingstar
Mimosa borealis	Fragrant mimosa

Scientific Name	Common Name
Monroa squarrosa	False buffalograss
Muhlenbergia arenicola	Sand muhley
Muhlenbergia torreyi	Ringed muhley
Muhlenbergia spp.	Undifferentiated muhley species
Opuntia spp.	Undifferentiated prickly-pear cactus species
Panicum capillare	Witchgrass
Panicum halli var. *halli*	Hall's panicum
Panicum obtusum	Vine mesquite
Panicum virgatum	Switchgrass
Plantago spp.	Undifferentiated plantain species
Pleuraphis mutica (Hilaria mutica)	Tobosa
Prosopis glandulosa	Honey mesquite
Psilostrophe tagetinae	Wooly paper flower
Ratibida columnaris	Prairie coneflower
Salsola kali	Russian thistle
Schizachyrium scoparium	Little bluestem
Scleropogon brevifolius	Burrograss
Senecio douglasii	Smooth threadleaf ragwort
Senecio flaccidus	Threadleaf ragwort
Senecio spartoides	Broom groundsel
Setaria leucopila	Plains bristlegrass
Solanum elaeagnifolium	Silverleaf nightshade
Solanum rostratum	Buffalobur nightshade
Solanum sp.	Undifferentiated nightshade species
Spergularia sparsiflora	Salt sandspurry
Sphaeralcea coccinea	Scarlet globemallow
Sporobolus cryptandrus	Sand dropseed
Stillingia sylvatica	Queen's delight
Tetraneuris scaposa	Stemmy four-nerve daisy
Teucrium lacinatum	Lacy germander
Thelesperma megapotamicum	Hopi-tea
Tridens albescens	White tridens
Yucca glauca	Soapweed yucca
Zinna grandiflora	Plains zinnia

14.7 Appendix G. Locations of Black-tailed Prairie Dog Towns on Melrose Air Force Range in 2021 (NRI 2021d).

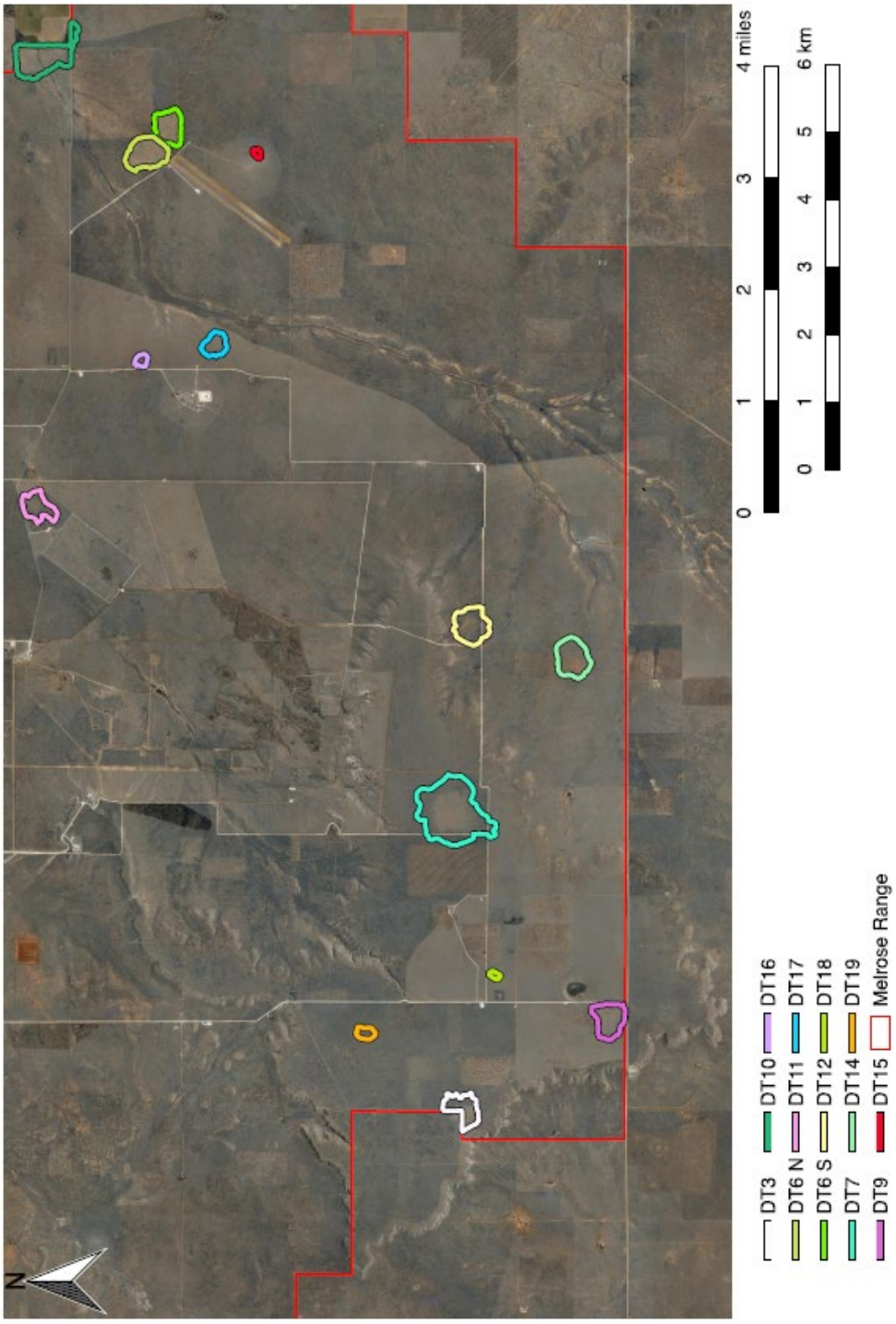


Figure 6. Locations of Black-tailed prairie dog towns and survey points on Melrose Air Force Range in 2021.

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 - CAFB Sustainable Landscape Development Plan

15.4 Tab 4 - Integrated Cultural Resources Management Plan (ICRMP)

15.5 Tab 5 - Installation Development Plan (IDP)

15.6 Tab 6 - Integrated Pest Management Plan (IPMP)