INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

ARMY NATIONAL TRAINING CENTER AND FORT IRWIN, CALIFORNIA

UNITED STATES DEPARTMENT OF THE ARMY

August 2024

REVISED INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN
NATIONAL TRAINING CENTER AND FORT IRWIN
CALIFORNIA

This Integrated Natural Resources Management Plan (INRMP) has been reviewed for Operation and Effect and updated with current mission and program management requirements. It is consistent with the Sikes Act, as amended (16 United States Code [U.S.C.] §670a et seq.), and sets appropriate and adequate guidelines for mission support and conservation of natural resources at the NTC and Fort Irwin.

Date: 03Dec2024

Garrison Commander
United States Army Garrison Fort Irwin

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Executive Summary

Established in 1980, the National Training Center (NTC) and Fort Irwin encompass 753,537 acres in San Bernardino County, California. NTC and Fort Irwin provide training for the U.S. Army and joint military branches. Because of its size, design, and terrain, the NTC is one of the only locations in the world where brigade-size units (5,000+ Soldiers) can test their combat readiness. The training needs and requirements of the U.S. Army change as new weapons and defense systems are developed, as new threats in different parts of the globe emerge, and as the tactics and technology used by enemies change.

NTC and Fort Irwin contain complex ecosystems with diverse habitats and hundreds of plant and animal species across 753,537 acres, with only seven year-round sources of water. Various arid desert habitats exist throughout the installation, including creosote bush scrub communities; dry lake beds/alkali flats; five rugged block-faulted mountain ranges separated by alluvium and lacustrine-filled basins; bajadas; extensive and complex dendritic networks of canyons, arroyos, and washes; boulder/rock outcrops of granite or volcanic basalt; sand dunes; and seeps and springs. The Army actively participates in the Mojave Desert Ecosystem Program and other regional initiatives.

NTC and Fort Irwin also provide habitat for more than 580 species of Mojave Desert plants, 160 resident or migrant avian species, 35 mammals, 30 reptiles, and 1 (non-native) fish. There are several species endemic to the Mojave Desert that are not found anywhere else in the world.

The Sikes Act Improvement Act (SAIA) of 1997 (16 U.S. Code [U.S.C.] §670a et seq., as amended), and Department of Defense (DoD) and Army Policy require military installations with significant natural resources to develop an Integrated Natural Resources Management Plan (INRMP). The INRMP defines natural resources management activities and priorities, and provides the vehicle by which the installation participates in regional planning efforts under the West Mojave Coordinated Management Plan.

An INRMP was first developed for the NTC and Fort Irwin in 1999 and updated in 2006. This revised INRMP incorporates changes as described in the *Legislative Environmental Impact Statement for Military Training and Public Land Withdrawal Extension* (U.S. Army 2021a), which includes an additional 110,000 acres and habitat for federally listed species and updated natural resources data since 2006. To ensure effective implementation, the plan will be assessed and adjusted annually in coordination with FWS and CDFW; and undergo thorough review at least every five years.

The NTC and Fort Irwin will use ecosystem management to guide the natural resources program and inform goals and priorities. Implementation of this INRMP will support the mission, vision, and priorities of the NTC and Fort Irwin. Goals reflect this vision, and each goal is supported by objectives tied to criteria and policies for achieving the stated goal. The objectives drive the development of activities and projects to achieve those objectives. The goals and objectives in this updated INRMP are a consolidation and continuation of the goals and objectives in the 1999 and 2006 INRMPs.

Two interrelated programs are essential to implementing this INRMP: the Directorate of Public Works-Environmental Division (DPW-ENV) Natural Resources Management, and Integrated Training Area Management (ITAM). ITAM and DPW-ENV integrate the military mission and natural resources in different ways and together ensure sustainable use of training lands while providing strong consideration for environmental stewardship.

Military Mission Benefits: Implementation of this INRMP will enhance mission realism by maintaining realistic training lands. It will reduce maintenance costs and improve health, safety, and the ability for long-range planning at the NTC and Fort Irwin.

Environmental Benefits: The INRMP provides the basis for conserving natural resources. The prescribed management activities will reduce vegetation loss and soil erosion due to military activities, reduce the potential for environmental pollution, and provide biodiversity conservation. Plan implementation will increase overall knowledge of the NTC and Fort Irwin ecosystem through surveys and research.

Other Benefits: Soldier environmental awareness will be enhanced while training at the installation. Quality of life for the NTC and Fort Irwin community will be improved. INRMP implementation will decrease long-term environmental costs and reduce personal and installation liabilities from environmental non-compliance.

This INRMP supports the military mission by conserving and enhancing training lands upon which the mission is critically dependent and supporting large-scale force-on-force training exercises. The INRMP also describes recreational opportunities associated with natural resources of the NTC and Fort Irwin community, thus supporting the U.S. Army's commitment to the Quality of Life and Communities of Excellence programs.

The INRMP describes the impacts of the military mission on natural resources and the means to offset them. However, this INRMP does not evaluate the NTC and Fort Irwin's military mission, nor does it replace any requirement for environmental documentation of the military mission at the NTC.

All requirements set forth in this INRMP requiring the expenditure of the NTC and Fort Irwin's funds are expressly subject to the availability of appropriations and requirements of the Anti-Deficiency Act (31 USC section 1341). No obligation undertaken by the installation under the terms of this INRMP will require or be interpreted to require a commitment to expend funds not obligated for a particular purpose.

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1 Integrated Natural Resource Management Plan (INRMP) Overview

1.1 Purpose and Scope

This Integrated Natural Resource Management Plan (INRMP) guides the implementation of the natural resources program on the National Training Center and Fort Irwin, California (referred to as NTC and Fort Irwin). Fort Irwin consists of three management units: the National Training Center, the Goldstone Deep Space Communications Complex, and Leach Lake Bombing Range. Large-scale live-fire military training is the primary mission of the NTC and Fort Irwin, and natural resources are managed to actively support the military mission across the 753,537-acre federal facility in San Bernardino County, California. In addition, NTC and Fort Irwin maintain 103,000 acres of conservation lands acquired for desert tortoise (*Gopherus agassizii*) conservation and 66 leased acres at Barstow-Daggett Airfield from the County of San Bernardino. The INRMP conserves the NTC and Fort Irwin's land and natural resources and supports compliance with environmental laws, regulations, and policies. The INRMP also helps ensure the maintenance of quality training lands to accomplish the NTC and Fort Irwin's critical military mission on a sustained basis, and that natural resource management and mission activities are integrated and consistent with applicable regulations and policies.

An INRMP was first developed for the NTC and Fort Irwin in 1999 and updated in 2006. This revised INRMP incorporates changes as described in the *Legislative Environmental Impact Statement for Military Training and Public Land Withdrawal Extension* (U.S. Army 2021a), which includes an additional 110,000 acres and habitat for federally listed species and updated natural resources data since 2006. The INRMP defines the priorities and intensity of natural resources management and provides the vehicle by which the U.S. Army participates in regional planning efforts under the West Mojave Coordinated Management Plan (**Section 1.4.5**).

This INRMP applies to each directorate, command, and tenant unit at the installation (including other land-holding commands and service branches, contractors, private groups, spouses and dependents, and individuals who either directly or indirectly use or impact natural resources) as well as rotational commands, units, and augmentees assigned or attached to the installation. This INRMP is integrated with several other plans related to the operations, military use, and environment on the NTC and Fort Irwin (see **Section 1.4**).

The NTC and Fort Irwin will use ecosystem management to guide the natural resources program and inform goals and priorities. This management strategy enables the installation to conduct military training while conserving natural resources upon which the quality of training ultimately depends. Adaptive management is an important component of ecosystem management. Adaptive management involves implementing the best option, testing that option's results, and modifying implementation accordingly. Implementation of this INRMP will support the mission, vision, and priorities of the NTC and Fort Irwin (see **Section 2.4** for more on the military mission).

Goals and objectives provide the framework to achieve this vision through the natural resources management program. Goals reflect this vision, and each goal is supported by objectives tied to criteria and policies for achieving the stated goal. The objectives drive the development of activities and projects to achieve those objectives. The goals and objectives in this updated INRMP are a consolidation and continuation of the goals and objectives in previous versions. Goals, objectives, and related evaluation criteria are presented in **Appendix B, Table B-1**. Activities and projects, and the objectives they support, are described in **Appendix B, Tables B-**

2, and **B-3**. The management program is described in **Section 3**, with applicable management direction identified under each technical area.

Two interrelated programs are essential to implementing this INRMP: the Directorate of Public Works-Environmental Division (DPW-ENV) and Integrated Training Area Management (ITAM). ITAM and DPW-ENV integrate the military mission and natural resources in different ways and together ensure sustainable use of training lands while providing strong consideration for environmental stewardship.

This INRMP is intended to be consistent with the SAIA, 16 U.S.C. §670a et seq., as amended; Department of Defense (DoD) Instruction (DoDI) 4715.03, Natural Resources Conservation Program and the associated manual; Army Regulation (AR) 200-1, Environmental Protection and Enhancement (see **Appendix I** for all relevant laws, regulations, and policies). This plan describes how the NTC and Fort Irwin will implement local regulations, principally NTC Regulation (NTC Reg) 200-1 (Environmental Protection and Enhancement), and portions of NTC Reg 385-63 (Range Safety). An INRMP is required for the NTC and Fort Irwin due to the presence of significant natural resources, including federally listed endangered and threatened species, and significant vegetation and soil management requirements.

The National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. §4321 et seq.) requires that federal agencies consider potential environmental consequences of proposed actions. New INRMPs and major revisions of INRMPs require an Environmental Assessment (EA) to meet NEPA requirements per Department of the Army Memorandum, May 25, 2006. Updates that do not alter the natural resources management and continued implementation of an existing INRMP do not require an EA or opportunity for public comment. As required by NEPA and the policies described above, an EA will be completed for this revised INRMP (see **Section 1.4.4**).

1.2 Responsibilities

1.2.1 National Training Center (NTC) and Fort Irwin

1.2.1.1 Commanding General

The Commanding General oversees the implementation of the policies and directives of the Department of the Army and the U.S. Army Forces Command (FORSCOM) on NTC and Fort Irwin. The Commanding General bears ultimate responsibility for the mission of the NTC and Fort Irwin. Acting through the Command Group, personal and special staff, directors, and separate commanders, the Commanding General is responsible for:

- planning land utilization to avoid or minimize adverse effects on environmental quality and provide for the sustained accomplishment of the mission;
- ensuring the functioning of an Installation Environmental Quality Control Committee;
- ensuring ongoing and timely coordination of current and planned land uses between mission, natural resources, environmental, legal, and master planning;
- ensuring all installation land users are aware of and comply with procedures and requirements necessary to accomplish objectives of this INRMP (and other environmental plans) together with laws, regulations, and other measures designed to comply with environmental quality objectives; and
- authorizing and managing natural resources-based recreation in accordance with locally published installation regulations promulgated in compliance with applicable federal and state laws, Army regulations, and military requirements.

1.2.1.2 Garrison Commander

The Garrison Commander supports the Commanding General and the NTC and Fort Irwin mission by directing all aspects of garrison operations and providing services for the NTC and Fort Irwin training area. Services directed by the Garrison Commander are primarily staffed by civilians and include environmental services, such as hazardous waste management, air quality monitoring, and natural and cultural resources management. As such, the Garrison Commander is responsible for:

- implementation of the INRMP and all of its goals and objectives;
- providing for funding and staffing of natural resource management professionals and other resources required to manage natural resources on the installation effectively; and
- entering into appropriate cooperative plans (16 U.S.C. 670a) with state and federal conservation agencies for the conservation and development of fish and wildlife, soil, outdoor recreation, and other resources.

1.2.1.3 Directorate of Public Works (DPW)

The DPW maintains an organization with resources and personnel needed to manage the facilities, other infrastructure, and lands associated with NTC and Fort Irwin. DPW is responsible for operations and maintenance, engineering services, business operations, and environmental services. This includes design, engineering, and maintenance related to stormwater, erosion, pests, and landscaping. This also includes responsibilities to implement the INRMP and manage natural resources, which the Chief of the Environmental Division supervises. These include:

- implementing this INRMP;
- implementing and funding programs to ensure the inventory, delineation, classification, and management of all applicable natural resources;
- providing for the training of natural resources personnel;
- reviewing all environmental documents and construction designs and proposals to ensure adequate conservation of natural resources;
- ensuring appropriate NEPA consideration of NTC and Fort Irwin actions;
- coordinating with local, state, and federal government and civilian conservation organizations relative to natural resources stewardship for the NTC and Fort Irwin;
- administering all aspects of the installation pest control program;
- addressing environmental contamination issues;
- invasive species prevention and management; and
- conserving and managing all natural resources on NTC and Fort Irwin.

DPW-ENV is specifically responsible for natural and cultural resources, air and water resources, solid/hazardous waste management, pollution prevention, and spill compliance. The DPW Natural Resources Team implements this INRMP and the integrated management of natural resources on the NTC and Fort Irwin, as well as implementing the Integrated Cultural Resources Management Plan (ICRMP) and management of cultural resources. Responsibilities of the DPW Natural Resources Team include:

- maintaining and implementing the INRMP and ICRMP;
- maintaining the Integrated Pest Management Plan (IPMP) and serving as the NTC and Fort Irwin Pest Management Coordinator;
- using natural resources management to support the military mission;
- protecting land investments from depreciation by adopting land use practices based upon soil capabilities;
- implementing general natural resources management and research;
- ensuring compliance with federal, state, and installation laws and regulations pertaining to natural and cultural resources;

- cooperating with state and federal natural and cultural resources agencies;
- protecting perennial seeps and springs and wildlife habitat;
- minimizing erosion in coordination with DPW and ITAM;
- managing threatened and endangered species by:
    - species inventorying and monitoring,
    - habitat maintenance and enhancement,
    - ecological research initiatives,
    - recovery planning and implementation,
    - regional coordination,
    - conserving populations of threatened and endangered plants and their habitats,
    - consulting with the U.S. Fish and Wildlife Service (FWS) and complying with Biological Opinions (BO), and
    - implementing this INRMP; and
- coordinating with subject matter experts as needed to implement the INRMP and manage natural and cultural resources.

The Compliance Program Manager is not responsible for implementing this INRMP. However, some environmental compliance programs that directly or indirectly affect natural resources management on NTC and Fort Irwin include:

- drinking water and wastewater treatment,
- surface- and stormwater management,
- air quality management,
- solid waste and recycling program, and
- pollution prevention measures.

1.2.1.4 G3 (Training Directorate)

The Deputy Commander, Chief of Staff, acting through the G3 (Training Directorate), is the principal assistant to the Commanding General for planning, estimating, coordinating, integrating, and supervising activities related to military operations. These include military training, short- and long-range mission and mobilization planning and training, troop movements, aviation operations, range operations, nuclear biological and chemical plans, operations and training, operational security, intelligence, counterintelligence and security activities, emergency operations, special events, and ceremonies, and force modernization and integration activities.

The G3 provides access to training areas and ranges to accomplish provisions of this plan, assists in enforcing considerations within range regulations. It is directly responsible for the implementation and/or support of portions of this INRMP that directly affect or interact with training responsibilities, including:

- operating and maintaining NTC and Fort Irwin ranges and Training Areas, associated training facilities, field training sites, and range equipment;
- preparing, maintaining, and enforcing the Range Regulation (NTC Reg 385-63);
- preparing and updating the Range Complex Master Plan (RCMP);
- providing ITAM program management and funding for the NTC and Fort Irwin;
- providing input to FORSCOM for ITAM program users' requirements;
- managing the geographic information system (GIS) database to ensure support for all installation training programs that rely on GIS data layers; and
- coordinating with DPW on training activities that may affect natural resources, the desert ecosystem, or cultural resources.

The ITAM Program Manager is responsible for implementation of the ITAM program, as broadly described in **Section 1.4.3**. Key responsibilities include:

- coordinating with NTC and Fort Irwin agencies to integrate training mission requirements with environmental planning;
- providing input on training land condition and maneuver impacts to the RCMP and other installation-level plans;
- implementing the Land Rehabilitation and Maintenance (LRAM) component to enable new maneuver capabilities, maintain existing training land resources, and repair maneuver damage;
- implementing the Range and Training Land Assessment (RTLA) component to evaluate training land condition and capacity;
- managing the Sustainable Range Program (SRP) GIS Program to create, analyze, manage, and distribute standardized authoritative geospatial information, products, and services to support training; and
- educating range and training land users on landscape conditions, safety and emergency protocols, and local environmental considerations related to mission requirements.

1.2.1.5 Director of Fort Irwin Family and Morale, Welfare, and Recreation (FMWR)

The Director of FMWR establishes procedures and governs the installation's outdoor recreation activities. Programs that particularly affect the NTC and Fort Irwin natural resources include most outdoor recreation, equestrian programs, off-road cycling, and golf. Responsibilities include:

- planning and implementing the installation Outdoor Recreation Program (AR 215-2);
- supervising and maintaining outdoor recreation activities; and
- collecting fees and charges for various outdoor recreation activities.

1.2.1.6 Public Affairs Office

The Public Affairs Office is responsible for promoting an understanding of the NTC and Fort Irwin among its various publics and providing professional public affairs advice and support to installation leaders and activities. The Public Affairs Office is an important component of the natural resources program for the NTC and Fort Irwin, especially in disseminating information critical to the program's success.

1.2.1.7 Staff Judge Advocate

The Staff Judge Advocate provides legal advice and counsel, and services to Command, Staff, and subordinate elements of the NTC and Fort Irwin. Specific Staff Judge Advocate responsibilities with regard to integrated natural resource management include:

- conducting legal research and preparing legal opinions pertaining to the interpretation and application of laws, regulations, statutes, and other directives;
- coordinating with the Department of Justice, Litigation Division of the Office of the Judge Advocate General, and other Governmental agencies on matters pertaining to litigation for the Federal Government;
- advising the DPW on compliance with NEPA, especially with regard to the management of endangered species on the NTC and Fort Irwin; and
- advising the G3 on laws and regulations that affect training land use, management, and compliance.

Implementation of this Plan will require assistance from other directorates and organizations. Such organizations include the Mission and Installation Contracting Command, Directorate of Emergency Services (law enforcement and fire services), commanders of major subordinate organizations, and commanders of tenant units and activities.

1.2.1.8 Directorate of Emergency Services

The Provost Marshal historically was responsible for activities related to natural resources that include:

- coordinating firearms registration;
- taking action to terminate unauthorized activities;
- apprehending and detaining violators; and
- controlling unauthorized entry to restricted areas, coordinating with the G3.

1.2.2 U.S. Department of the Army

1.2.2.1 U.S. Army Installation Management Command (IMCOM), Readiness Directorate

The IMCOM Readiness Region is responsible for providing command and technical supervision of the NTC and Fort Irwin's Natural and Cultural Resources programs by:

- assisting with program implementation and conducting staff visits to NTC and Fort Irwin,
- reviewing outdoor recreation plans for compatibility with the Installation Master Plan and natural resources management plans and programs, and
- ensuring that effective natural resources stewardship is an identifiable and accountable function of management and reviewing and approving this INRMP as the Final Approving Authority.

1.2.2.2 U.S. Army Forces Command (FORSCOM)

The FORSCOM is responsible for providing command and technical supervision of the NTC and Fort Irwin's natural resources program by:

- ensuring planning land utilization to avoid or minimize adverse effects on environmental quality and provide for the sustained accomplishment of the mission,
- reviewing and validating ITAM projects in the Annual Workplan, and
- providing funds for planned ITAM projects.

1.2.2.3 U.S. Army Environmental Command

The U.S. Army Environmental Command is a major sub-command of IMCOM, providing technical and legal support, program implementation assistance, and execution services of U.S. Army environmental programs and projects. It has support capabilities in the areas of NEPA, endangered species, cultural resources, ITAM, environmental compliance, and related areas.

1.2.3 Other Agencies

1.2.3.1 U.S. Fish and Wildlife Service (FWS)

The FWS Region 8 has a field station at Palm Springs, California, which provides technical advice and regulatory guidance for the management of natural resources on the NTC and Fort Irwin, particularly endangered and threatened species. The FWS partners with the Training Center on regional initiatives and cooperative ventures, including line distance sampling for the desert tortoise. The recent programmatic BO for desert tortoise and Lane Mountain milk-vetch (*Astragalus jaegerianus*), hereafter referred to as LMMV, is provided in **Appendix H.** The BO provides current requirements for avoiding and minimizing impacts to these species, as well as an incidental take statement related to the U.S. Army and other military activities, translocating desert tortoises, and implementing recovery actions for the desert tortoise within the Western Mojave Recovery Unit. They are also collaborating with the NTC and Fort Irwin on a translocation plan for tortoises in the Western Training Area (WTA).

The FWS is a signatory cooperator in developing and implementing this INRMP in accordance with the Sikes Act. The Sikes Act directs the Secretary of Defense, in cooperation with FWS and the appropriate state fish and wildlife agencies, to prepare and implement INRMPs for DoD lands with significant natural resources. The FWS will help NTC and Fort Irwin and the California Department of Fish and Wildlife (CDFW) enforce wildlife laws and shall furnish technical assistance for developing and implementing professionally sound natural resources programs. This INRMP has been written to comply with the current BO and other agreements as described.

1.2.3.2 Bureau of Land Management (BLM)

BLM is a key player in the real property aspect of NTC and Fort Irwin as they support the withdrawal of 110,000 acres of land from BLM management to DoD management (as described in the Legislative Environmental Impact Statement [EIS], 2021). The U.S. Army collaborates routinely with BLM on vegetation management on BLM and U.S. Army lands to ensure consistent approaches across the Mojave Ecosystem, as BLM manages lands to the south and east of NTC and Fort Irwin. The BLM partners in other regional initiatives and cooperative ventures with the NTC and Fort Irwin, including a translocation study of WTA tortoises to off-post parcels and BLM land. Additionally, because of their involvement in the West Mojave Coordinated Management Plan, the BLM has the potential to play a significant role in implementing this INRMP.

1.2.3.3 National Aeronautics and Space Administration (NASA)

The Goldstone Deep Space Communication Complex and satellite tracking facility uses 33,242 acres on the western edge of the NTC and Fort Irwin and is leased and operated by NASA and the Jet Propulsion Laboratory. Goldstone has its own environmental program, including endangered species management. However, the U.S. Army has ultimate responsibility for natural and cultural resources management on Goldstone. Goldstone and the NTC and Fort Irwin environmental personnel have close working relationships.

Goldstone has very limited use for military activities and thus serves as a control for comparison purposes with other portions of the NTC and Fort Irwin. This has been particularly useful for evaluating the effects of military activities on the desert tortoise. The NTC and Fort Irwin ITAM program has RTLA sites on Goldstone to facilitate these control-treatment studies.

1.2.3.4 California Department of Fish and Wildlife (CDFW)

The CDFW is responsible for managing and protecting fish, wildlife, native plants, and associated habitats in the State of California, as well as regulatory enforcement and management of related recreational, commercial, scientific, and educational uses. The CDFW maintains the California Natural Diversity Database, which is useful for managing natural resources at the NTC and Fort Irwin. The CDFW monitors a herd of desert bighorn sheep (DBS, *Ovis canadensis nelsoni*) that move through the northeastern portion of the installation. They have an interest in chukar management since the bird is a major game species in the Mojave Desert. The agency is responsible for maintaining a list of state-listed and sensitive species, some of which are found on NTC and Fort Irwin such as the Mojave fringe-toed lizard (MFTL, *Uma scoparia*), the Mohave ground squirrel (*Xerospermophilus mohavensis*), and the western burrowing owl (*Athene cunicularia*).

The CDFW is a signatory cooperator in developing and implementing this INRMP. The CDFW is responsible for establishing season and bag limits for the harvest of game species on the NTC and Fort Irwin, and advises on management of both rare and nuisance species .

1.3 Review and Revision Process

In accordance with the Sikes Act, DoDI 4715. 03, and AR 200-1, there are two components to the INRMP review process. An annual review process provides cooperating entities an update regarding what has been accomplished in the last year and what is planned for the following year. The Review for Operation and Effect must occur at least every five years and is a more comprehensive review process with FWS and CDFW to determine if the INRMP, as currently written, has achieved the goals and objectives established and whether any content needs to be modified. If the natural resources management on the NTC and Fort Irwin changes significantly, a major revision to the INRMP may be required. This occurs in fairly limited circumstances, however, as most changes are generally just updates based on new data, regulations, and/or adaptive management.

1.3.1 Annual Reviews and Coordination

The INRMP is reviewed annually to ensure the achievement of mission goals, document the implementation of projects, discuss available funding, and establish any necessary new management needs. The NTC and Fort Irwin DPW Natural Resources Team will communicate annually with FWS, CDFW, and internal stakeholders to review the INRMP implementation from the previous year and the projected implementation of upcoming programs and projects. Details regarding annual reviews will be documented by the NTC and Fort Irwin. The NTC and Fort Irwin DPW Natural Resources Team is responsible for ensuring that annual INRMP reviews are completed, tracked, and reported via yearly Environmental Quality data calls.

As part of the annual review, the NTC and Fort Irwin will:

- inform FWS and CDFW which INRMP projects and activities are required to meet current natural resources compliance needs,
- document specific INRMP projects and activities implemented the previous year and identify potential projects and activities for the next year, and
- identify any information being updated based on new data.

Cooperating agencies (FWS, CDFW) may request updated natural resources data, INRMP implementation progress, project results, and/or a site visit at any time.

1.3.2 Review for Operation and Effect

Not less than every five years, the INRMP will be reviewed for Operation and Effect by all cooperating agencies and internal stakeholders to determine if the goals and objectives are being met, if the INRMP is being implemented, if natural resources management is achieving necessary outcomes, and if substantial changes in military scope or natural resource management have occurred.

The result of the Review for Operation and Effect is a determination to continue the implementation of the existing INRMP with no updates or minor updates or to proceed with a revision. The Review for Operation and Effect may be done as part of every annual review or as a separate, more in-depth process, depending upon the parties involved and their concerns. The conclusion of the review will be documented in a jointly executed memorandum, meeting minutes, or in some other way that reflects mutual agreement.

If updates are needed, they will be completed by the NTC and Fort Irwin and reviewed and approved by all parties. If it is determined that major changes are needed (i.e., sufficient to trigger a full revision and change in natural resources management), all parties will provide input, and an INRMP revision and an associated NEPA review will occur (see **Section 1.4.4**). The existing INRMP remains operational until the update or revision is complete, and all concurrences are received, as long as all parties agree in writing. Revisions to the INRMP will go through a more comprehensive review process similar to the development of the initial INRMP, while an update will go through a more limited review.

1.4 Integration with Other Plans and Programs

By its nature, an INRMP is multidisciplinary and provides a summary of natural resources at a specific installation. As a result, information from an INRMP is incorporated into other plans, and other plans help identify management priorities and potential impacts to natural resources. The INRMP is integrated with several NTC and Fort Irwin plans, including the following in this section.

1.4.1 Operational and Installation Regulations and Plans

- National Training Center Regulation (NTC Reg) 385-63 – Range Safety, March 1, 2018 – This regulation establishes policy and procedures for the use of ranges and Training Areas on the installation (U.S. Army 2018a).
- Range Complex Master Plan (RCMP) – This plan details current status and planned upgrades to range and Training Area infrastructure, as well as ITAM projects necessary to meet certain requirements (U.S. Army 2022).
- Installation Landscape Management Plan – This plan describes how to select, plant, and maintain vegetation on the installation and applies to all landscaping activities at the NTC and Fort Irwin – design, construction, planting, maintenance, or removal of vegetation (U.S. Army 2004).

1.4.2 Environmental Regulations and Plans

- Army Reg 200-1 – Environmental Quality Environmental Protection and Enhancement– This regulation prescribes responsibilities, policies, and procedures for environmental protection and enhancement on the installation.
- Integrated Cultural Resources Management Plan (ICRMP) – this plan is the decision document for cultural resources management and specific compliance procedures that integrates the installation's cultural resources program with ongoing mission activities.
- Integrated Pest Management Plan (IPMP) – This plan describes the administrative, safety, and environmental requirements for managing pest species and outlines surveillance and control methods to minimize impacts to the military mission, real property, personnel, and the environment.
- Integrated Wildland Fire Management Plan (IWFMP) – This plan provides a summary of the wildland fire program, including training requirements, safety considerations, prescribed fire use, wildfire response protocols, notification procedures, and other wildland fire management concerns.
- Stormwater Management Plan – This plan was prepared for the Cantonment Area to identify improvements that will protect existing and future facilities from up to a 100-year flood event.
- Spill Prevention and Contingency Plan – This plan describes the action that facility personnel must take to minimize hazards from fires, explosions, or any unplanned sudden or non-sudden release of hazardous waste.
- Hazardous Materials and Hazardous Waste Management Plan – This plan prescribes responsibilities, policies, and procedures for storing and managing hazardous materials and wastes within the NTC and Fort Irwin.

1.4.3 Integrated Training Area Management (ITAM) Program

The ITAM program is a U.S. Army-wide program to provide quality training environments to support the U.S. Army's military mission. ITAM, as part of the Sustainable Range Program, provides U.S. Army range managers with the capabilities to manage and maintain training lands by integrating mission requirements with environmental requirements and management practices. At Fort Irwin, ITAM resides within the G3 Training Support Division to provide support to the NTC mission. The ITAM program sustains the U.S. Army's training land capability by repairing maneuver damage, reconfiguring land to enable new maneuver training capabilities, and creating and maintaining a resilient and adaptive training land base to keep pace with the U.S. Army's modernization efforts.

ITAM activities are detailed in a work plan submitted annually, which outlines projects and activities required during the next fiscal year. The ITAM Workplan is included as **Appendix B, Table C-4**. ITAM funds can only be used in accordance with ITAM funding guidance and cannot be used for range maintenance, range modifications, environmental conservation, or environmental compliance.

ITAM comprises the following five components:

- Training Requirements Integration – Integrates training mission requirements with non-training mission (e.g., environmental) planning, including coordination with DPW and Environmental. Training Requirements Integration supports project siting within the Training Area, training event scheduling, and permitting downrange ground-disturbing activities.
- Geographic Information Systems (GIS) Program – Creates, analyzes, manages, and distributes standardized authoritative geospatial information, products, and services for training missions. ITAM is responsible for maintaining forty-three training-related data layers in accordance with U.S. Army data standards. ITAM also acquires and maintains numerous other data layers, such as soils, hydrology, vegetation, topography, transportation system, downrange utilities, and aerial photography, to support a wide variety of installation mapping needs. ITAM GIS capabilities also support Range Development, Range Modernization, Range Operations functions, and other Training Directorate (G3) initiatives.
- Range and Training Land Assessment (RTLA) – Acquires and uses natural and physical resource data to maximize the capability and sustainability of the training land to support live training. This data is used to support training land management decisions and assists with identifying suitable landscape conditions to support training mission requirements. RTLA supports ITAM projects (identification, design, and monitoring) and also provides data and technical input to other plans, including RCMP, INRMP, and ICRMP.
- Land Rehabilitation and Maintenance (LRAM) – Implements projects and actions to sustain realistic training conditions through repair of maneuver damage, maintenance of existing training land, reconfiguration of training land to enable new maneuver capabilities, resolving safety hazards, and preventing regulatory violations.
- Sustainable Range Awareness – Educates range and training land users about safety and emergency protocols and local environmental considerations through various educational materials. Soldier Field Cards and other training aids provide vital information, including Medical Evacuation procedures, work/rest and water consumption table, threatened/endangered species protocols, downrange digging protocols, and other installation-specific information.

1.4.4 National Environmental Policy Act (NEPA) Implementation

NEPA regulations provide guidance to the U.S. Army on how to implement the NEPA process for U.S. Army Actions. NEPA is a process and planning tool to identify environmental problems and provide an opportunity to resolve them using planning at the early stages of project development. The DPW-ENV has primary responsibility for NEPA review at the NTC and Fort Irwin.

1.4.4.1 NEPA Review

A NEPA analysis is required, whether the proposed action is a plan (like this INRMP) or a project (like the projects included in **Appendix B**). For actions that do not impact the environment, the NEPA analysis is a Categorical Exclusion (CATEX), often with an attached Record of Environmental Consideration (REC). This simple documentation generally works well for routine projects, such as borrow sites, small digging projects, routine maintenance, small construction projects, updates to management plans, research projects, certain testing and training activities, and other projects where it can be determined that specific screening criteria have been met as outlined in 32 Code of Federal Regulations 651. This process can be used for actions that tier from a prior NEPA analysis in some cases.

EAs are required for specific types of projects or when the screening criteria for a CATEX are not met. Not being able to meet the criteria for a CATEX can happen when a new military exercise or range is planned, when the action involves a wide geographic area, when cultural resources are present and may be impacted, or when sensitive natural resources may be impacted. EAs require approval from the DPW and a 30-day public comment period. The final document after the EA has been approved is the Finding of No Significant Impact (FONSI), which states that the project has no significant impacts and that an EIS is unnecessary.

If a FONSI is not appropriate, the following options are available.

- Modify the action to remove significant impacts
- Mitigate significant adverse impacts
- Not implement the action
- Publish a Notice of Intent to prepare an EIS

Decisions such as specific siting or mission planning should be coordinated with NEPA, Natural Resources, and Cultural Resources personnel discussed prior to preparing draft documents. The ITAM program (**Section 1.4.3**) is often integral to the NEPA process for evaluating alternatives and identifying ways to minimize impacts while meeting mission requirements. When natural resources managers understand mission/project requirements in terms of land features and requirements, they often not only offer more potential site options to mission or project planners but also offer alternatives to avoid future environmental conflicts.

1.4.5 Regional Planning

The Mojave Desert is a large, complex ecosystem with diverse governmental agencies and several federally listed species. As a result, a number of regional plans and organizations have been established to facilitate shared efforts, resources, and expertise to allow each agency to achieve its mission while conserving sensitive resources in the Mojave Desert.

- <u>Desert Managers Group (DMG)</u> – The objective of this organization is to establish a forum for government agencies that oversee the Mojave Desert ecosystem where they can address and discuss issues of common concern, including threatened and endangered species. The DMG is a forum to share knowledge and suitable management of the desert tortoise and LMMV (see **Section 3.7.3** and **Appendices F** and **G** for more on these federally listed species). Participation by NTC and Fort Irwin staff improves the understanding and management of federally listed species. This group now meets unofficially once a year.

- Federal Land Policy and Management Act (FLPMA; 1976) – Section 601 of this act requires the BLM to develop a plan for long-term protection and administration of public lands in the California desert. FLPMA requires this plan to consider multiple use management and sustained yield principles in providing for resource use and development, including maintenance of environmental quality, rights-of-way, and mineral development. To the extent applicable, NTC and Fort Irwin will abide by the FLPMA.
- California Desert Protection Act (1994) – This law protected more than 9.6 million acres of the desert under the Department of Interior and added wilderness areas to the California Desert Conservation Area. As part of implementing this law and managing the related California Desert Conservation Area, comprehensive interagency plans were developed. While land management of NTC and Fort Irwin is not directly governed by this law, the interagency planning efforts can provide useful guidance and tools that support activities on NTC and Fort Irwin. The two plans (led by National Park Service [NPS] and BLM) most relevant to NTC and Fort Irwin are:
    - West Mojave Coordinated Management Plan (BLM 2006) – This interagency plan is for the West Mojave region and was developed by five federal agencies, six State of California agencies, one water district, five counties, and 11 towns and cities. This plan provides a consistent and streamlined regional program for compliance with the California and federal Endangered Species Act (ESA). The West Mojave Plan also developed measures to reduce and offset impacts to unlisted plants and animals. DoD installations (five military bases) in the West Mojave support this plan to the extent that it does not conflict with the military mission.
    - Northern and Eastern Mojave Desert Management Plan (BLM 2002) – This interagency plan is for the Northern and Eastern Mojave region and was developed by five federal agencies, five State of California agencies, one State of Nevada agency, three counties in California, three counties in Nevada, and two tribal councils. The eastern boundary of NTC and Fort Irwin is the western boundary of the Northern and Eastern Mojave planning area.
- Mojave Weed Management Area (MWMA) – This organization tracks the spread of weeds and exotic species in the Western Mojave Desert and coordinates weed control. Participation by NTC and Fort Irwin Staff benefits the desert tortoise and desert vegetation because invasive weeds increase fire hazards and reduce tortoise forage.
- Recovery and Sustainment Partnership (RASP) – This is a regional partnership to facilitate desert tortoise recovery in the Western Mojave Desert Tortoise Conservation areas. The partnership includes NTC and Fort Irwin, National Fish and Wildlife Foundation, U.S. Marine Corps (USMC) (29 Palms), FWS, and BLM.

2 Site Overview

2.1 Installation Information

The NTC and Fort Irwin is in the Central Mojave Desert, approximately 38 miles northeast of Barstow in San Bernardino County, California (see **Figure 2-1**). The NTC and Fort Irwin occupies 753,537 acres. Due to the lack of adequate hangar space for maintenance, the NTC and Fort Irwin leases a portion of the Barstow-Daggett Airport for helicopter maintenance. Barstow-Daggett Airport is located east of Barstow and about 35 miles south of the installation. The NTC and Fort Irwin also includes two sections of land to the northwest of Coyote Lake, about two miles south of the southwestern corner of the installation. This land was purchased as a potential future water withdrawal site for the installation. Approximately 103,000 acres outside the NTC and Fort Irwin have been acquired for desert tortoise conservation and are intermixed with BLM-managed lands. They are not managed as part of NTC and Fort Irwin, but the U.S. Army has provided funds to BLM to maintain these areas for desert tortoises (FWS 2021a).

Fort Irwin Road is the only paved road providing access to NTC and Fort Irwin, intersecting with Interstate 15 approximately 37 miles south. Interstate 15 provides the major east-west travel route linking Los Angeles and Las Vegas. The majority of Fort Irwin's civilian workforce resides in the Barstow-Victorville area.

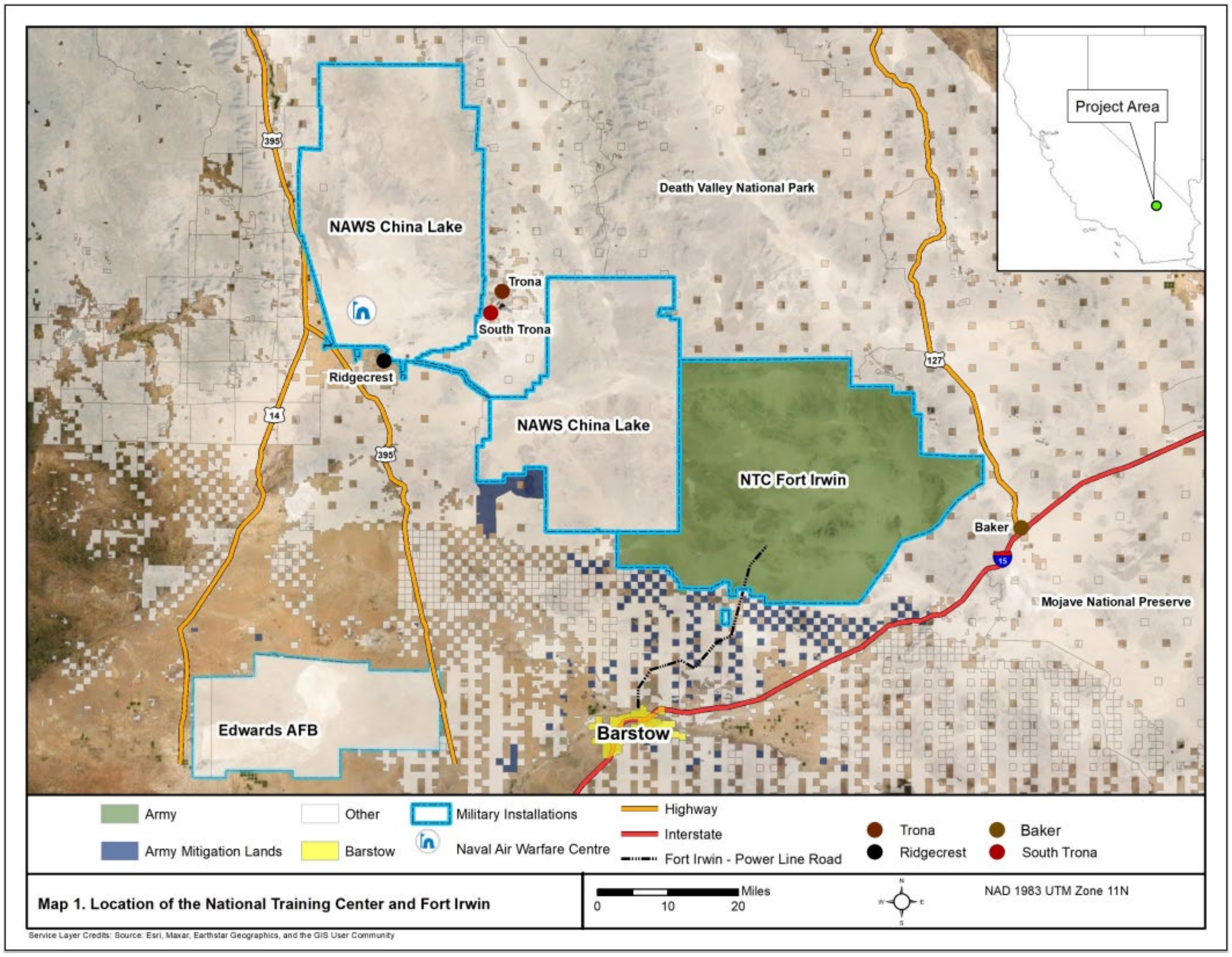


Figure 2-1. Location of the National Training Center and Fort Irwin

2.2 Regional Land Use

Figure 2-1 indicates land use areas adjacent to the NTC and Fort Irwin. The installation is bordered to the west by Naval Air Weapons Station (NAWS) China Lake. Lands at NAWS China Lake adjoining NTC and Fort Irwin are used for air-to-ground gunnery and a variety of research, development, testing, and evaluation of Navy air weapons. With the exception of the aerial gunnery range on the southern edge of China Lake, most of the area has few ground-disturbing impacts, and there is a requirement for a highly controlled emission environment (both dust and electronic) on the station to support research requirements.

Death Valley National Park borders the NTC to the north. The portion of Death Valley National Park bordering NTC and Fort Irwin is designated as a wilderness area and is protected under the Wilderness Protection Act of 1964 (NPS 2022). National Park lands are highly protected with few uses that negatively impact natural resources.

To the east, NTC and Fort Irwin is bordered by multiple-use BLM land interspersed with state school lands. The area adjacent to the northeastern corner of NTC and Fort Irwin is the Avawatz Mountains Wilderness Study Area (WSA). To the southeast, the NTC and Fort Irwin border a large power transmission line and the Soda Mountains WSA. The Eastern Training Area borders the South Avawatz Mountains WSA. Most of these BLM lands are designated Limited Use, with two small northeastern-adjacent parcels designed as moderate use (controlled balance between higher intensity use and protection). There are two BLM Areas of Critical Environmental Concern near the NTC's eastern boundary: Denning Springs is just northeast of the northeastern corner of the NTC, and Salt Creek Hills is east of state highway 127 in the northern Silurian Valley (BLM 2021). Much of the Soda Mountains WSA is within a BLM-administered grazing lease.

To the south of the NTC and Fort Irwin is mostly BLM land with small, interspersed parcels of privately owned land and a few state school land parcels. BLM land to the immediate south is part of the Superior-Cronese Area of Critical Conservation Concern (BLM 2021).

2.3 History of the NTC and Fort Irwin

In 1940, President Roosevelt withdrew lands for War Department use to establish an anti-aircraft firing range by Executive Order (EO) 8507. The Mojave Anti-Aircraft Range (Camp MAAR) was activated on August 8, 1940, and Soldiers first occupied the post during June 1941. On November 4, 1942, the reservation was renamed Camp Irwin after Major General George Leroy Irwin, Commander of the 57th Field Artillery Brigade, during World War I. During World War II, Camp Irwin trained Soldiers for deployment to various theaters of war and was a holding area for prisoners of war from the European Theater. After World War II, the post was put on surplus status and was transferred to the War Assets Administration in 1948.

Camp Irwin was reactivated on July 16, 1951, for the Korean Conflict and was under the command of the Sixth Army, headquartered at the Presidio in San Francisco, California. Camp Irwin was redesignated as the Fort Irwin Armor and Desert Training Center on August 1, 1961, and the status of the installation was upgraded to a permanent Class I installation. Fort Irwin was again closed in January 1971 and placed into caretaker status under the jurisdiction of the California Army National Guard. In August 1979, Fort Irwin was selected as the site for the U.S. Army's NTC. The U.S. Army resumed the operation of Fort Irwin in January 1981. The first NTC training exercise took place on April 13, 1981, but major force-on-force exercises did not begin until January 17, 1982.

The NTC and Fort Irwin also leased a portion of Southern California International Airport (formerly George Air Force Base) from 1998 to 2017 for use as a troop transfer facility. Rotational troops were flown to George Air Force Base and then bussed an hour and fifteen minutes to the NTC. Prior to using George Air Force Base, troops landed in Las Vegas, which was a three-hour bus

Figure 2-1. Location of the National Training Center and Fort Irwin

ride. In October 2017, the NTC began using March Air Reserve Base as the aerial port of embarkation/aerial port of debarkation for rotational units training at NTC, and Army discontinued the other lease.

Through the years, Congress has continued to acquire the lands making up present-day Fort Irwin and the NTC from public and private use. As part of these efforts, Eastern and Western Training Areas came under the management of the U.S. Army in 2001.

The NTC and Fort Irwin has expanded its boundaries to improve its military training mission to provide realistic training to entire brigades or Units of Action. The expansion process began in the 1980s. The description of the need for additional Training Areas and the expansion alternatives are summarized in Charis Professional Services Corporation (2003). On January 11, 2002, President George W. Bush signed the Fort Irwin Military Lands Withdrawal Act of 2001 (Public Law 107-107) into law. This legislation withdrew approximately 110,000 acres of land formerly managed by the BLM for military use. Subsequent surveys and GIS analysis indicated that the proposed expansion area covers 114,932 acres, including 71,249 acres in the WTA (Superior Valley) and 43,683 acres in the Eastern Training Areas I1 and I2.

The NTC and Fort Irwin has been used for anti-aircraft, armored, and mechanized training for both regular U.S. Army and California Army National Guard units since 1940. The NTC and Fort Irwin provides critical capacity for training brigade-level units in highly realistic combat situations. This facility is unique in the world and has played a major role in the development of tactics, techniques, and procedures for military operations used successfully in all of America’s conflicts since its inception—including Operations Desert Shield and Storm, Operation Iraqi Freedom, and Operation Enduring Freedom.

2.4 Military Mission

The mission of the NTC and Fort Irwin is to provide tough, realistic training for U.S. Army brigade combat teams (BCTs) under full battle conditions. The climate and terrain in the California high desert are harsh and severe, intensifying the stress and fatigue for Soldiers and equipment. As a result, the training at the NTC and Fort Irwin allows unit leaders and their Soldiers an opportunity to train as they will fight, make mistakes, learn from them, survive, and win. This uniqueness of the NTC and Fort Irwin is a critical component of its mission. The large, instrumented battlefield provides continuous and real-time feedback and heightens learning at all levels.

The NTC and Fort Irwin also serves as a data collection source for training, doctrine, organization, and equipment. The NTC and Fort Irwin is America’s premier war-fighting training center and has served as the model for two other U.S. Army training centers (at Fort Polk, Louisiana, and in Europe) and numerous similar training centers in allied countries.

NTC Mission, Vision, Goals, and Priorities

Mission: Train Army combat formations to win the first fight of the next war while continuing to improve social connection and quality of life at Fort Irwin so that we can recruit and retain top talent.

Vision: Train the Force to win in large-scale combat operations.

- Develop ready units and adaptive leaders. Replicate complex, hybrid threats using a dedicated opposing force and a high-fidelity training support system (peer/near-peer threats). Replicate TSC and ESC capabilities to command-and-control RSOI, regeneration, and EAB sustainment. Integrate conventional, joint, special operations forces, and Unified Action Partners
- Provide a “leadership crucible” event
- Develop unit and leadership skills required to win

Priorities

- Adapt to win the first fight of the next war. Sustain social connection and quality of life at Fort Irwin. Recruit and retain top talent

Core Values

World-Class Training for the World’s Best Army- Now and for the 21st Century

Customer Service	Standards	Stewardship
Learning Environment	Professional Competency	Sense of Community

2.5 Operations and Activities

The training mission at the NTC and Fort Irwin normally consists of intensive simulated near peer scenarios between opposing and friendly forces. The NTC conducts up to 12 training rotations per year, with a typical training year having 10 rotations. Each rotation involves four organizations: the Rotational Training Unit (RTU), the 11th Armored Cavalry Regiment, which serves as the Opposing Force (OPFOR), the Operations Groups (OPS GRP; observers/ coaches/trainers), and the 916th Support Brigade (SPT BDE). RTUs consist primarily of Armored Brigade Combat Teams (ABCTs) and Stryker Brigade Combat Teams (SBCTs) from U.S. Army installations across the United States. In addition to ABCTs and SBCTs, portions of Infantry BCTs, USMC units, U.S. Air Force (USAF) units, Naval units, Special Forces units, aviation units, and other unified action partners take part in training events. Because rotations are a collection of multiple military units, the number of Soldiers and equipment used during a rotation can vary widely. Nonetheless, typical ABCT or SBCT training at the NTC comprises approximately 9,000 personnel using various vehicles and aircraft.

Typical training rotations at the NTC and Fort Irwin last 28 days and consist of five days of reception/staging/onward movement/integration and tactical scenario, 10 days of force-on-force scenario training, four days of live-fire scenario training, and nine days of regeneration of combat power.

A complete analysis of their performance is provided to the visiting unit after each mission down to the platoon level and as a take-home package to enhance future training at their home station.

Most live-fire training takes place in an extensive network of automated targets throughout the central and northern parts of the Fort Irwin Training Area. Machine guns, rifles, tanks, and armored personnel carriers are able to fire live ammunition in a very realistic, unconstrained manner, unlike operations on standard live-fire ranges. During live-fire exercises, maneuvering units must cross training minefields and negotiate concertina wire and other obstacles as they engage the enemy.

Sequential pop-up targets simulate progressive movement by the enemy, including alternating frontal and flank views to simulate movements around obstacles or responses to terrain contours.

Fort Irwin's daily population is approximately 27,000 people, including 4,448 active-duty military members, a 4,328 civilian resident workforce, approximately 5,530 non-resident contractors, and 6,600 family members. In addition, over 6,000 service members typically visit Fort Irwin during training rotations (U.S. Army 2018b). The largest home station units on NTC and Fort Irwin are the OPS GRP, 11th Armored Cavalry Regiment, 916th SPT BDE, U.S. Army Medical Department Activity, and U.S. Army Garrison.

The California Army National Guard often trains on weekends between scheduled NTC and Fort Irwin training rotations.

2.6 Current Land Use

The installation has 68 Training Areas that can be scheduled by military units during non-rotational training periods. Because the military activity is relatively consistent across each Training Area, it makes sense to use them as the basic natural resources management unit at NTC and Fort Irwin.

Primary land uses on NTC and Fort Irwin can be divided into five overall areas: Training Areas, Range Complex, Cantonment Area, Leach Lake Gunnery Range, and Goldstone Deep Space Communications Complex. **Figure 2-2** shows these areas, the three maneuver corridors, and their impact areas. The acreages of these units are shown in the box.

No land or forest products from the NTC and Fort Irwin will be sold under Section 2665 (a) or (b), Title 10 U.S.C., and no land will be leased on the NTC and Fort Irwin under Section 2667 of such Title 10 unless the effects of such sales or leases are compatible with the purposes of the INRMP.

2.6.1 NTC Training Areas

The NTC portion of Fort Irwin is divided into three maneuver corridors, consisting of multiple smaller Training Areas:

Training Areas*	595,879 acres
Cantonment Area	14,309 acres
Leach Lake Gunnery Range	91,330 acres
Goldstone Complex	32,412 acres
Range Complex	19,608 acres
Total Land	**753,537 acres**

Conservation Parcels (off-post) 103,000 acres

* Includes acreages not available for training due to environmental, cultural, and recreational constraints.

- Northern Corridor: contains the Granite Mountain range; task force live-fire exercises are conducted primarily in this corridor
- Central Corridor: South of the Granite Mountains and contains Tiefort Mountain; a majority of force-on-force maneuvers take place in the central corridor but also has pop-up targets and the dud-effects line
- Southern Corridor: South of the Tiefort Mountains; used primarily for force-on-force exercises and land navigation training; includes about 20,000 acres of desert tortoise critical habitat, which significantly reduces the corridor's value for military training

The former land expansions (eastern and western Training Areas) consist of two parcels: the western (Superior Valley) area (71,249 acres) and the eastern (East Gate) area (43,683 acres). These parcels were Congressionally withdrawn from the jurisdiction of the BLM and transferred to the jurisdiction of the U.S. Army under the authority of the Fort Irwin Military Withdrawal Act of 2001. The eastern area includes two Training Areas (I1 and I2) at the east end of the Central

Corridor and is open to military training. The Eastern Training Area is generally undeveloped and consists of steep topography that is not conducive to maneuver training activities. The WTA is currently off-limits to military training beyond dismounted, Special-Ops, and Forward Arming and Refueling Pont exercises. The WTA is expected to have limited military use until a programmatic EIS is completed and the anticipated translocation of tortoises in 2024.

In general, WTA, I1 and I2 parcels will be used primarily for staging and logistical support; however, the U.S. Army may also use these areas for heavy maneuvers.

The four impact areas listed below are no-digging restricted, and force-on-force training is excluded from these areas. Langford Lake, Lucky Fuse, Nelson, and Garry Owen are the four impact areas.

2.6.2 Cantonment Area

The cantonment area is located in the southwestern portion of the NTC and Fort Irwin. Day-to-day operations, administrative activities, family housing and neighborhood parks, barracks, maintenance yards, indoor recreation, restaurant facilities, and equipment posts are located in this area. Recreation and other facilities within the cantonment area operate independently of military activities on the installation, except that facility use depends primarily on the rotational schedule of NTC troops. The cantonment area is nearly completely developed. The extent and quality of the landscaping vary, especially among the housing facilities where residents maintain their own yards. Some facilities are landscaped and are regularly maintained, while others are not landscaped or need maintenance.

The cantonment area is the primary housing and recreation area on the installation. Numerous recreational activities and facilities are available for military and civilian personnel and their dependents. Activities and facilities include a movie theater, bowling alley, baseball and soccer fields, basketball and racquetball courts, pools, a jogging and confidence course, an outdoor skate park, a four-plex (softball), and 12 parks.

The NTC and Fort Irwin has constructed a Desert Tortoise Education Facility in the center of the cantonment area in Building 606. This facility is used for education awareness and environmental outreach for Soldiers, family members, and visitors, and where they can see captive desert tortoises.

2.6.3 Leach Lake Gunnery Range

The Leach Lake Gunnery Range covers most of the northern portion of the NTC and Fort Irwin and the Leach Lake Basin. Since 1967, this range has been used by the USAF, as well as U.S. Navy and USMC, year-round for air-to-air and air-to-ground gunnery and as an east-west, low-level flight corridor. Virtually all types of U.S. military aircraft (fighters and bombers) use Leach Lake. USAF use is on an as-needed basis or in collaboration with the U.S. Army.

The Leach Lake Gunnery Range is extensively contaminated with unexploded ordnance (UXO), which has been deposited since World War II. UXO ranges from 2,000-pound bombs to highly sensitive cluster bombs. The range is undergoing large-scale UXO removal. In March of 2022, explosive ordnance disposal Soldiers cleared 723 rounds from the Leach Lake Gunnery Range (Ham 2022). This is an ongoing task with a contractor where ordnance is exploded or consolidated after each rotation for later detonation.

2.6.4 Goldstone Deep Space Communications Complex

The Jet Propulsion Laboratory operates the NASA Goldstone Deep Space Communications Complex and satellite tracking facility. There are few military training options available on Goldstone, but it has significant value in terms of natural resources, primarily due to virtually no land impacts beyond facilities and roads. During critical NASA missions at Goldstone, military use is curtailed almost completely, and some restrictions include other portions of the NTC. The NTC and Fort Irwin has ultimate responsibility for the management of natural resources on Goldstone, but NASA has its own environmental program for the area and works closely with DPW-ENV.

2.6.5 Range Complex

Another live-fire complex is the much smaller multi-range Fort Irwin Range Complex located on Goldstone Road just east of the Goldstone Deep Space Communication Complex and adjacent to Cantonment. The Range Complex includes the Range Operations Building and static ranges, which are defined as firing areas with permanently defined Surface Danger Zones. The Range Complex includes tank ranges, machine gun transition ranges, auto record fire ranges, police qualification courses, basic firing ranges, field firing training, hand grenade ranges, and more.

2.7 Constraints

Potential natural resource constraints to future development and missions at the NTC and Fort Irwin include geographic and seasonal constraints. Table 2-1 summarizes each sensitive resource and resulting constraint, and the geographic constraints are depicted in **Figure 2-2**. Restrictions on training are occasionally necessary for the long-term sustainment of training lands. In the case of the NTC and Fort Irwin, these restrictions emphasize reducing impacts to native species, cultural resources, and avoiding conflicts with the mission at the Goldstone Complex.

Table 2-1. Summary of Environmental Constraints at the NTC and Fort Irwin

Sensitive Resource	Constraint	Approximate Area
Geographic Constraints		
Seeps, springs, dry lakes (playas)	No activity within 500 feet without prior approval from DPW-ENV (except Leach Lake which is part of bombing range and off limits for safety)	13 springs/seeps 9 dry lakes
Species conservation areas (Table 2-2)	No activity	49,446 acres
Joshua trees	Avoid disturbance of trees and buffer around them	1,114 acres
Steep slopes (greater than 30%)	Foot traffic only	9,921 acres
Significant cultural resources	No ground-disturbing activities and designate as a no-fire area. Disturbance with potential to affect resources require review by cultural resources personnel and consultation with Tribes and SHPO.	3,627 acres
Safety (primarily UXO) Constraints		
Leach Lake Gunnery Range and Goldstone Complex	No activity, no digging	125,867 acres
Garry Owen, Lucky Fuse, Nelson Lake, and Langford Lake	Restricted digging	40,850 acres

Note: % = Percent, SHPO = State Historic Preservation Office

2.7.1 Conservation Areas

Designated "Conservation Areas" for federally listed and at-risk species are an important management tool on NTC and Fort Irwin. It is more cost-effective to place use restrictions on some critical areas to prevent and minimize damage or disturbance than to repair damage or disturbance after it has occurred. Fort Irwin and NTC have been consulting with the FWS regarding rare species on the installation since 1991, and the current (2021) BO provides stipulations for avoiding, reducing, and offsetting the impacts of military actions on LMMV and the desert tortoise (FWS 2021a).

Within NTC and Fort Irwin, eight conservation areas (Table 2-2) were established for one or more of the following species: LMMV, Desert Tortoise, Desert Cymopterus, or Mohave Ground Squirrel (MGS). Management of these species is further discussed in **Section 3.7**.

Table 2-2. Conservation Areas on NTC and Fort Irwin

Conservation Area	Approximate Area	Species	Status
Gemini Milk-vetch	2,322 acres	LMMV	Fenced and off-limits to military training
East Paradise Milk-vetch	4,681 acres	LMMV, DT	Fenced and off-limits to military training
Brinkman Wash Milk-vetch	3,933 acres	LMMV, DT	Fenced and off-limits to military training
Paradise Desert Tortoise	981 acres	DT	Fenced and off-limits to military training
Southwest Desert Tortoise	1,668 acres	DT	Fenced and off-limits to military training
Southeast Desert Tortoise (includes FISS)	3,102 acres	DT	Fenced and off-limits to military training
Desert Cymopterus	348 acres	DC	Fenced and off-limits to military training
Goldstone Complex	32,411 acres	MGS	Off-limits to military training

Note:DC = desert cymopterus, DT = desert tortoise, FISS = Fort Irwin Study Site

2.7.2 Other Sensitive Biological Resources

Springs and seeps are critical to many plant and wildlife species within the Mojave Desert, including federal- and state-listed species. Playas are critical to other specialized plant and wildlife species within the Mojave Desert. When playa crusts are disturbed, wind creates dust, lowering air quality, and creating health and safety hazards. Due to playas' potential to generate fine particulate matter, they are off limits to military maneuvers. Playas are also frequently associated with archaeological (and sometimes paleontological) sites.

The Joshua tree is a species of interest in California, although its distribution and density are limited on the NTC and Fort Irwin. In 2019, a petition to list the Joshua tree (both species) was considered but rejected for listing by the FWS. It is currently under federal (FWS) review for listing (Conley 2021). In March 2022, CDFW recommended that western Joshua trees not be listed as state threatened (Bonham 2022). To the extent possible, construction projects will be directed to avoid disturbing Joshua trees, and habitat management for this species is described in **Section 3.7.5.2**.

2.7.3 Cultural Resources

Within the boundaries of NTC and Fort Irwin, there are numerous cultural resources, mainly archaeological sites. A wide range of sites are represented, including:

- prehistoric habitation and resource procurement sites (dating back at least 12,000 years);
- Native American rock art sites (petroglyphs and rare pictographs);
- historic period Euro-American (and potentially other) habitation sites;
- several sites that are Historic Properties eligible for listing in the National Register of Historic Places;
- hard rock and dry placer mines, roads, and trails (including the congressionally designated route of the Old Spanish Trail, which crosses Fort Irwin), military training facilities; and
- NASA facilities built in 1958, including the Pioneer Deep Space Antenna which was registered as a National Historic Landmark in 1985.

Projects such as fence building, performing management around playas or springs, and exotic plant removal have the potential to disturb or damage archeological sites. Projects involving decompaction, earth moving, and fill deposition can damage or bury archaeological sites.

2.7.4 Compliance with Constraints

Information about access restrictions and regulations for sensitive plants and wildlife are briefed in various forums and detailed in the Soldiers Field Card and other training materials.

To ensure compliance with constraints, there are leadership tools that allow rapid consequences. The NTC and Fort Irwin military personnel:

- Use observer/controller teams to prevent habitat destruction in the conservation areas by rotational units unfamiliar with the terrain and travel routes. These teams are assigned to each command element of the rotational unit. The job responsibilities of these teams are to serve as observers, mentors, and trainers during actual training exercises, and to reorient units if necessary.
- Artificially “kill” training personnel and their vehicles (i.e., disqualify them from further training for that mission) if they are found near controlled or off-limits areas. Rotational units are strictly controlled using position location devices to display their location within 33 feet. The complete instrument package for all unit vehicles and personnel enables a visual contact with units via remote video cameras.

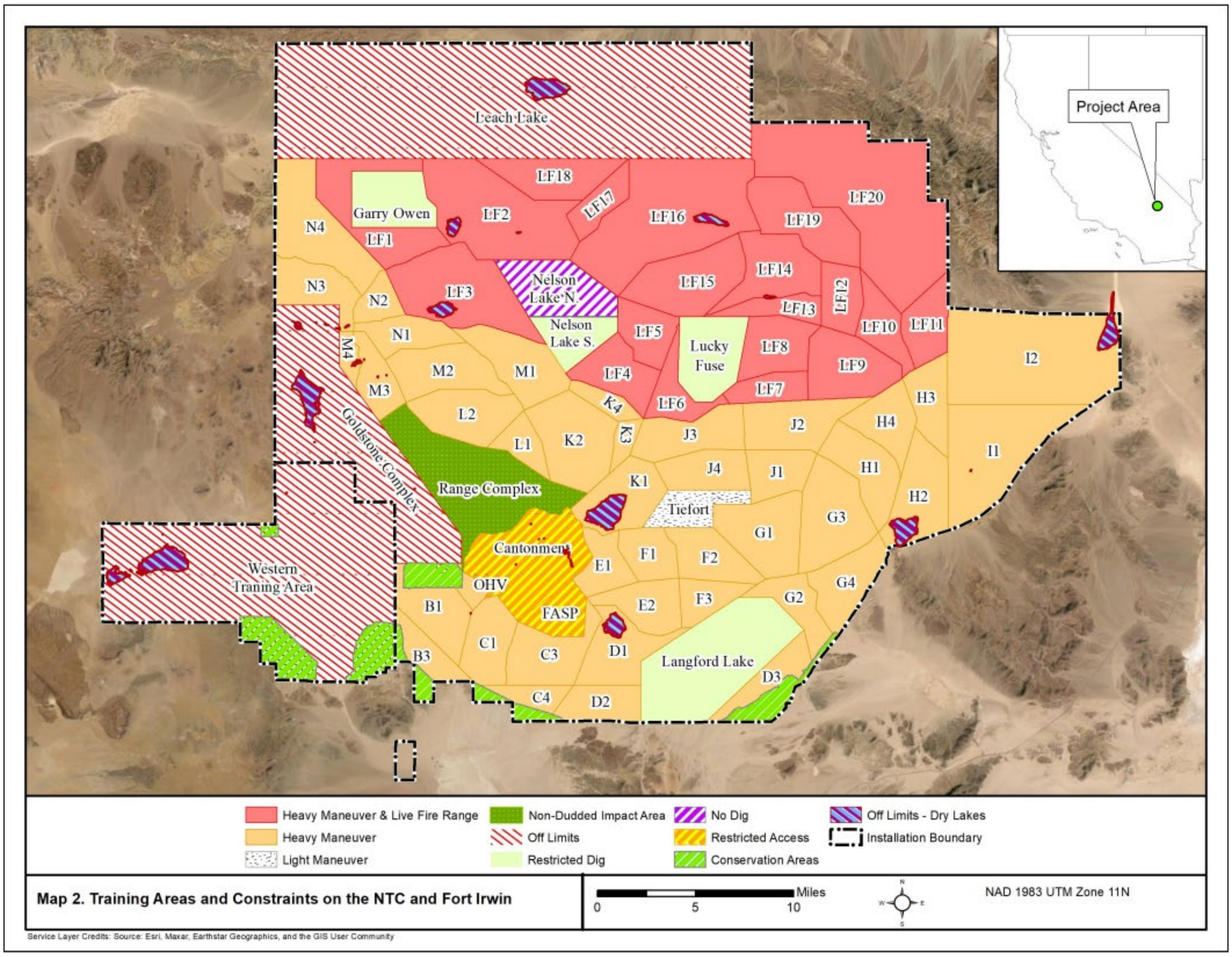


Figure 2-2. Training Areas and Constraints on the NTC and Fort Irwin.

3 Natural Resource Management Summary

This chapter includes a summary of each type of natural resources and their management goal and strategies on NTC and Fort Irwin, as well as relevant policies. This chapter is a companion to **Appendix B**, which includes the goals and objectives (Table C-1), in-house activities (Table C-2), projects (Table C-3), and implementation related to listed species (Table C-4). The goals and objectives in this updated INRMP are consolidation and continuation of the goals and objectives in the 2006 INRMP. To accomplish these goals and objectives, projects and recurring natural resources management activities have been identified. Activities generally refer to in-house, no-cost actions undertaken by specialists at NTC and Fort Irwin. Projects generally refer to actions performed by others, usually under contract but sometimes by other means. Projects can be completed using DPW-ENV, ITAM, Facilities Management, non-DoD federal funds, various grants, state funds, or volunteers (**Section 4.4**). A complete summary of all relevant laws, regulations, executive orders, and policies is provided in **Appendix I**.

In general, military training gradually degrades vegetation, biodiversity, topsoil, and soil structure. These resources reestablish naturally over long periods of time and attain equilibrium with natural disturbance. However, areas used repeatedly for military training can approach full removal of vegetation. These resources can recover, but they take time. An active LRAM program (as part of ITAM) is necessary for natural resources to recover sufficiently and continue supporting the mission needs. The ITAM program rehabilitates damaged sites and makes recommendations about the manner in which training is conducted to minimize damage. However, the backlog of damaged areas is extensive, and natural recovery is slow.

These potential conflicts between the military mission and maintaining native vegetation and natural soils will be minimized through active management and the natural limiting effects of the terrain. Gunnery ranges and impact zones are generally off-limits; springs and other areas of high biological diversity are off-limits; measures to minimize impacts to populations of listed species have been developed. Many training maneuvers are confined by the natural topography, with slopes greater than 30% not used extensively and mountainous terrain is largely avoided. Constraints are discussed in more detail in **Section 2.7**.

An essential role of natural resources specialists on NTC and Fort Irwin is to participate in various project review processes. This ensures that potential impacts to natural resources are identified, preferably early in any project planning, and avoided / minimized to the maximum extent practicable. In the case of training activities, discussions include coordination with the ITAM program, and land rehabilitation is accomplished using ITAM funds. In the case of construction, these discussions are part of the DPW environmental review process (**Section 4.2**). In both cases monitoring of the short and long-term outcomes and adaptive management are necessary to ensure that objectives and compliance requirements are being met.

The natural resources management of NTC and Fort Irwin has much in common with other governmental agencies, other military reservations, and other parties that manage land in the Mojave Desert. Cooperating with other organizations to implement regional, inter-agency initiatives is important for the long-term maintenance of ecosystem processes and to promote climate resiliency. In addition, managing natural resources on NTC and Fort Irwin involves multiple offices and interaction with multiple stakeholders.

3.1 Program Management

Successfully implementing this INRMP and achieving the goals and objectives requires a complex set of programmatic tools. Much of the program management is captured as activities in **Appendix B**, Table C-1, rather than as projects. Undertaking annual coordination with FWS, CDFW, and internal stakeholders; evaluating whether the objectives are being met by using monitoring results; and determining any modifications in the objectives, projects or activities needed are core functions of the natural resources program at NTC and Fort Irwin. This is also known as adaptive management and provides the structure for the entire program.

3.1.1 Adaptive Management

The adaptive management process begins with monitoring. Monitoring triggers review if environmental quality declines, and review produces actions targeting specific impacts. Two types of review will be used. *Internal adaptive review* requires an immediate review of current management policy by the Fort Irwin Natural Resources staff. *Interagency review* takes place as part of the INRMP annual review may include FWS CDFW, or other stakeholders. Examples of events that may trigger adaptive management are listed in Table 3-1.

Table 3-1. Adaptive Management Process on NTC and Fort Irwin

Actions/Thresholds	Possible Response
Training Impacts: Major fence breach requiring U.S. Army discipline and repair	Communicate with responsible party; Increase education; Improve fencing and/or signs; Monitor outcome and elevate issue if not successful
Lane Mountain Milk-Vetch: Based on annual report to FWS, effects on LMMV differ from what was expected	Initiate consultation with FWS
Desert Tortoise: Based on annual report to FWS, incidental take was exceeded or effects on desert tortoise differ from what was expected	Initiate consultation with FWS
Other Rare Species: For any priority rare species, a population decline, or significant impact is documented or a large number of dead individuals are found	Communicate with appropriate stakeholders and/or experts; Evaluate and possibly increase survey effort; Add or modify management activities as needed

3.1.2 Inventory and Monitoring

Natural resources management requires a foundation of basic knowledge about current conditions, including the soils, vegetation, and species. This process has been ongoing for many years on NTC and Fort Irwin, primarily driven by the ESA and the implementation of the ITAM program. Inventories (also called planning level surveys) need to be updated regularly, especially as climate changes and invasive species modify the communities.

Using the inventory data as a starting point, monitoring is used to identify trends (or absolute numbers if needed) of individual species or other components, such as vegetation cover types or plant communities. Monitoring is generally performed on a regular basis and often targets species or geography for a particular purpose, endangered species, and indicator species of overall ecosystem health.

The ITAM program initially collected inventory data and later conducted more studies to determine plant and animal species that might be indicators of ecosystem degradation resulting from military activities. ITAM currently monitors vegetation and soil parameters on permanent plots to determine trends in the condition of training lands over time and identify rehabilitation needs. In addition, DPW-ENV inventories and monitors soil, water, and endangered species. The DPW and ITAM staff cooperate to collect and distribute natural resource information and evaluate general and site-specific ecosystem integrity.

Various techniques assess land conditions and other natural resources, including qualitative and quantitative methods. Monitoring plots are located throughout the post and are regularly sampled in addition to informal surveys. Quantitative plots are used to monitor long-term trends in land conditions as they relate to training. Qualitative surveys rely mostly on the experience of field personnel and can be subjective. These qualitative surveys provide a quick assessment of an area, and management actions are prioritized based on those assessments.

3.1.3 Conservation Law Enforcement

Many aspects of natural resources management require effective law enforcement. Conservation Law Enforcement Officers (CLEOs) have historically been provided from the Directorate of Emergency Services as part of law enforcement services. Range enforcement is generally accomplished concurrent with other duties or in response to specific situations. To minimize potential for effects to natural and cultural resources, CLEOs are required on post.

OHVs are a problem in a few areas near installation boundaries. Scrappers (persons who enter military reservations to steal ordnance and other items from range areas) are a serious problem on installations in southwestern U.S. and elsewhere. The installation has the potential for significant losses due to theft or vandalism of cultural resources. The size and remote location of the NTC and Fort Irwin are significant challenges to effective enforcement.

3.1.4 Environmental Awareness and Public Outreach

Environmental awareness (i.e., education and training of users internal to NTC and Fort Irwin) and public outreach (i.e., education and interfacing with the public interested in NTC and Fort Irwin) are critical parts of successfully implementing this INRMP. All members of the installation community play a role in good stewardship of natural resources. The NTC and Fort Irwin approach to awareness and outreach stresses education and provides military personnel and the public with insights into the natural environment and conservation challenges. The more people know about the installation’s unique and sensitive natural resources, the more responsibly they act toward them. This section will focus on environmental awareness and public outreach related to natural resources, but these efforts are part of a larger environmental program that includes hazardous waste spill prevention and response, general resources conservation, and many other environmental topics. This larger environmental awareness program also coordinates with a safety awareness program that includes desert safety, unexploded ordnance protocols, and similar topics.

3.1.4.1 Environmental Awareness (Military Users)

ITAM Environmental Awareness

The ITAM program provides a robust environmental awareness program for military users with a focus on land management and preventing damage to natural and cultural resources. The primary purpose of this program is to help preserve the capability of training lands to indefinitely sustain the military mission. The ITAM environmental awareness program began in 1996 on NTC and Fort Irwin and includes briefings, training posters, handouts, and natural and cultural resources videos. Briefings cover restricted areas, off-limits areas, and sensitive resources. Safety information and potential hazards are typically incorporated into these materials.

NTC and Fort Irwin Soldiers are briefed through various academies and other requested safety briefings. Visiting units receive briefings as needed based on their intended military activities. Take-home pamphlets, booklets, maps, and digital media are also available, and some materials are provided on the website. Virtual briefings are provided to rotational units prior to their arrival at the Training Center to be used at their home stations.

DPW-ENV Environmental Awareness

DPW-ENV has also developed an environmental awareness program for military users, with a focus on developing Soldier conservation ethics. An environmental awareness program is a key part of managing federal and state-listed species (see **Section 3.7**) and ensuring compliance with requirements associated with the BO (**Appendix H**) and ESA, as well as cultural resources agreements and laws.

Typical Briefings

The DPW Natural Resources Team and ITAM together have implemented a series of educational briefings and handouts explaining sensitive resources, including the desert tortoise. Briefings are conducted by the Garrison Commander, Range Control, and representatives from the DPW Natural Resources Team, usually consisting of one biologist and one archaeologist. Briefings cover restricted and off-limits areas, and sensitive resources, including the desert tortoise and its habitat. The following educational programs are either in place or scheduled for implementation.

- The Observer/Controller Academy is a one-hour course on natural and cultural resources training at NTC and Fort Irwin for all Observer/Controller Academy personnel on post and rotational military police who escort troops. Specific procedural information is provided to all personnel as handouts and lectures explaining ways to deal with desert tortoises and other wildlife observed in the field.
- The OPFOR Academy is a monthly program for leaders and officers who are currently stationed at the installation. Materials provided in the OPFOR Academy include presentations, a handout on natural and cultural resources on post, and a take-home quiz to reinforce learning. This program teaches leaders and officers the purpose and regulation of conservation areas. A component for enlisted personnel may be added in the future.
- Environmental Control Team (ECT) Briefings are tailored to brigade personnel and provide basic desert awareness, safety, and natural history. The ECT brief includes safe handling of desert tortoises, consistent with the current BO.
- The Leader/Trainer Program has a 30-minute course presented one to two times each month to approximately 85 visiting officers who will be responsible for coordinating training maneuvers against OPFOR during their rotation.
- Hazardous Waste Training is required for all military and civilian personnel on post and all subcontractors working with potentially hazardous materials. This briefing includes a ½-hour presentation on cultural and natural resources (including the desert tortoise and other listed species). Approximately 25 military and civilian personnel attend this class every other month.
- A Rotational Unit Environmental Briefing Handbook is presented to all personnel attending the above trainings. At the start of each rotation, all Soldiers receive a Soldier's Field Card summarizing critical information about natural resources, including conservation areas.
- Range Safety Training is a two-hour class that must be taken yearly by all personnel going down range. There are no exceptions to receiving this training. Training includes a section on environmental stewardship, particularly on sensitive species.

- Periodic presentations are conducted for Newcomer Spouse Orientations regarding familiarity with desert ecosystems, unique flora and fauna at the installation, and prevention of adverse human-wildlife interactions.
- Wildlife awareness and safety briefings are given to other groups such as the 11th Armored Cavalry Regiment and Weed Army Community Hospital.
- Periodic public outreach is conducted for NTC homeschooled children and their parents as well as local scout troops, and wildlife PSAs (public service announcements) are drafted for the Public Affairs Office.

3.1.4.2 Public Awareness

News Media

The media is important to the dissemination of information regarding natural resources management. Information provided by the Public Affairs Office provides timely newspaper articles and spots on social media and radio stations to installation personnel and the public.

The NTC and Fort Irwin's weekly newspaper, the *High Desert Warrior*, is the most efficient way for natural resources personnel to access the NTC and Fort Irwin community. This newspaper is used to explain programs and gain support for their implementation. Articles target a wide range of readers but may be designed to appeal to specific categories of readers.

Natural resources and ITAM personnel often write articles for the *High Desert Warrior*, and staff writers also cover natural resources and ITAM programs. Examples of articles include the use of engineer units to support ITAM projects, desert tortoises, the use of the Student Conservation Association (SCA), and Scouts helping designate off-limits areas.

Other newspapers, such as the Barstow *Desert Dispatch* and Victorville *Daily Press*, use information about the Training Center's natural resources programs. Occasionally U.S. Army publications have published articles about land management on NTC and Fort Irwin (e.g., soil stabilization, Seibert stakes, etc.) for dissemination to other military installations. News releases and interviews with media are coordinated with the Public Affairs Office.

Desert Tortoise Education Facility

The installation constructed a Desert Tortoise Education Facility in the middle of the cantonment area at Building 606. Captive desert tortoises are residents of the facility and can be observed by installation personnel and visitors. Tortoises in the facility are captives that have been injured on post and cannot be returned to the wild.

Special Events

The NTC and Fort Irwin DPW Natural Resources Team and ITAM personnel go to considerable efforts to spread the word regarding their programs using special events. Below is a partial listing of examples.

- Earth Day talks at civic clubs and schools
- Talks and tours for scientific groups
- Local Chamber of Commerce meeting presentations
- Environmental displays at Barstow Earth Day, Torrance for Armed Forces Appreciation Day, and Fort Irwin Earth Day
- Field trips for community and youth groups

3.1.4.3 Professional Organizations

DPW Natural Resources and ITAM personnel from NTC and Fort Irwin regularly share information with other land managers and biologists about the natural resources, their management, and lessons learned. NTC and Fort Irwin leadership will occasionally sponsor or co-sponsor research symposia, which feature presentations from scientists that have collaborated with the U.S. Army on projects to better understand and manage natural resources on NTC and Fort Irwin. These scientists include biologists, geologists, botanists, meteorologists, GIS managers, and archaeologists.

3.1.5 Natural Resources Management Staff and Training

Professional development and training are important to ensure that the NTC and Fort Irwin DPW Natural Resources Team and ITAM specialists understand the latest research on how the Mojave Desert ecosystem and natural resources work and learn about the latest techniques that work in this ecosystem. This can be done through training and participation in workshops, conferences, and other activities related to regional and national professional natural resources research and conservation programs. The following workshops and conferences are typically attended annually by one or more NTC and Fort Irwin specialists:

- Desert tortoise handling class
- Desert tortoise management oversight group meetings
- ITAM annual workshop
- National Military Fish and Wildlife Association annual workshop
- FORSCOM training sessions
- Meetings related to regional initiatives (Mojave Oversight Group, Tortoise Advisory Group, DMG)

Additional training will be evaluated as identified. This could include global position system training, GIS training, endangered species training, or local BLM-sponsored workshops.

3.1.6 GIS and Data Management

3.1.6.1 Data Management

Maintaining comprehensive GIS data for natural resources is critical for analyzing trends, sharing knowledge with others, creating maps for environmental awareness and outreach, and implementing the adaptive management aspect of ecosystem management. The NTC and Fort Irwin is committed to providing efficient, cost-effective systems for data storage and analysis.

The ITAM program at the NTC and Fort Irwin established a GIS dataset in 1996, primarily to support land management programs, and is supported by additional databases. Both the GIS data and other databases require continuing maintenance and are used for many purposes. Data collected will be statistically analyzed and stored on the ITAM server and in the Natural and Cultural Resources Section.

The GIS data has been used for the production of maps, including maps for military planning and operations. This technology can also provide three-dimensional views of training missions, which enables Soldiers to visualize the terrain. Data can also be used in spatial analyses to improve planning decisions and the analysis of potential environmental impacts, particularly for visualizing past trends and future projections. ITAM maintains GIS data focused on the installation’s physical layout, such as training areas, ranges, trail networks, and downrange infrastructure.

The DPW-ENV section uses a central database of all-natural and cultural resource-related items, spatial information (points, lines, and polygons), and input from handheld field GPS units (Garmin). Personnel in the field will log locations which will be uploaded to the central database regularly.

3.1.6.2 Remote Sensed Imagery

Various forms of remote imagery and aerial photography provide an economical way to monitor changes in the landscape on NTC and Fort Irwin. The oldest aerial photographs of the NTC and Fort Irwin area were likely taken in the 1940s, but these have not been used for natural resources management on the installation. Remote imagery is now used for soil and disturbance mapping, which provides information concerning land change over time. This type of sampling was used intensively as part of the recent land acquisitions. Low altitude aerial photography has been used for tracking road proliferation and other types of disturbance.

High-resolution, true-color aerial photography of the entire installation is acquired by the ITAM program about every four years. This is supplemented by imagery obtained from other sources for specific projects or training events.

Currently, there is available remote imagery that provides adequate information for NTC and Fort Irwin. However, as invasive grasses spread, there may be a need for spring imagery that captures their locations better than the typical late summer/fall imagery generally available.

3.1.7 Regulations and Policies

Regulations: DoDI 4715.03, AR 200-1, NTC Reg 200-1

The following are policies implemented at NTC and Fort Irwin to conserve natural resources generally, at the programmatic level.

- Foster the principles of stewardship of the natural environment to provide for wildlife habitat, recreational opportunities, environmental education opportunities, and scenic and aesthetic values, in addition to the military mission (NTC Reg 200-1).
- Eliminate or minimize degradation of all natural resources, including soil, vegetation, watersheds, and associated water resources, wildlife, and scenic values, when not detrimental to the mission (NTC Reg 200-1).
- Coordinate and monitor all natural resources utilization. Approve and monitor all activities to assure that natural resource stipulations are observed and to better coordinate future activities (NTC Reg 200-1).
- Conduct all survey activities for plant and wildlife communities, including threatened, endangered, or candidate species, using qualified personnel to locate, identify, inventory, and assess plant and wildlife communities and their inter-relationships (NTC Reg 200-1).
- Provide guidance to land users to recognize activities that are potentially damaging to the natural resources and related improvements (NTC Reg 200-1).

3.2 Soil Conservation and Sediment Management

The Mojave Desert ecosystem is fragile and typically only receives three to four inches of rain a year. Soils develop very slowly in the harsh conditions of desert environments and may not be replaced for centuries following disturbance (Belnap 2003; Dregne 1983). Desert soils are extremely vulnerable to disruption and, once disturbed, can be easily eroded by wind and water. Desert soils are also highly vulnerable to compaction. Roads and tank trails, which are necessary for the rapid deployment of equipment and personnel, are subject to flash floods, especially in unusually intense summer rainstorms. As a result, there are several policies and active management to conserve soils on NTC and Fort Irwin.

Mountainous installation areas (greater than 20% slope) are less affected by training than the other areas (less than 20% slope). Steep slopes are not conducive to large-scale military training and are relatively undisturbed, except that some vehicles use slopes up to 50%, which often creates unplanned trails. These steep areas tend to harbor displaced species from more heavily used, flatter Training Areas.

While there has been some soil mapping in the past on NTC and Fort Irwin (Natural Resources Conservation Service [NRCS] 2000), it did not include the expansion areas now known as the WTA and Training Areas I1 and I2. Modern mapping techniques and additional information related to site-specific soil testing, landform, and geomorphic data would provide additional information about soils. This improved data could help with identifying problem areas and understanding vegetation patterns and invasive plant species risk.

Appendix C, specifically D.2 for landforms, D.3 for geology, and D.4 for soils, has detailed background information related to soils and conditions on NTC and Fort Irwin. **Figure 3-1** depicts the soils across NTC and Fort Irwin.

3.2.1 Management Strategies for Soil and Sediment

Management for soils and minimizing sediment loss in developed and undeveloped areas include the following:

- Monitor for changes in soil conditions
- Implement appropriate Best Management Practices for the activity and soil type
- Use dust control to manage fugitive dust from training
- Use revegetation, mulch, and other methods to stabilize soil and repair erosion
- Harden frequently used sites to support training impacts

3.2.2 Regulations and Policies

<u>Regulations:</u> Clean Water Act, NTC Reg 200-1, DoDI 4715.03, AR 200-1

The following are policies implemented at NTC and Fort Irwin to conserve soils.

- Minimize maneuver training in areas with slopes greater than 20%
- Tracked vehicles remain on tank trails and roads except when engaged in a battle exercise.
- Eliminate or minimize degradation of all natural resources, including soil, when not detrimental to the mission (NTC Reg 200-1).
- The construction and maintenance of all downrange land resources, including all facilities, roads, trails, tank ditches, trenches, berms, dam construction and maintenance activities, and vegetation maintenance activities, will be coordinated with the DPW Natural Resources Team in order to ensure compliance (NTC Reg 200-1).

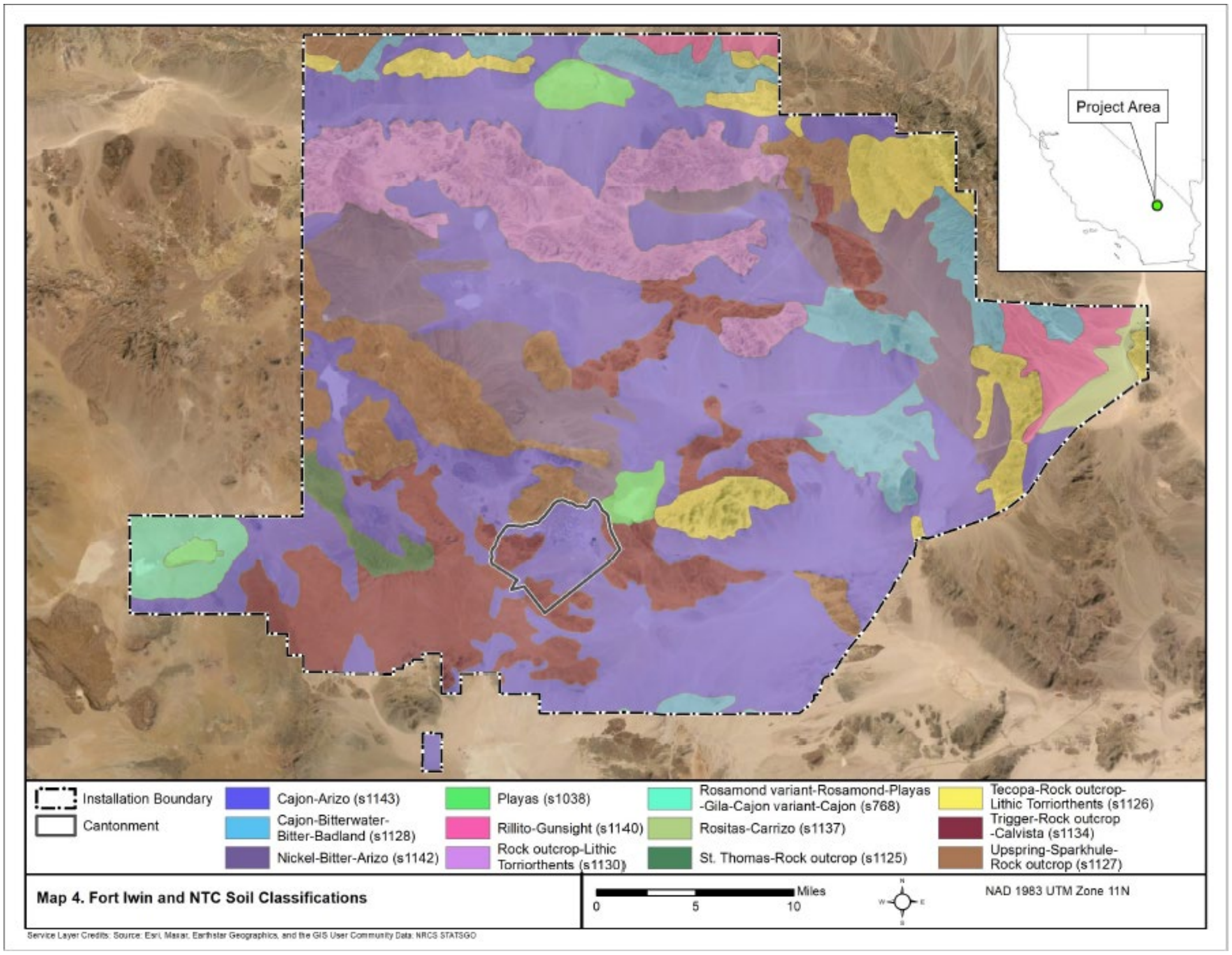


Figure 3-1. Fort Irwin and NTC Soil Classifications

3.3 Water Resources

NTC and Fort Irwin has its own water supply system and groundwater with moderate amounts of naturally occurring salts (about 720 milligrams per liter of total dissolved solids). Groundwater management consists of addressing pollution as needed and is managed by DPW-ENV but is not part of natural resources management. A routine groundwater monitoring program was implemented in 1989 at the NTC and Fort Irwin. Since then, no groundwater quality contamination from toxic releases by installation facilities or activities has been reported. Groundwater monitoring wells were installed at the landfill, and a regular schedule of groundwater monitoring has been implemented.

Stormwater is also an important facet of environmental management at the NTC and Fort Irwin, although not part of natural resources management, as significant rainfall events can generate enough stormwater to inundate the Wastewater Treatment Plant (which is designed to withstand potential “100-year flood events”). The installation has developed a stormwater management plan (USACE 2014). This plan was prepared for the Cantonment Area to identify improvements that will minimize damage to existing and future facilities during a "100-year flood event." Properly managing stormwater minimizes indirect effects on natural resources.

Fort Irwin's Wastewater Treatment Facility contains a few constructed percolation ponds. The constructed ponds are not natural and are only present to percolate or evaporate excess treated wastewater; therefore, they are not Waters of the United States. They are regulated by the State Water Resources Control Board and must be maintained and operated according to the applicable Waste Discharge Permit. These ponds also provide useful habitats and are a year-round water source for birds, and many species have been documented near the wastewater treatment ponds (see **Appendix E** for examples). Maintaining these ponds supports the proliferation of migratory birds, shorebirds, and waterfowl, as well as rare species on the installation, without negatively impacting the mission.

Wind and water erosion, while significant, is not a threat to water quality on NTC and Fort Irwin, largely due to very limited permanent surface waters and limited access to land around springs. The implementation of the land rehabilitation elements of ITAM also helps minimize sedimentation.

Different parts of the Clean Water Act regulate different water resources, and the Army complies with those requirements as appropriate. Relevant sections of the Clean Water Act include §401 (water quality), and 319 (non-point sources).

3.3.1 Seeps, Springs, and Playas

Natural surface water features on NTC and Fort Irwin are confined to nine playas and thirteen springs/seeps, only a few of which are perennial. These areas are essential to the survival and well-being of many wildlife species and therefore, management of these areas is a priority. Seeps and springs support the most diverse assemblage of both plants and animals that occur on NTC and Fort Irwin, including rare species. They are invaluable for numerous migrating birds that use these areas as stopover points.

Spring and seep habitats are small, relatively rare "biodiversity hot spots" in arid lands because they support a substantial number of aquatic, riparian, and terrestrial species. Many desert species are dependent on these aquatic habitats for their habitat requirements and are unique to these locations, such as bats and aquatic insects. These sites are also the primary water sources for most larger wildlife species.

Playas provide temporary yet essential habitats for migratory shorebirds and waterfowl, brine shrimp, and plants. These dry, vegetation-free, flat areas at the lowest part of an undrained desert basin can become ephemeral lakes during brief wet periods, as seen in seasonal monsoons.

The water quality of springs on the installation has been monitored annually since 2008. Currently, nine springs are surveyed for general conditions in spring and fall, including typical water quality parameters, flow, vegetation, wildlife use, and invasive plant presence. Results for the springs have been generally consistent every year, with the highest water quality typically found at Bitter Spring and lowest at Devouge Spring.

Due to the presence of water, all these water resources are prone to invasion by non-native plants, and active management has been implemented for years. Efforts to remove saltcedar (tamarisk) in particular, however, have had limited or temporary success. Recent control measures were implemented at Bitter Spring.

Wild burros (*Equus asinus*) are an introduced species that cause damage to native vegetation, spring ecosystems, and compete with native wildlife. Fencing has been effective at securing seeps from burro disturbance, though burros are still able to access Bitter Springs and are the primary source of disturbance there. It is recommended that long-lasting fencing similar to what was used for LMMV and CYMO conservation areas be installed at Bitter Springs and other springs to prevent burro activity. Disturbances such as invasive plant species, burro activity, and drought continue to adversely impact these springs. Continued annual monitoring of these areas is necessary to manage these important resources.

Playas have the potential to generate fine particulate matter (PM10) when disturbed. These can cause human and wildlife health issues and are regulated under the Clean Air Act. Cultural resources sites are also often associated with springs and playas. For all these reasons, springs and playas are off-limits for nearly all activities on NTC and Fort Irwin.

While these areas are very important natural resources, they are generally not considered "waters of the U.S." They are not regulated under the Clean Water Act, and there are no confirmed wetlands that meet USACE criteria. There are no perennial water courses, only intermittent and ephemeral ones.

As part of the active management of these water resources, regular inspections are conducted, and environmental reviews are completed of proposed actions (**Section 4.2**). There are also take active measures marking resources off-limits, as well as constructing barriers, including berms and fencing, to reduce negative impacts.

Appendix C, specifically D.5.1 for groundwater and D.5.2 for surface water, has detailed background information related to water resources on NTC and Fort Irwin. **Figure 3-2** depicts the water resources across NTC and Fort Irwin.

3.3.2 Management Prescriptions for Water Resources

Initiatives to conserve springs and playas include:

- continuing education of field personnel about springs and playas as part of major briefings prior to each military exercise to minimize impacts,
- installing and maintaining fencing and metal crossbars at portions of these springs likely to be approached by wheeled and tracked vehicles to limit accidental intrusion and damage.
- conducting Operational Range Assessments as directed by DoDI 4715.14 (15 Nov 2018). These documents require all Services to identify operational ranges, munitions constituents (MC) contained in military munitions used on operational ranges, and to assess whether MC from military munitions used on operational ranges are migrating to off-range areas and/or posing an unacceptable risk to off-range human health and/or the environment

Maintenance of springs includes:

- installing and maintaining fences designed to exclude wild burros but allow access for DBS at springs in the Avawatz Mountains,
- continuing to actively remove invasive, non-native plant species from the vicinity of the springs,
- assess cattail (*Typha*) at springs and remove when it covers greater than 50% of the previous open surface water,
- continuing quarterly fence checks and repair breaches to prevent burro and human incursions, and
- monitoring the nine springs twice annually following established protocol.

3.3.3 Regulations and Policies

Regulations: Clean Water Act, EO 11990, EO 12608, NTC Reg 200-1

The following are policies implemented at NTC and Fort Irwin to conserve water resources.

- Springs and playas are off-limits to all training and most other activities (**Section 2.7**)
- Environmental awareness materials reflect the off-limits status of water resources.
- Environmental reviews will be completed on all proposed actions to prevent and minimize impacts to water resources.
- Isolated natural springs and seeps are off limits to vehicular and foot traffic, development, and all other land use. Interfering with these areas in any manner is prohibited (NTC Reg 200-1).
- In the event that any of these areas may be impacted by an installation project, a plan is prepared, approved, and implemented to maintain or improve the functions performed by drained, filled, or degraded water resources (NTC Reg 200-1).
- Eliminate or minimize degradation of all natural resources, including watersheds and associated water resources, when not detrimental to the mission (NTC Reg 200-1).

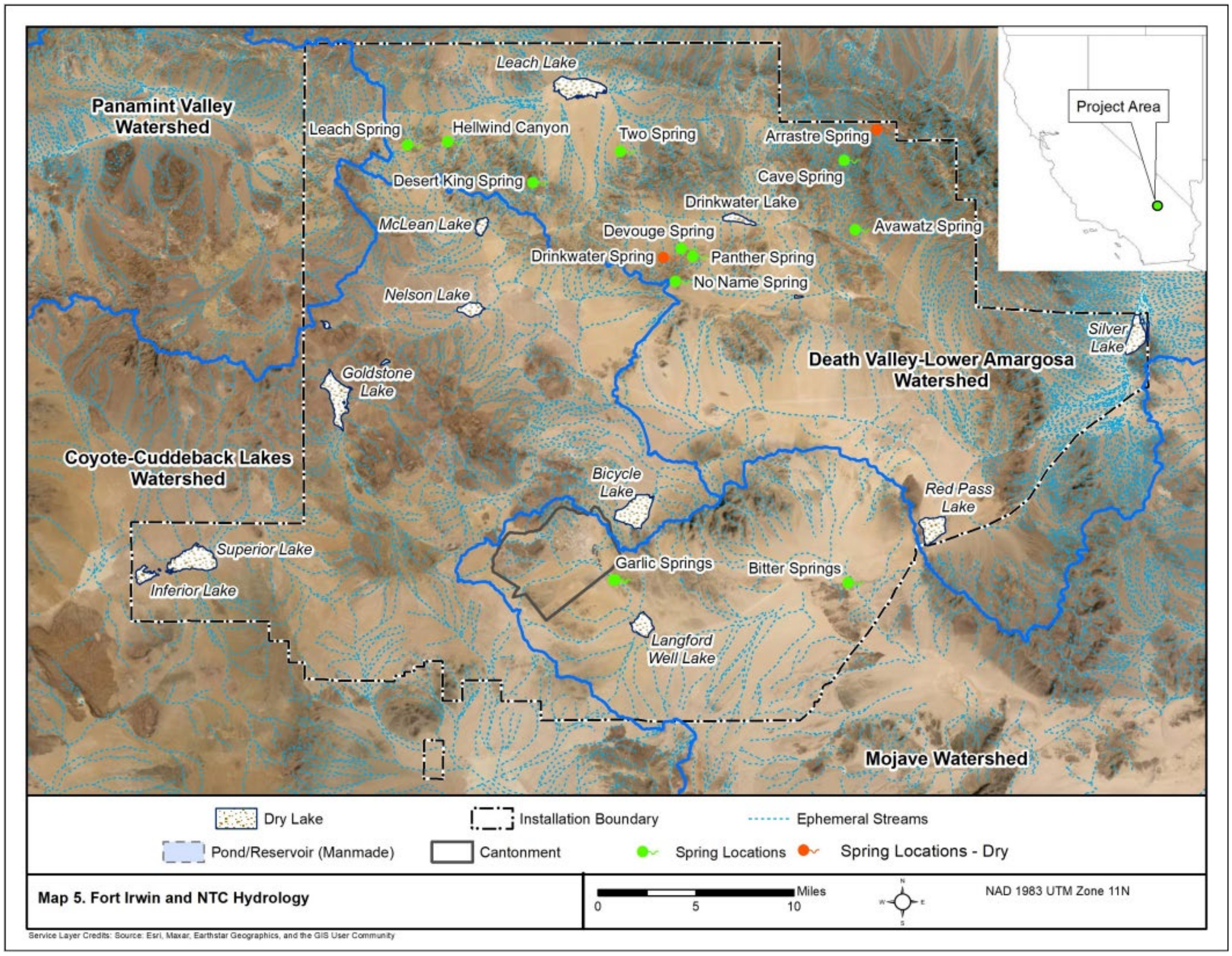


Figure 3-2. Fort Irwin and NTC Hydrology.

3.4 Vegetation Management

Eight major vegetation communities (U.S. National Vegetation Classification group level) have been identified on the NTC and Fort Irwin (**Appendix D and Figure 3-3**). The extent of these communities varies dramatically based on elevation, water availability, topography, soil content, and other abiotic factors. Each vegetation community supports a diverse assemblage of wildlife; some wildlife species are specific to a vegetation type, whereas others are distributed throughout NTC and Fort Irwin and occur in all vegetation types.

Due to the limited rainfall, plants of the Mojave Desert grow very slowly. A large creosote bush about five feet tall with a five-foot-wide spread may be more than 50 years old. Removal of this type of vegetation for camouflage or driving over it during battles would leave a void in that area that would not be replaced for many decades. Driving a tank across previously undisturbed desert leaves a mark that remains for decades and destroys desert crusts, even if no vegetation is disturbed. However, there are some desert shrubs that regrow vigorously after low levels of vehicle disturbance.

Plant-related studies on NTC and Fort Irwin have focused on four topics: 1) general plant and vegetation community inventories; 2) physiology of dust accumulation on vegetation; 3) life history of the endangered LMMV (**Appendix F** and **Section 3.7.3.3**); and 4) surveys for sensitive species, particularly the LMMV. The ITAM program censuses a subset of permanent vegetation plots in the spring. All of these efforts have generated a comprehensive plant species list (**Appendix H**).

There are less than 300 acres of improved vegetated lands (e.g., lawns, athletic fields, golf areas, landfill, playgrounds, and parks), which require regular maintenance. There are less than 2,000 acres of vegetation on semi-improved lands (e.g., ammunition storage, airfields, and heliports), which require periodic maintenance, but to a lesser degree than on improved lands. Ground maintenance and landscaping within the cantonment area are accomplished by a contractor provided by facilities maintenance, not by environmental.

The creosote bush scrub community receives the highest degree of impact from military maneuvers. This vegetation type dominates the Mojave Desert and will not be significantly reduced in extent by training impacts.

While the California Wildland Action Plan (WAP) is discussed more in Wildlife (Section 3.6), it identifies Shadscale-Saltbush Scrub as a priority conservation target. Conservation strategies from the California WAP that are applicable at NTC and Fort Irwin include 1) monitoring invasive plants within this community, how they impact the native vegetation and work together to manage invasive plants; 2) improving the understanding of alkali desert scrub; and 3) maintaining connectivity for desert alkali scrub habitat to support priority wildlife species.

A significant focus of the ITAM program is on rehabilitating vegetation (and related soils) damaged by military training. It takes many years, if not decades, for Mojave Desert vegetation (and soils) to recover, so active rehabilitation and revegetation is needed. Maintaining native vegetation is also important for both desert tortoise and LMMV as well as other rare wildlife.

Appendix D, specifically E.3 for plant diversity and E.4 for vegetative communities, has detailed background information related to plants and vegetation on NTC and Fort Irwin. **Figure 3-2** depicts the water resources across NTC and Fort Irwin. For rare plants, see Section 3.7.5 and **Appendix E**.

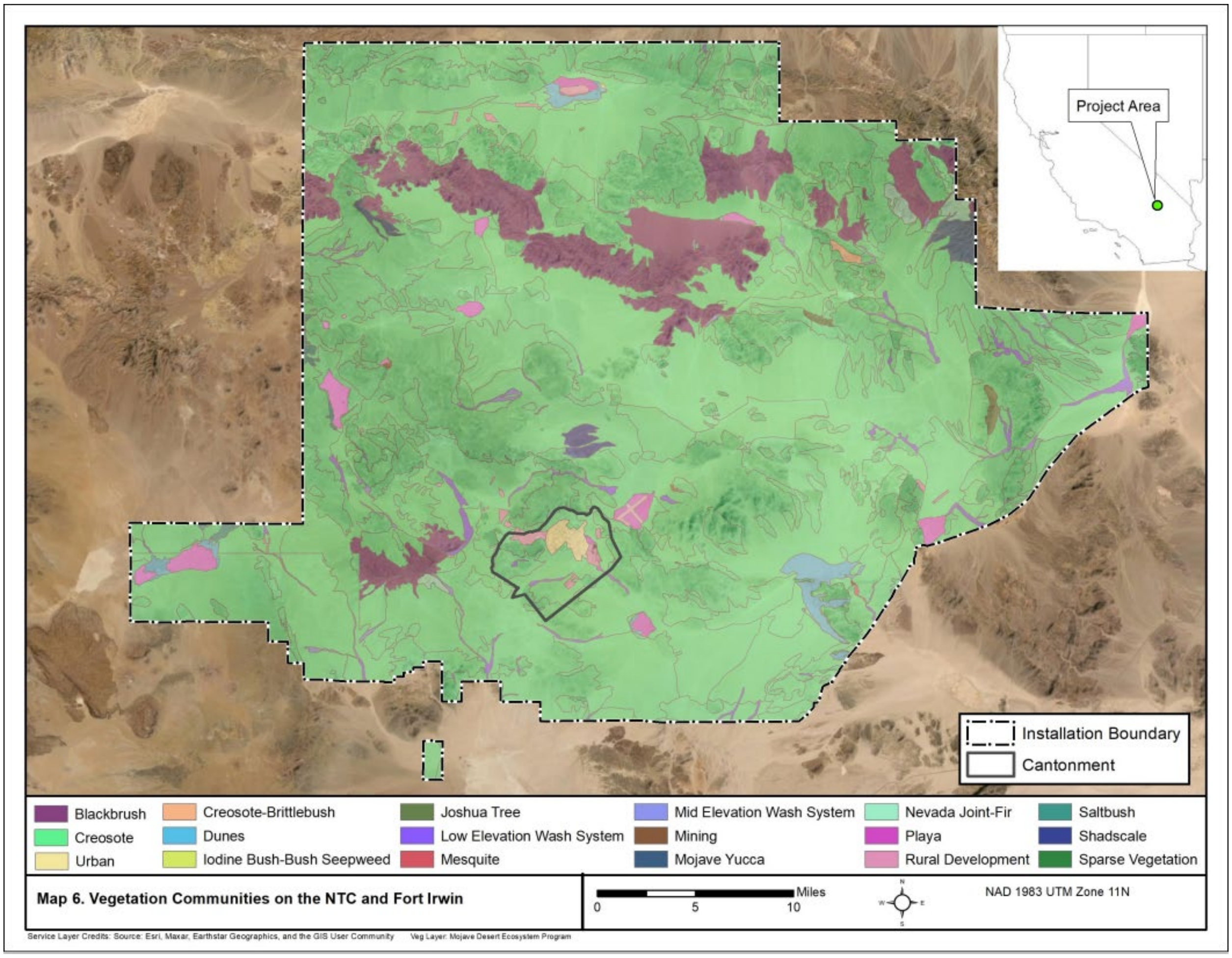


Figure 3-3. Vegetation Communities on the NTC and Fort Irwin.

3.4.1 Management Strategies for Vegetation

Management strategies for vegetation impacted by training activities include:

- reducing disturbance by
    - minimizing disturbance, including off-road travel, to reduce accidental tortoise deaths, damage to milk-vetch and their host plants, habitat degradation, and fragmentation;
    - controlling erosion;
    - reducing fugitive dust, where possible;
    - hardening frequently-used sites to support training and protect surrounding areas; and
- rehabilitating heavily damaged areas with contouring, erosion control, and native vegetation.

Management strategies for native vegetation communities include:

- minimizing disturbance,
- monitoring and managing invasive plants that increase fuel loads, and

- replacing native vegetation damaged by fire and preventing additional invasion by invasive plants.
- See **Section 3.7.5** for management strategies for rare plants.

Management strategies for landscaping and other vegetation in developed areas include:

- using native, drought tolerant, low maintenance plants while avoiding invasive plants; and
- using water-wise landscaping methods, including mulch, with specific strategies are available at the following websites:
    - https://specialdistricts.sbcounty.gov/wp-content/uploads/sites/54/2021/05/a_guide_to_high_desert_landscaping.pdf (detailed discussion of appropriate landscaping for the desert), and
    - https://summertree.org/water-wise-landscaping/how-to-use-our-water-wise-plant-data-base/ (database of appropriate plants for use in southern California deserts).

3.4.2 Regulations and Policies

Regulations: EO 12902, EO 11987, NTC Reg 200-1

The following are policies implemented at NTC and Fort Irwin to manage vegetation.

- Limit any landscaping or revegetation to plants included on the approved list provided by DPW Environmental.
- Use drip irrigation as much as possible when irrigation is required.
- Eliminate or minimize degradation of all natural resources, including vegetation, when not detrimental to the mission (NTC Reg 200-1).
- The construction and maintenance of all downrange land resources, including all facilities, roads, trails, tank ditches, trenches, berms, dam construction and maintenance activities, and vegetation maintenance activities will be coordinated with the DPW Natural Resources Team in order to ensure compliance (NTC Reg 200-1).
- It is not permissible to dig up, cut down, or otherwise damage vegetation in the cantonment area without approval from the DPW Natural Resources Team (NTC Reg 200-1).
- Improve and enhance the natural environment, including, but not limited to, landscaping the cantonment area and rehabilitating severely degraded areas (NTC Reg 200-1).
- Continue the ITAM program’s action to encourage revegetation to the degree practicable after training events.

3.5 Wildland Fire Management

Wildfires, primarily fueled by non-native grasses, are a threat to the Mojave Desert ecosystem, including endangered, threatened, or otherwise sensitive plant and animal species. Fires encourage the spread of exotic plant species, which then results in even more fire frequency and fire intensity. This is especially true in areas, such as gunnery ranges, which may experience frequent fires in wet years when fuel load is high. Fire management on the NTC and Fort Irwin consists of rapid response and effective control of fires. The goal is complete control as quickly as possible. The native vegetation in the Mojave Desert is not fire-adapted, so prescribed fire is not a useful tool on NTC and Fort Irwin.

The Fire Department states in the current IWFMP that the potential for a major fire at Fort Irwin exists at potentially only two locations: the Goldstone Complex and the WTA. NTC and Fort Irwin’s IWFMP is undergoing revision.

3.5.1 Management Strategies for Wildland Fire

Since fire is not a natural part of the Mojave Desert ecosystem, the management strategies are focused on fire prevention.

- Reduce fire-prone invasive plants, particularly in areas with a risk of fire from training activities.
- Recover native vegetation quickly to prevent non-native invasive plants from establishing.

3.5.2 Regulations and Policies

Regulations: IMCOM Policy Memo – Execution of Wildland Fire Programs (2022), Army Wildland Fire Guidance (2021), DoDI 6055.6, AR 420-90

The following are policies implemented at NTC and Fort Irwin with respect to wildland fire.

- Implement IWFMP and associated policies.

3.6 Wildlife Management

Most species management on the NTC and Fort Irwin is directed towards listed species (**Section 3.7**), primarily due to their compliance requirements. These species are only a small part of the installation biodiversity; however, their management benefits many other wildlife species on the installation. Birds have the highest diversity of vertebrate wildlife species on NTC and Fort Irwin, with reptiles and mammals also contributing to local diversity. There are no known fish species on NTC and Fort Irwin, with the exception of the non-native mosquitofish (*Gambusia affinis*) at Garlic Springs, due to the limited perennial water. Only one amphibian species (red-spotted toad, *Bufo punctatus*) might possibly occur on the NTC and Fort Irwin, and has never been documented. There have been limited surveys related to invertebrates, and their diversity is not well understood at NTC and Fort Irwin. Full species lists are provided in **Appendix G**.

There is active management for wild burros due to adverse impacts on multiple natural resources. Ravens impact desert tortoise and are discussed further in **Section 3.7.3.2**. Nuisance wildlife, such as coyotes, may also impact desert tortoise, and management is discussed in this section.

Conservation areas (**Section 3.7.1; Figure 3-4**), water resources (**Section 3.3**), vegetation management (**Section 3.4; Figure 3-3**), reducing wildfire risk (**Section 3.5**), and invasive species management (**Section 3.8**) all benefit wildlife in general.

3.6.1 Mammals

More than 40 mammal species have been documented on the installation, starting in 1993 (Recht 1995a, 1995b, 1996, 1998). Small mammals have been inventoried as part of a study evaluating the use of small mammal abundance and distribution as bioindicators of the impacts of military activities on desert habitats. Abandoned mines, natural caves, trees, and manmade structures throughout the installation provide potential roosting habitats for bats. Mammal surveys focused on bats were begun in 1994, and 11 bat species have been detected (Brown 1994; Brown and Berry 2006; Brown and Rainey 2012). Several rare mammals are found on post are discussed more in **Section 3.7** and **Appendix E**.

Coyotes and wild burros are mammal species of management priority due to their adverse impacts on sensitive resources. The San Bernardino County Health Department has requested that coyotes be kept out of the landfill and managed in the cantonment area. Coyotes are trapped and either euthanized (if sick) or relocated on NTC and Fort Irwin (if healthy).

A Feral Burro Management Plan was developed in 1982 in cooperation with the BLM and NAWS China Lake to eliminate wild burro herds on their respective lands. This project, which was very successful, continued until 1991. In 2018, an agreement was established with Peaceful Valley Donkey Rescue (PVDR) to conduct burro roundups on NTC and Fort Irwin after the population reached an estimated 1,000 individuals. PVDR has been successfully removing burros since 2018 from NTC and Fort Irwin; removing more than 300 individuals so far. PVDR either adopts out the burros or houses them on their sanctuaries. Typically, roundups include helicopters and trapping at water sites to remove feral burros. The agreement is currently being renewed. In addition, a collaborative burro collar tracking study by the University of California – Davis, PVDR, and the Army determined that burros migrate throughout the Goldstone Complex, various parts of NTC and Fort Irwin, and the southern property of Death Valley National Park, known as the 'Bowling Alley.'

For more discussion on mammals, see **Appendices E** and **H** for the species list.

3.6.2 Birds

Birds have been inventoried using walking transects, driving transects, and spot birding, beginning in the early 1990s, with more than 220 species documented (Brydolf 1994, 1995a, 1995b, 1996a, 1996b, 1998, 1999; Hanrahan et al. 1997; Harmsworth Associates 2003, 2004, 2005; Franklin 2010; Moreton and Rathbun 2011; Tetra Tech 2016).

Most of the birds that occur on NTC and Fort Irwin are migratory species and protected under Migratory Bird Treaty Act, although different species use NTC and Fort Irwin for different parts of their life history. As a result of documented population declines, migratory birds are the subject of an international conservation effort, and a variety of regional and national plans exist related to migratory bird conservation. The *Desert Bird Conservation Plan* (California Partners in Flight 2009) describes conservation and management issues and recommendations that mirror those presented here (i.e., manage invasive plants, minimize damage, maintain habitat and connectivity, etc.).

On the NTC and Fort Irwin, the limiting factors for migratory birds are water and suitable habitat. NTC and Fort Irwin springs and wastewater treatment impoundments are valuable resources for resident and migratory bird species. All of the springs and playas are designated off-limits to military training and personnel, as is the wastewater treatment impoundment. Potential nesting locations include creosote bushes, Joshua trees, and rocky cliff sides.

Ravens (*Corvus corax*) are a species of management priority on the installation due to their impacts on desert tortoise and are managed as part of an adaptive management program being used at multiple military bases in southern California. See the section on desert tortoises for more about raven management.

Several rare birds are found on post and discussed more in **Appendix E**. For more discussion on birds, see **Appendices E** and **H** for the species list.

3.6.3 Reptiles

More than 35 reptile species have been documented on the installation through several surveys, beginning in 1993 (Brown and Nagy 1995a, 1995b, 1998; Morafka 1994, 1997; Neihaus 1996; MacAller 2004; MacAller and Woodward 2004; RDN 1996). The diverse reptilian populations known to occur on NTC and Fort Irwin are typical of those found in creosote bush scrub communities. The desert tortoise (federally listed) receives significant management focus and is discussed further in **Section 3.7.3.2** and **Appendix E**. Rattlesnakes can cause issues in areas of human use and are managed according to the IPMP when that occurs (**Section 3.8**). **Section E.6.3** has more information on reptiles, and a list of reptile species can be found in **Appendix G**.

3.6.4 Invertebrates

Few invertebrate-specific studies have been conducted on the installation (Pratt and Alley 1998, 1999). However, the spring and seeps bi-annual monitoring samples regularly for aquatic macro-invertebrates. One invertebrate species of note is a land snail of the genus *Cahuillus*, discovered inhabiting talus slopes in Red Pass and southwest of Eastgate. Invertebrates are an essential component of desert ecosystems, providing food for many vertebrate species and acting as pollinators for many plant species. Africanized bees can cause issues in areas of human use and are managed according to the IPMP when that occurs. **Section E.6.5** has more information on invertebrates, and a list of documented invertebrate species can be found in **Appendix G**.

3.6.5 California State Wildlife Action Plan

During the INRMP update process, the NTC and Fort Irwin consulted the California WAP to ensure INRMP goals, objectives, and strategies that are consistent with California's overall statewide and site-specific plans. In particular, Section 3.6 has conservation targets that are specific to the Mojave Desert, which include conserving aquatic habitats and Shadscale-Saltbush Scrub vegetation communities (CDFW 2015). A number of reptiles, mammals, and birds were identified as species of greatest conservation need for the Mojave Desert. Much of the conservation strategies for the Mojave Desert are focused on managing the vegetation and invasive plants in the alkali desert scrub (Section 3.4), but they also include maintaining connectivity for desert alkali scrub habitat to support the wildlife species of greatest conservation need.

A copy of the California WAP can be found on the CDFW website.

3.6.6 Wildlife Habitat

Wildlife habitat can be described as all the food, water, and cover resources that wildlife requires to survive. These three resources must be available in sufficient amounts to maintain a healthy wildlife population. Habitat requirements are different for each species of wildlife, although some species have very similar habitat requirements.

Habitat management is accomplished through focused wildlife habitat management projects, training land rehabilitation, aquatic resource management (springs, seeps, and playas), fire management, erosion control, and similar programs. The following sections describe the focused wildlife habitat programs and projects. All other activities are described in their corresponding sections of the INRMP.

The purpose of habitat management is to enhance natural resources on which wildlife depends. This means increasing access to or amounts of food, cover, and water for desirable species while considering training requirements. It also entails limiting access to these resources for those species that pose threats to native vegetation, spring ecosystems, and/or compete with native wildlife (e.g., burros). Habitat management is generally the responsibility of the DPW Natural Resources staff. When activities can also be considered Training Area improvements, as in the case of revegetation projects, the ITAM program implements the project.

Occasionally, supplemental water is provided for wildlife. One method is to add rain-catchment systems near existing springs. Previous INRMPs had recommendations from CDFW to install six wildlife water catchment systems. In January 2022, Ft. Irwin's first wildlife water catchment system was installed in the Avawatz Mountain region of the installation. A second is anticipated to be installed in January 2023.

Appendix D, specifically E.6 for wildlife, has detailed background information related to wildlife on NTC and Fort Irwin. **Figure 3-2** depicts the water resources across NTC and Fort Irwin. For federally- and state-protected wildlife, see **Section 3.7** and **Appendix E**.

3.6.7 Management Strategies for Wildlife

General

- Create underpasses (e.g., install culverts) to allow the movement of wildlife and connect wildlife corridors.
- Maintain connectivity between areas as much as feasible without impacting the military mission.
- Install wildlife water catchment systems.
- Continue ongoing monitoring to assess wildlife population trends.
- Continue coordinated efforts with ITAM (i.e., land rehabilitation and revegetation).
- Conduct pre-construction surveys for certain species as part of the dig permit process.

Birds

- Use non-lethal methods outside of breeding season to deter birds from roosting in places that result in conflicts with human activities.
- Coordinate with the wastewater treatment impoundment contractor to avoid and minimize disturbance (e.g., draining, vegetation maintenance/manipulation/removal) to the wastewater treatment impoundments during spring breeding and migration (March through May) and fall migration (August through October).
- Minimize impacts from communication towers.
- Limit off-trail travel for vehicles not participating in exercises feasible to avoid damaging vegetation.
- Minimize disturbance to migratory birds and eagles during breeding season, which can be from February to September in the western Mojave Desert.
- Raven management is addressed in Section 3.7.3.2.

Wild Burros

- Continue agreement with PVDR to conduct burro round-ups for rescue/adoption and transfer to their training facilities (females to Scenic, AZ and males to San Angelo, TX) when needed, toward zero population goal. Periodically update MOA/MOU with PVDR as needed.

Nuisance Wildlife

- Expand public outreach program to address human-wildlife conflict prevention and establish / disseminate standard operating procedures for nuisance wildlife response.
- Informational stickers are provided on all trash receptacles, reminding personnel to keep trash bins covered at all times.
- Refuse at the landfill is bailed and covered daily to reduce the attractiveness to potential scavengers.
- Educational handouts, including information on the proper handling and disposition of trash, are included in awareness programs.
- Tarpaulins are placed over trash hauled in from the field during training rotations, which helps to reduce the amount of wind-blown trash lost in transit.
- Publicize and facilitate regular litter control in the cantonment area.
- Continue coyote trap and release to manage numbers in the cantonment area, as needed.

- Apply and implement the plan for *Adaptive Management of the Common Raven* (USMC 2022) (Section 3.7.3.2)
- Manage invasive species at springs/seeps and continue burro roundups for rescue and adoption.

3.6.8 Regulations and Policies

Regulations: Migratory Bird Treaty Act, EO 13186, Fish and Wildlife Conservation Act, Conservation Programs on Military Reservations, California Fish and Wildlife Protection and Conservation, NTC Reg 200-1

The following are policies implemented at NTC and Fort Irwin for stewardship of wildlife.

- No exotic species of fish or wildlife will be introduced on NTC and Fort Irwin lands without prior written approval of the U.S. Army, CDFW, and the FWS.
- Collection or "take" of wildlife on the NTC and Fort Irwin is prohibited unless part of approved biological studies and permitting (as applicable) with CDFW and FWS.
- Waste management protocols will be followed, both in Training Areas and in the cantonment area.
    - Require Soldiers and work crews to place trash in appropriate containers and remove trash at the completion of work or training events
- Follow FWS' *Recommended Best Practices for Communication Tower Design, Siting, Construction, Operation, Maintenance, and Decommissioning* (FWS 2021b).
- Eliminate or minimize degradation of all natural resources, including wildlife, when not detrimental to the mission (NTC Reg 200-1).
- Foster the principles of stewardship of the natural environment to provide for wildlife habitat, recreational opportunities, environmental education opportunities, and scenic and aesthetic values, in addition to the military mission (NTC Reg 200-1).
- Wildlife will not be intentionally harassed, wounded, or killed unless personal safety is endangered or during an approved licensed hunting activity (NTC Reg 200-1).
- Feeding any wildlife is strictly prohibited. It is especially important to limit access to any edible material to ravens, coyotes, and rodents to minimize the proliferation of these species (NTC Reg 200-1).
- Apply water for dust suppression in a manner that does not create pools that could attract pest species.

3.7 Rare Species Management

Due to its location in the Mojave Desert, many rare species are documented on NTC and Fort Irwin, and large areas of known or potential habitat occur on site. Often the management for one species benefits multiple other species, so while management is presented by species, especially for federally and state-listed species, the reality is management benefits multiple species.

There are five federally protected species documented on the NTC and Fort Irwin. For species descriptions and status on the installation, refer to **Appendix E**.

- Lane Mountain milk-vetch (LMMV or milk-vetch; *Astragalus jaegerianus*) – federally endangered
- Desert tortoise (*Gopherus agassizii*) – federally threatened
- Least Bell's vireo (LBVI; *Vireo bellii pusillus*) – federally endangered
    - The parent species has been documented, but subspecies identification is very difficult.
- Southwestern willow flycatcher (SWFL; *Empidonax traillii extimus*) – federally endangered

  - Genus / species have been documented on the installation; subspecies has not been determined.
- Golden eagle (*Aquila chrysaetos)* – federally protected under the Bald and Golden Eagle Protection Act

There are eight state-protected species documented on the NTC and Fort Irwin. For species descriptions and status on the installation, refer to **Appendix E**.

- Desert bighorn sheep (DBS; *Ovis canadensis nelsoni*) – state threatened, except as described in Section 4902 of the California Fish and Game Code.
- Mohave ground squirrel (MGS; *Xerospermophilus mohavensis*) – state threatened
- Sandhill crane (*Antigone canadensis canadensis/tabida*) – *A. c. tabida* is state threatened
- Bank swallow (*Riparia riparia*) – state threatened
- Desert kit fox (*Vulpes macrotis arsipus*) – fur-bearing mammal
- Swainson's hawk (*Buteo swainsoni*) – state threatened
- White-tailed kite (*Elanus leucurus*) – state threatened
- Peregrine falcon (*Falco peregrinus anatum*) – state threatened

There are other animal species of concern on the NTC and Fort Irwin; refer to **Appendix E** and **Figures 3-5 through 3-7** for additional information and locations of selected species.

3.7.1 Conservation Areas

Eight conservation areas for rare species have been designated along the southern and western boundaries of the installation (**Figure 3-4**).

- *Gemini Milk-vetch Conservation Area* contains approximately 2,322 acres to the west of the cantonment area. This conservation area was created in 2003 for the NASA Goldstone population of LMMV and is fenced and off-limits to military training.
- *East Paradise Milk-vetch Conservation Area* contains approximately 4,681 acres along the southwestern boundary of the installation in the WTA. This conservation area was created for the East Paradise population of LMMV and is fenced and off-limits to military training. Desert tortoise also benefit from this conservation area.
- *Brinkman Wash Milk-vetch Conservation Area* contains approximately 3,933 acres along the southwestern boundary of the installation in the WTA. This conservation area was created for the Brinkman Wash population of the LMMV and is fenced and off-limits to military training. Desert tortoise also benefit from this conservation area.
- *Paradise Desert Tortoise Conservation Area* contains approximately 981 acres along the southern boundary of the installation. This conservation area was created for the desert tortoise, and is fenced and off-limits to military training.
- *Southwest Desert Tortoise Conservation Area* contains approximately 1,668 acres along the southern boundary of the installation. This conservation area was created for the desert tortoise, and is fenced and off-limits to military training.
- *Southeast Desert Tortoise Conservation Area* (which includes the FISS) contains approximately 3,102 acres along the southeastern boundary of the installation. This conservation area was created for the desert tortoise, and is fenced and off-limits to military training.
- The *Desert Cymopterus Conservation Area* contains approximately 348 acres in the north-central area of the installation within the WTA. This conservation area was created in 2004 for the desert cymopterus, and is fenced and off-limits to military training.
- The *Goldstone Complex* contains approximately 32,412 acres in the western area of the installation (**Figure 2-2**). This area is maintained as an MGS conservation area and is off-limits to military training.

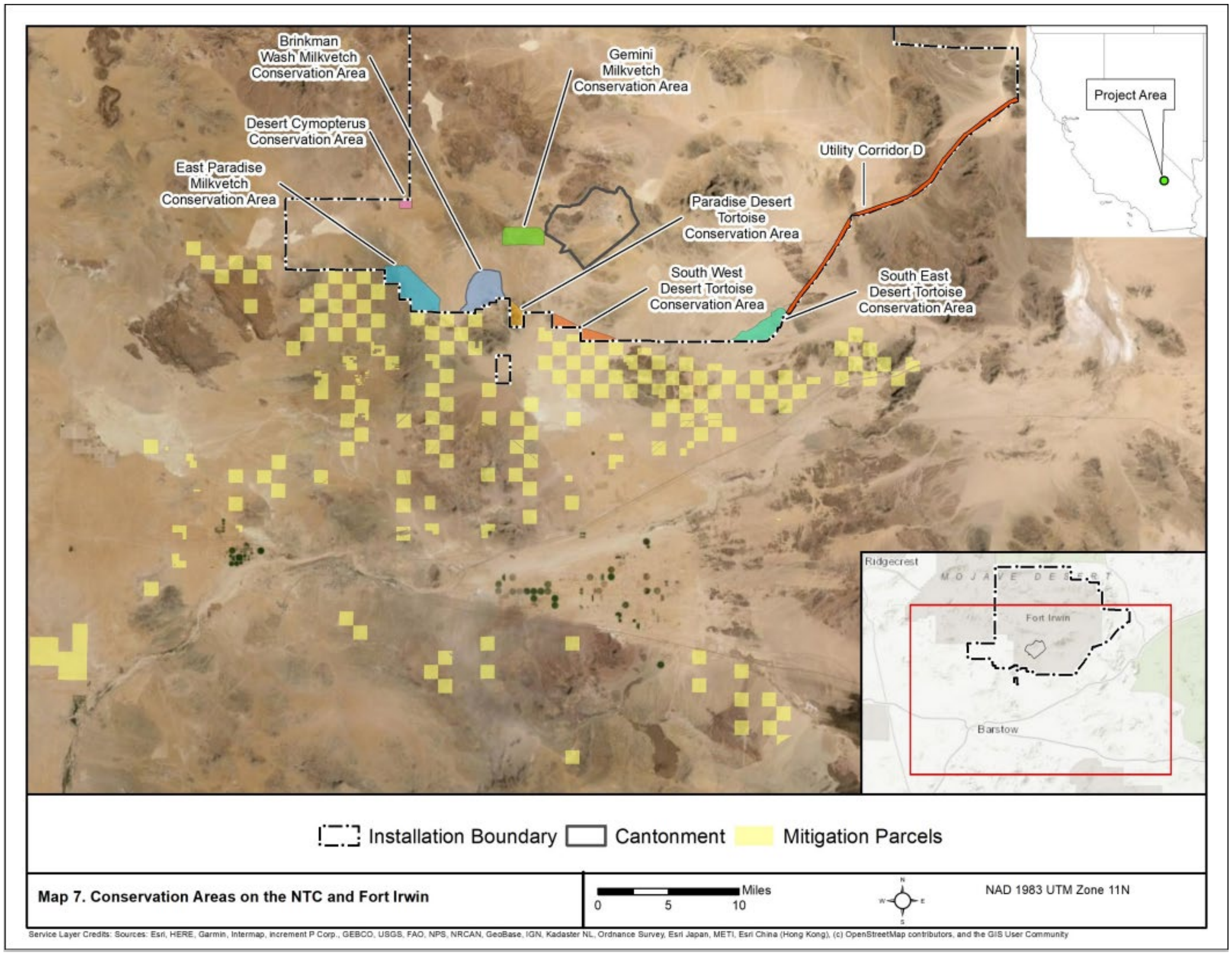


Figure 3-4. Conservation Areas on the NTC and Fort Irwin.

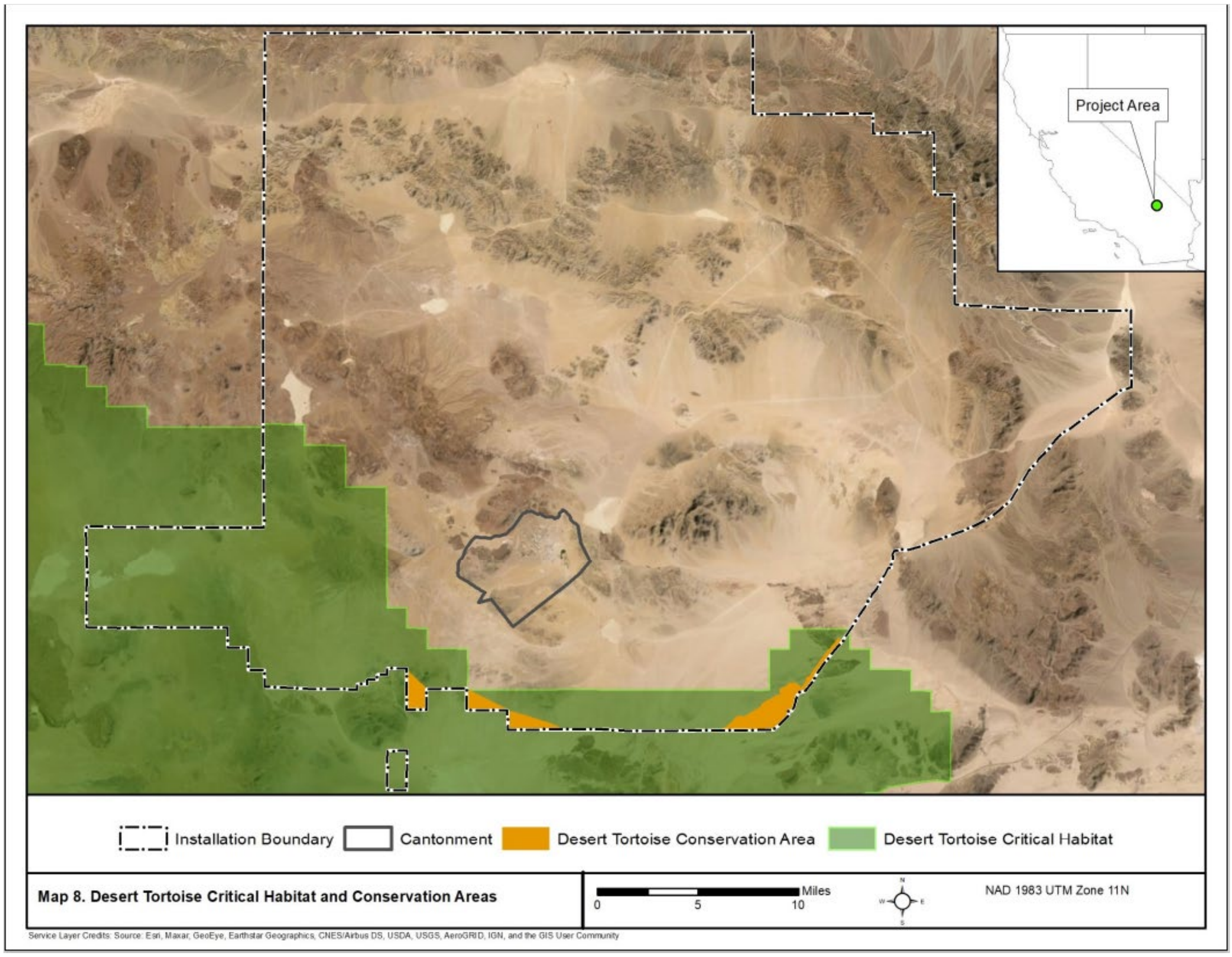


Figure 3-5. Desert Tortoise Critical Habitat and Conservation Areas.

3.7.2 General Management Strategies for Rare Species

While there are several species-specific management strategies described for each species, there are also a number of management strategies that benefit multiple species, including the following.

- <u>Maintain conservation areas and fencing</u> to conserve habitats for and individuals from listed and rare species.
- <u>Internal coordination</u> to identify activities that have the potential to impact listed and other rare species and their habitat and identify opportunities for avoidance / minimization.
- <u>Compile and review annual monitoring results</u> for all species and identify any changes needed for management. Coordinate the monitoring programs with FWS, BLM, and other federal agencies as appropriate to ensure regional trends are visible to all agencies.
- <u>Reduce disturbance</u>
    - Minimize disturbance, including off-road travel, to reduce accidental tortoise deaths, damage to milk-vetch and their host plants, habitat degradation, and fragmentation

    - Control erosion
    - Reduce fugitive dust, where possible.
- Create underpasses (e.g., install culverts) to allow the movement of wildlife and connect wildlife corridors.
- Limit access to sensitive areas, using barriers and fences
    - Barriers and fences discourage unauthorized use, including exclusionary fencing around conservation areas, cultural sites, and springs and seeps.
    - Place desert tortoise-proof fencing along major roads. Tortoise fencing has been proven to reduce and even eliminate mortalities.
    - Designated travel routes should be outlined with fencing, Siebert stakes, or shrubs to avoid any unnecessary incursions into adjacent habitats.
- Monitor fencing, suitable habitat for rare species, and other priority areas for damage and coordinate with appropriate entity to repair damage and/or discipline violators.
- Monitor dust levels, particularly near Conservation and Restricted Access Areas using passive samplers.
- Monitor water quality and quantity at springs and the quality of surrounding habitat annually.
- Rehabilitate habitat damage caused by military activities or other activities, especially in the conservation areas.
- Education awareness (internal to users of NTC and Fort Irwin) and public outreach are important management tools for minimizing impacts to rare species. However, these programs are also implemented for environmental issues other than rare species.
- Regional planning and coordination are also important aspects of the management of these rare species, as the efforts and threats on other surrounding property can impact the populations and habitat on NTC and Fort Irwin.
- Manage invasive species to minimize impacts on rare species through competition and to minimize changes in fire regimes that damage desert vegetation.
- Manage nuisance wildlife/predators to minimize harm and mortality in rare species from ravens and coyotes.
- Work with partners and scientists to conduct research on rare species to inform future decisions, and support regulatory compliance for the Army’s mission.

3.7.3 Management Strategies for Federally Protected Species

Management for all federally protected species includes monitoring populations and habitat, adopting an ecosystem management approach, and adaptive management. Some specific management strategies include:

- completing the annual report as required in the BO, including research, education, and monitoring;
- ensuring survey methods follow the latest guidelines from FWS unless otherwise agreed upon; and
- minimize incidental take (as defined by the ESA)
    - Pre-activity surveys and compliance monitoring will be conducted by authorized biologists for projects that may potentially impact sensitive species.
    - Personnel who handle and relocate these species will be properly trained and receive authorization from the FWS, and will use approved protocols.

3.7.3.1 2021 Biological Opinion (BO)

The *2021 Biological Opinion for the Recovery and Sustainment Partnership Initiative, Use of Additional Maneuver Training Lands, and Operations and Activities at the National Training Center and Fort Irwin, San Bernardino County, California* (FWS-SB-20F0163-21F1366) provides stipulations for avoiding, reducing, and offsetting impacts of military actions on LMMV, desert tortoise, and desert tortoise critical habitat.

As a part of maintaining overall compliance with the BO, Fort Irwin will implement or fund various activities developed under a five-year plan by the FWS and the DoD to identify and prioritize the DoD's desert tortoise recovery activities, subject to the availability of funds. The installation will provide a report to the FWS that details activities where desert tortoises are encountered while training or working on installation lands. Encounters with desert tortoises include injury, death, moving from harm's way, or translocation. The Palm Springs FWS office will be notified within 24 hours of locating a dead desert tortoise by phone (760-332-2070) and e-mail. The report must include the date, time, and location of the carcass, a photograph, cause of death if known, and any other pertinent information. The full BO can be found in **Appendix H**.

3.7.3.2 Desert Tortoise (*Gopherus agassizii*)

The Mojave Desert tortoise is a large, herbivorous tortoise that is native to the Mojave Desert north and west of the Colorado River in southwestern Utah, southern Nevada, southeastern California, and northwestern Arizona. Desert tortoises spend most of their lives underground and live in a variety of habitats from sandy flats to rocky foothills, including alluvial fans, washes, and canyons where suitable soils for den construction can be found. They generally live 50 to 80 years, grow slowly, and have low reproductive rates. Most threats to the desert tortoise are associated with human land uses that result in habitat loss and fragmentation.

Within NTC and Fort Irwin, most tortoises are located within disjunct populations in the foothills of the Granite and Tiefort mountains, and some of that habitat is not high quality. These steep areas, as well as isolated washes and canyons, are generally avoided by military vehicles and consequently provide a relatively safe area for tortoises. However, these areas are fragmented and isolated from larger, contiguous areas supporting tortoise populations. The long-term suitability of these refugia is limited due to their relatively isolated nature and small size. Other populations exist within Goldstone Complex, Range 1, and East Gate. Tortoise densities have been estimated to range from zero (in developed or extensively disturbed areas) to relatively high (several hundred tortoises) in areas of critical habitat in the WTA. A detailed discussion of desert tortoise on NTC and Fort Irwin and historic trends is provided in **Appendix E**.

The 2021 BO describes many management actions for the desert tortoise. Avoidance of impacts and minimization of incidental take are the most significant components of natural resources management on NTC and Fort Irwin. The approach is to focus on populations rather than individuals, ecosystem-level management, and educational outreach to improve awareness and prevent additional take.

Over the years, the installation has rehabilitated desert tortoise habitat on the installation, and obtained off-post parcels with high-quality tortoise habitats to serve as refugia. A number of actions are identified in the BO to continue the species' conservation on post and support recovery regionally. Maintaining the conservation areas (Section 3.7.1) and fencing are essential, ongoing management for the desert tortoise.

A southern section of the NTC and Fort Irwin is within the desert tortoise Superior-Cronese Critical Habitat Unit, as designated by the FWS in 1994. This 20,000-acre section was originally fenced and made off-limits to military training. Upon approval in the past, tortoises were translocated out of some of the area, and it was reopened to military training. Over time, the Army designated three sections on NTC and Fort Irwin as conservation areas, which were then fenced. The fencing did allow for tortoise movement through the boundary fence. Outside these conservation areas, tortoises are typically relocated, and training continued. These are the conservation areas specifically designated for the desert tortoise on the NTC and Fort Irwin: the Paradise Desert Tortoise Conservation Area, Southwest Desert Tortoise Conservation Area, and the Southeast Desert Tortoise Conservation Area (**Figure 3-4** and **Figure 3-5**). These areas have tortoise fencing along their northern boundaries and are off limits to all nonscientific human activities, thereby establishing perpetual habitats for small populations of desert tortoises. See **Section 3.7.1** for additional information about these conservation areas.

There is also a 500-meter-wide buffer adjacent to the Boulder Utility Corridor on the southeast section of the installation. Tortoise populations within this utility corridor are not monitored, and this is not a “true” conservation area for desert tortoises. This buffer primarily prevents military activities in the Boulder Utility Corridor, but also provides additional habitat for the desert tortoise.

<u>*Raven Management*</u>

Ravens are now managed as part of the programmatic effort by multiple military bases as described in the *Final Programmatic Environmental Assessment for Integrated, Adaptive Management of the Common Raven on Department of Defense Lands in the California Desert* (USMC 2022). Common raven populations have increased in the Mojave Desert, with surveys from 1966 to 2019 showing about a 2.71% per-year increase in raven numbers in the Sonoran and Mojave Deserts (USGS et al. 2019). Conditions at NTC and Fort Irwin are conducive to increasing the number of ravens in the desert, with road kills, permanent water supplies at the wastewater treatment facility, a supplementary food supply at the landfill, and permanent structures that provide raven nesting and roosting sites. Because ravens are known to prey on juvenile desert tortoises, any increase in the raven populations in the area could have negative impacts on desert tortoise populations.

As a result of this regional increase, multiple DoD installations in the California Desert have developed and approved an adaptive raven management program (USMC 2022). Under the proposed plan, NTC and Fort Irwin managers will use a mix of effective non-lethal and lethal raven management actions to reduce the raven population to more sustainable levels (between 0.64 and 0.75 raven/square kilometers). The current estimated raven density on NTC and Fort Irwin is 1.56 ravens/square kilometer, with the cantonment area having the highest density. Raven management includes reducing food and water subsidies; education and outreach regarding ravens; removal of roosting and nesting sites; hazing and other active deterrents; exclusion; egg/nest destruction; and lethal depredation (USMC 2022). All activities will be conducted in compliance with a Federal Migratory Bird Depredation Permit to be issued by FWS.

Other nuisance wildlife that could impact the desert tortoise is discussed in Section 3.6.

Management strategies specific to the desert tortoise (in addition the general management strategies above) on the NTC and Fort Irwin include:

- maintaining signage and marking on travel corridors close to desert tortoise habitat and escort convoys within these travel corridors;
- installing and maintaining desert tortoise fencing;
- installing predator control measures to reduce predator populations when needed (Section 3.6);
- minimizing disturbance and restoring damage to training lands outside the conservation areas to a level suitable for the military mission;
- supporting desert tortoise recovery in the region as described in the 2021 BO; and
- reporting all incidental take of desert tortoises to FWS and maintain frozen specimens until they are sent to a FWS-approved facility for necropsy.

3.7.3.3 Lane Mountain Milk-Vetch (LMMV) (*Astragalus jaegerianus*)

The LMMV is a rare species of milk vetch endemic to northeastern San Bernardino County, where only four known populations exist. It is a fragile plant with thin stems that grow tangled into neighboring shrubs that provide support. LMMV occurrence is thought to be highly dependent on specific soil conditions. It occurs in granite-rich soils and is found on very low ridges in bajadas on shallow, gravelly hummocks of coarse sand.

The NTC will ensure the long-term survival of LMMV populations by avoiding populations without constraining mission activities to the maximum extent practicable. Because military training is expected to impact some milk-vetch plants, conservation will be achieved by focusing on large portions of the three populations located on the NTC.

Focusing on populations rather than the total number of individuals is particularly appropriate for the LMMV because it is a narrow endemic. The species' entire distribution is limited to four populations; two of which are located within the WTA. Further, the species is limited to areas of specific habitat within this area (Charis Professional Services Corporation 2002). Small populations of many species are known to undergo fluctuations in size, often to the point of population extinction (Primack 1995). Extinction can be followed by colonization from neighboring populations that act as "sources" (Primack 1995; Pulliam 1988). Therefore, maintaining the viability of multiple populations is needed for the long-term persistence of the species, particularly when the primary threat to the species is a small distribution in the face of a fluctuating environment.

The current BO requires the NTC and Fort Irwin to report annually to the FWS with LMMV conservation activities, including land acquisition and road monitoring/closures, and invasive plant control. Any changes made to LMMV conservation areas would be made in coordination with the FWS. Locations of the milk-vetch conservation areas are shown in **Figure 3-4**.

Additional management strategies include:

- Support research and monitoring of LMMV with a focus on species recovery, including management-oriented research on the demographics, life history, and ecology of the species and models related to population dynamics.
- Continue annual monitoring in accordance with the LMMV monitoring plan (**Appendix F**).
    - Plants within all the populations are surveyed, including one population on BLM land south of the installation.
    - Annual monitoring of the LMMV has been standardized on the NTC and Fort Irwin into a long-term monitoring program focusing on demographics, population trends, and threats. The monitoring plan focuses on determining the number of living LMMV on study plots; finding, mapping, and tagging new recruits; examining demography and reproduction; recording host plant cover; and measuring dust. Previously tagged plants are monitored each year to determine mortality.

3.7.3.4 Least Bell's Vireo (LBVI) (*Vireo bellii pusillus*) and Southwestern Willow Flycatcher (SWFL) (*Empidonax traillii extimus*)

LBVI is one of four subspecies of Bell's vireo; it is the western-most subspecies, breeding entirely within California and northern Baja California. These small birds winter in southern Baja California, where they occupy a variety of habitats, including mesquite scrub within arroyos, palm groves, and hedgerows bordering agricultural and residential areas. They arrive to their southern California breeding areas from mid-March to early April and generally remain until late September.

The SWFL is one of four subspecies of willow flycatcher. These small birds breed in patches of riparian habitat throughout the American southwest, including southern California, southern Nevada, southern Utah, New Mexico, southwestern Colorado, and historically in western Texas and extreme northwestern Mexico. They winter in Mexico, Central America, and northern South America. SWFL requires moist microclimatic and vegetative conditions and frequently nests in nonnative tamarisk as well as native willow.

The primary goal for the LBVI and SWFL is to conserve and manage the species' potential habitat, which is riparian areas around the springs and seeps. All springs on NTC and Fort Irwin are managed to prevent the loss, fragmentation, or degradation of riparian areas, which have the potential to provide habitat for LBVI or SWFL. At present, all the springs that occur on the NTC are designated off-limits to all military use (Section 2.7). Three- or four-strand barbwire fencing and concertina wire have been installed to prevent intrusions into Bitter, Garlic, Cave, Desert King, Devouge, No Name, and Panther Springs. Bitter Spring is the only spring being managed that has been degraded by intrusion of feral burros. Fencing has been repaired and patched, but sandy soils and infrequent flooding allow burros to breach the fence and cause damage. Additional funding has been requested to replace the fence. Additionally, Siebert stakes have been placed approximately every 30 meters along these fences as a secondary boundary marker. Locations of springs can be seen in **Figure 3-2**. This will benefit the vireo and flycatcher by minimizing the habitat loss on the NTC and Fort Irwin.

Stewardship of springs benefits other species like the alkali mariposa lily. Management strategies for these two birds (in addition to the general ones listed above) focus on minimizing habitat disturbance and include:

- conducting a focused survey for the LBVI approximately every five years;
- continuing spring and seep monitoring annually;
- maintaining and monitoring barriers and fences that exclude vehicles and burros from riparian areas;
- removing tamarisk and cattails to improve the quality of potential habitat but postpone large tamarisk removal to keep some nesting sites available until native trees are available; and
- where significant cultural resources will not be affected, planting native tree species at springs to improve the quality of potential habitat.

3.7.3.5 Golden Eagle (*Aquila chrysaetos*)

The golden eagle is a large bird of prey found throughout North America, but more commonly in western North America. Most golden eagles in California are year-round residents, but some migrate into the state for winter. These birds maintain large home ranges (up to 200 square kilometers) and inhabit a variety of habitats, including forests, canyons, shrublands, grasslands, and oak woodlands. Breeding typically occurs in the spring, and nests are built in cliffs and other high places to which they may return for several breeding years.

Golden eagles are not common on NTC and Fort Irwin and roam widely throughout the region. Surveys from 2016 through 2019 documented five or fewer active golden eagle nests each year. These surveys also included telemetry studies on two golden eagles (PacArctic LLC & BioResource Consultants Inc. 2019). Management for golden eagles at the NTC and Fort Irwin consists primarily of continued monitoring. Management strategies specific to golden eagles (in addition to the general ones listed above) include:

- conducting pre-project natural resources surveys to identify potential nesting sites
- minimizing disturbance to eagles and their nests,
- sharing survey results and coordinating golden eagle management with FWS and CDFW, and
- restoring and managing shrub-steppe habitats.

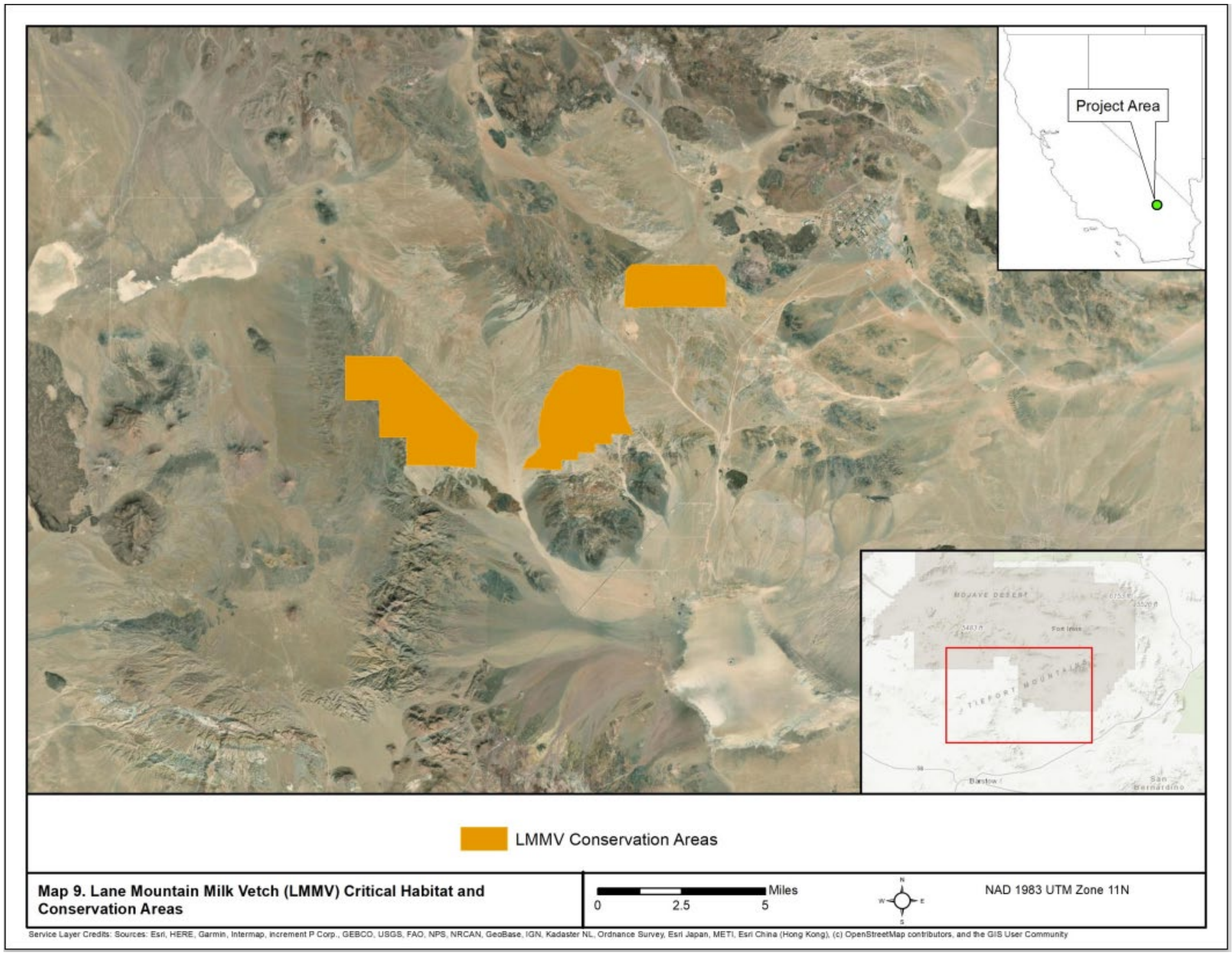


Figure 3-6. Lane Mountain Milk Vetch (LMMV) Critical Habitat and Conservation Areas.

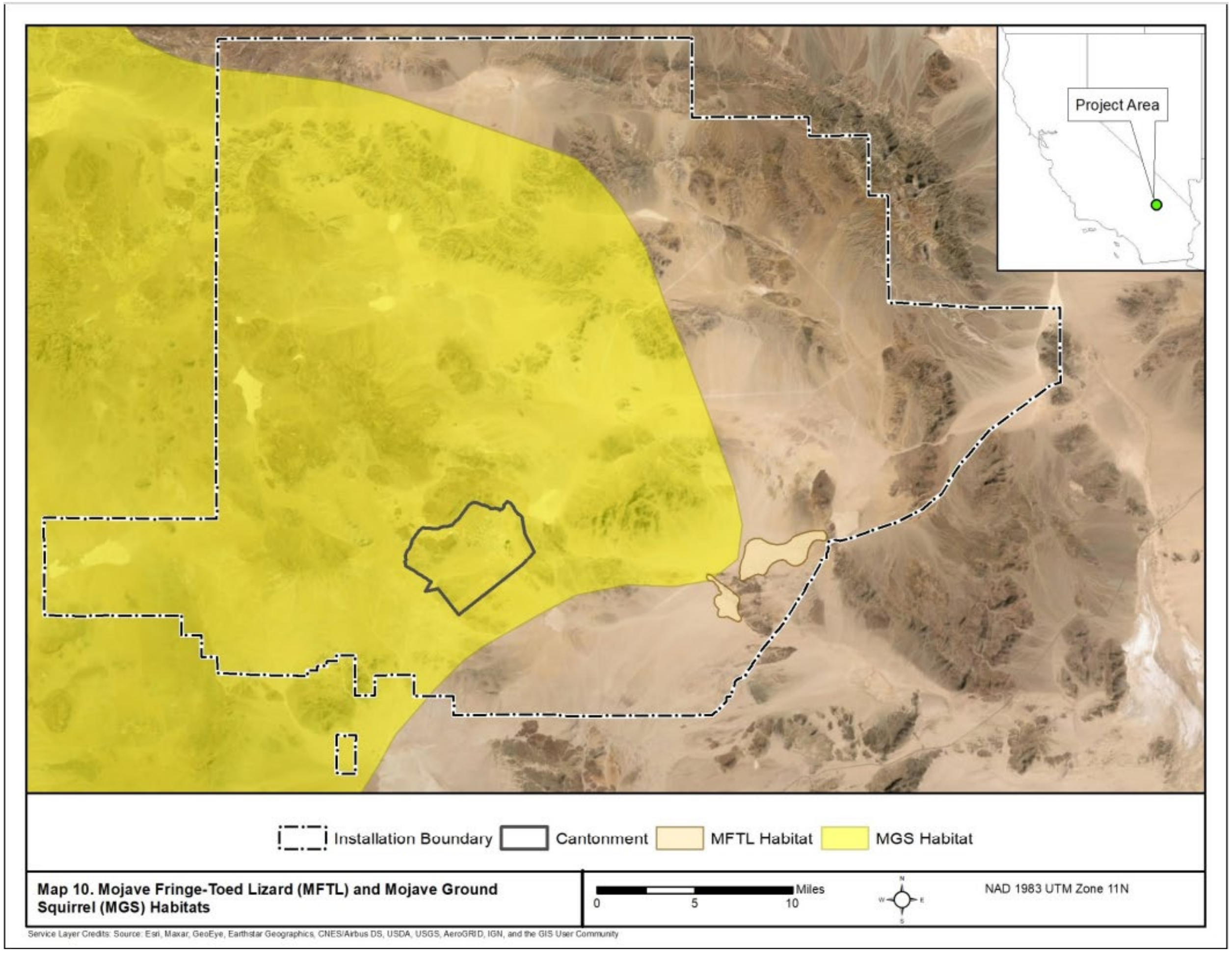


Figure 3-7. Mojave Fringe-Toes Lizard (MFTL) and Mojave Ground Squirrel (MGS) Habitats.

3.7.4 Management Strategies for State Listed and Other Rare Wildlife

While requirements related to federally listed species are prioritized, management of state listed species and other rare wildlife also occurs at the NTC and Fort Irwin.

3.7.4.1 Desert Bighorn Sheep (DBS) (*Ovis canadensis nelsoni*)

DBS are a subspecies of bighorn sheep that are native to the deserts of the United States' intermountain west and southwestern regions as well as northwestern Mexico. These stocky, heavy-bodied sheep have concave, elastic hooves that allow them to easily climb the steep, rocky terrain of the desert mountains. They are highly adapted to the desert climate and can go for extended periods without drinking water. DBS are social animals and generally form herds of eight to ten individuals, although herds of up to 100 have been observed.

California has the most extensive array of naturally persisting DBS populations in North America. DBS populations on Federal Lands (BLM, DoD, NPS) play a disproportionate and important role in the regional conservation of this collective metapopulation. Monitoring and maintaining an interconnected network of DBS populations promotes high genetic diversity and allows populations to recover from drought and disease-induced die-offs (Bleich et al. 1996; Cassirer and Sinclair 2007; Epps et al. 2006) but can be difficult to implement given the mosaic of land-uses and managers involved in this region. Oregon State University (OSU) is conducting a DBS project to assess the connectivity and permeability of land usage and to better understand how populations of sheep are being increasingly fragmented by degradation of habitat quality. OSU partnered with multiple agencies to fill in critical knowledge gaps regarding bighorn sheep metapopulation dynamics in this region and to test new tools for documenting changing conditions into the future. OSU researchers will use existing data and collect new data in order to: 1) Refine the known DBS distribution while testing the efficiency of multiple survey methods, and 2) Assess existing connectivity between DBS populations relative to movement and gene flow with data from less-studied regions. Given the recent history of disease-induced mortality and rapid spread of pathogens throughout this region, filling existing knowledge gaps regarding distributions and movement would assist transboundary efforts to monitor and manage threats to sheep persistence both within and outside of NTC and Fort Irwin, as well as other federal lands.

Management strategies for DBS include:

- coordinating and collaborating with various stakeholders such as BLM, other DoD installations, OSU, and NGOs such as the Society for Conservation of Bighorn Sheep; consulting with CDFW; and supporting studies in the region
- maintaining perennial springs/seeps as water sources by installing wildlife-friendly fencing to exclude burros (**Section 3.3.1**); and,
- installing and maintaining augmented water sources for long-term, year-round water availability that improves DBS habitat and connectivity along with enhancing habitat for mesocarnivores, such as foxes and gamebirds (i.e., Gambel's quail).

3.7.4.2 Mohave Ground Squirrel (MGS) (*Xerospermophilus mohavensis*)

The MGS is found only in the Mojave Desert. It has one of the smallest geographic ranges of any North American ground squirrel and spends much of the year in underground burrows to avoid the harsh conditions of the desert. It can occupy a variety of habitats, including Joshua tree woodlands, creosote bush scrub, saltbush scrub, and Mojave mixed woody scrub. Areas of preferred habitat must provide soils conducive to burrow excavation and forage plants that meet nutritional and water content requirements.

Focusing on populations rather than the total number of individuals is appropriate for the MGS because of its small population size and limited distribution. Conservation areas for the LMMV and desert tortoise (management discussed in Section 3.7.3) also benefit the MGS. The Goldstone Complex is maintained as an MGS conservation area and is the focus of MGS management on NTC and Fort Irwin. This area is off-limits to military training with wheeled or tracked vehicles except on the tank trail (parallel to paved highway) that is used as a convoy route. Fencing and Siebert stakes are maintained along the tank trail to prevent vehicles from accidentally straying into the surrounding area. Fort Irwin is planning to participate in a working group if future initiatives under the RASP are initiated. In the interim, management strategies for MGS on NTC and Fort Irwin include:

- a camera-trapping study that was re-initiated on WTA using bait stations in 2021,
    - The results indicated presence of MGS, but the sample size was small, so extrapolation into a meaningful conclusion about population dynamics was not possible.
- maintaining Goldstone Complex as an MGS conservation area, including maintaining the fencing and Siebert stakes;

- enhancing 15 acres (split into 5-acre areas) of potential MGS habitat in the East Paradise Conservation Area (assuming this does not conflict with other management in this area) through broadcast seeding with preferred forage, such as spiny hop sage (*Grayia spinosa)*, winterfat (*Krascheninnikovia lanata*), and other assorted native desert wildflower seeds;
- monitoring MGS habitats within other conservation areas;
- monitoring the density of the Fort Irwin population of MGS through RASP or other partnerships
- controlling and monitoring fugitive dust and invasive weeds;
- supporting research and monitoring efforts; and
- conducting a survey of the Coolgardie Mesa population to identify the presence/absence and/or density of MGS.

3.7.4.3 Mojave Fringe-Toed Lizard (MFTL) (*Uma scoparia*)

The MFTL is a medium-sized, omnivorous lizard that lives in desert areas of Inyo, Los Angeles, Riverside, and San Bernardino Counties in California, and La Paz County in western Arizona. Habitats are restricted to areas that have fine sand. MFTL has concealing coloration that blends in with the desert environment, with skin ranging from tannish to grayish white with small black spots and three crescent-shaped throat markings characteristic of the species. During the breeding season in late spring, the underside turns yellow-green, and the black spots on the sides of the belly turn pink.

MFTL inhabit a limited number of sand dune complexes within the Mojave and Sonoran Desert in areas of sand dunes and sheets along the southeastern boundary of NTC and Fort Irwin. The species is known to be particularly impacted by low annual precipitation (Goodman 2019). This lizard occurs and has been monitored on NTC and Fort Irwin since 2007. Management strategies for MFTL include:

- surveying annual population to track trends and evaluate habitat (Goodman 2019), and
- Continuing ongoing monitoring to evaluate potential adverse impacts of training exercises on population trends.

3.7.4.4 Burrowing Owl (*Athene cunicularia*)

Burrowing owls are small, diurnal owls found throughout open landscapes of North and South America. They can often be found in grasslands, ranges, agricultural areas, deserts, or any other open, dry area with low vegetation. Burrowing owls live underground in excavated burrows and are vulnerable to the destruction of burrowing systems or reduction in other burrowing animals (desert tortoises, ground squirrels, prairie dogs). Monitoring for burrowing owls on NTC and Fort Irwin began in 2005. Management strategies for burrowing owls include:

- continuing surveys (consistent call broadcast surveys),
- performing annual maintenance on the artificial burrow system before the breeding season with more substantial maintenance every five years, and

3.7.4.5 Bats

Bats are of increasing conservation concern and are susceptible to changes in their key resources (i.e., caves and water sources that have insects). Management for bat species on NTC and Fort Irwin includes:

- conducting surveys to monitor bat species’ presence/absence,
- maintaining springs as key foraging habitats (Section 3.3.2),
- removing dense vegetation from springs (Section 3.3.2 and Section 3.8.3), and

- in conjunction with the cultural resources program (since a substantial number of the mines are historic), installing and maintaining bat-friendly gates on recommended mines (e.g., in the Avawatz Mountains near Goat Mountain, in the WTA).

3.7.4.6 Rare Predators

Rare mammal predators found on the NTC and Fort Irwin include the desert kit fox, mountain lion (*Puma concolor*), and American badger (*Taxidea taxus*). State-listed, rare transient raptors on NTC and Fort Irwin include the Swainson's hawk, white-tailed kite, and peregrine falcon. Other special status raptors such as the long-eared owl (*Asio otus*), ferruginous hawk (*Buteo regalis*), merlin (*Falco columbarius*), and osprey (*Pandion haliaetus*) have been documented as well. The primary management strategy for rare mammalian and avian predators is conservation and maintaining connectivity of high-quality habitat to the maximum extent practicable.

3.7.4.7 Other Bird Species of Concern

Other special status birds on NTC and Fort Irwin include many songbirds, hummingbirds, a swift, as well as waterfowl, wading birds, and seabirds. Management strategies for other bird species of concern include:

- maintaining seeps and springs (Section 3.3),
- participating in regional migration studies, and
- continuing surveying for bird species.

3.7.5 Management Strategies for Rare Plants

3.7.5.1 Desert Cymopterus (*Cymopterus deserticola*)

The desert cymopterus is a perennial herb that is endemic to California, where it grows in creosote bush scrub and Joshua tree woodlands. Little is known about the reproduction of this species, and it does not appear to produce fertile seeds (Charis Professional Services Corporation 2004). It was petitioned for listing under the ESA and subsequently determined to be not warranted in 2004. Botanical surveyors report that the drier the water year, the fewer the number of plants. In addition, the phenology of the species is related to precipitation events rather than to calendar dates. Additional study is needed to understand the relationship between precipitation and growth.

Management for desert cymopterus on the NTC and Fort Irwin centers conserving habitat and known populations. The Desert Cymopterus Conservation Area in the WTA contains approximately 348 acres for this rare plant. Fort Irwin will continue collaboration with external working groups to conserve regional populations to the maximum extent practicable.

3.7.5.2 Rare Plants in Joshua Tree Woodlands

Joshua tree woodlands are open areas of widely scattered Joshua trees with a community of low-growing, broad-leaved evergreen, and deciduous shrubs. These habitats usually contain little herbaceous understory. Joshua trees are usually the only arborescent shrubs present, but scattered junipers, pinyons, and other yuccas may be present in some areas.

A number of rare plants, in addition to Joshua trees themselves, are found in Joshua tree woodlands, like Clark Mountain buckwheat and striped horsebrush. Surveys and management for these areas will benefit a number of rare plants.

Management strategies for Joshua tree woodlands include:

- Approval by the DPW Natural Resources Team for removal of Joshua trees for construction or mission requirements;
- replacing or transplanting Joshua trees whenever possible;

- conducting surveys to better map the locations of Joshua tree woodlands, particularly in the Avawatz Peak North-Slope and South-Slope areas;
- using native species like the Joshua tree for the revegetation of disturbed areas;
- reducing the risk of wildfires (Section 3.5);
- reducing the density of non-native plants (Section 3.8); and
- burro management (Section 3.6).

3.7.5.3 Rare Plants in Desert Scrub Habitat

Alkali mariposa lily (*Calochortus striatus*), Clokey's cryptantha (*Cryptantha clokeyi*), and small-flowered androstephium (*Androstephium breviflorum*) all occur in desert scrub habitats. The existing conservation areas (Section 3.7.1) for other species also benefit these species. The primary management specific to these rare plants is to conduct surveys in the spring to document population status and locations.

3.7.5.4 Riparian Rare Plants

A number of rare plants are associated with the springs and seeps, and the management measures for those habitats (Section 3.3.2) and for federally listed riparian birds (Section 3.7.3.4) also benefit these rare plants.

3.7.6 Regulations and Policies

Regulations: ESA, California ESA, Bald and Golden Eagle Protection Act, California Desert Native Plant Act, Native Plant Protection Act, NTC Reg 200-1, DoDI 4715.03

The following are policies implemented at NTC and Fort Irwin to manage and conserve rare species.

- Ensure the conservation of species listed as threatened or endangered. Develop and implement management strategies to prevent the necessity to list candidates or rare species (NTC Reg 200-1).
- Maintain conservation areas and fencing.
- Comply with current Biological Opinion.
- When a Soldier encounters a desert tortoise, he/she is instructed to stop activities and call Range Operations or DPW-ENV for guidance in dealing with the animal. If the Soldier has the proper desert tortoise awareness training, they may be instructed to move the tortoise out of harm's way. If the training or the situation does not permit movement, a biologist will go to the site; the biologist will inspect the animal and move it from harm's way. If circumstances will not permit the biologist to visit the site, the Soldier (or unit) is instructed to monitor the tortoise to ensure it is not harmed until they move from the area (FWS 2014).
- Only qualified desert tortoise biologists (approved by DPW-ENV) are authorized to conduct surveys for the desert tortoise or move them; these biologists are also authorized to halt any action that might result in harm to the desert tortoise.
- Only qualified desert tortoise biologists are authorized to handle tortoises when the tortoise is in imminent danger and follow FWS handling protocols, other than, as noted above, when a Soldier has completed the desert tortoise awareness training.
- Train Soldiers to avoid impacts to the desert tortoise; this includes stopping activity until the tortoise has cleared the trail. Within the Manix Trail, use trained home station Soldiers to escort convoys and conduct relocation if a tortoise must be moved.
- Monitor endangered, threatened, or state special concern species and manage populations in accordance with the INRMP.

- If any species known to occur on post are listed under the ESA in the future, NTC and Fort Irwin will initiate dialogue with FWS to establish management strategies.
- To avoid any effects on ESA-listed species, ensure all construction involves the implementation of avoidance and minimization measures agreed to with the FWS.

3.8 Invasive Species and Integrated Pest Management (IPM)

INVASIVE SPECIES AND INTEGRATED PEST MANAGEMENT GOAL: TO MINIMIZE IMPACTS OF INVASIVE AND PEST SPECIES USING AN IPM APPROACH.

3.8.1 Integrated Pest Management (IPMP)

The installation has an IPMP (Glassey and Thompson 2022) as required by DoD and U.S. Army policy. This plan is updated annually and describes an IPM approach, with an emphasis on minimizing pesticide use whenever possible. IPM includes the implementation and coordination of optimum sanitation, good structural design and maintenance of facilities, mechanical control, cultural control, biological control, and regulatory control. A number of requirements related to certification, storage, application, and reporting are included in the IPMP. This plan also identifies and prioritizes pests and their destructive effects, with an emphasis on pest management within the cantonment area. Pest control efforts are implemented on the basis of surveillance. Pest surveys are necessary to determine the type of pest, the extent of the problem, and the pest management technique most appropriate for safe, effective, and economic control.

Cantonment area pest management on the NTC and Fort Irwin is primarily accomplished by a contractor, with technical assistance from DPW-ENV. The DPW-ENV and ITAM both implement projects that manage weeds and invasive species and follow the IPMP.

The presence of threatened, endangered, or species of concern and their habitat, especially the MGS, requires that special precautions be followed closely during any pest management activities that could affect these species. Surface waters require special precautions if pesticides are used in their vicinity.

The NTC and Fort Irwin IPMP recognizes eight categories of pests or undesirable vegetation that cause significant damage and require control or management. In order of priority, they are the following.

1. Disease vectors and medically important pests (e.g., gnats, mosquitoes, black widow spiders, scorpions, bees and other stinging insects, and filth flies)
2. Quarantine pests (typically none on the NTC and Fort Irwin)
3. Real property pests (e.g., subterranean termites)
4. Stored products pests, occasionally found in food facilities and food-storage warehouses
5. Ornamental plant and turf pests (e.g., elm leaf beetles and aphids)
6. Weeds and other undesirable vegetation, including invasive, exotic species on unimproved grounds (e.g., Russian thistle, saltcedar)
7. Vertebrate animal pests (e.g., feral burros, mice, ravens, coyotes, rattlesnakes, stray pets)
8. Household and nuisance pests (e.g., cockroaches, ants, spiders, crickets, fleas, beetles)

3.8.2 Priority Invasive Species

Native vegetation in California appears to be particularly susceptible to invasion by exotic plants. Non-native plants and weeds often pose threats to native habitats, endangered species, and plant community composition and diversity. More specifically, they threaten vital spring ecosystems, complicate ITAM land rehabilitation projects, add to the cost of pest management, and in general, threaten ecosystem functionality.

A list of documented invasive plant and animal species on the installation can be found in **Appendix D**. High-priority invasive plants include:

- Red brome (*Bromus rubens*),
- Sahara mustard (*Brassica tournefortii*),
- Russian thistle (*Salsola tragus*),
- Smallflower tamarisk (*Tamarix parviflora*), and
- Saltcedar (*Tamarix ramosissima*).

Priority invasive animals include:

- Mosquitofish (*Gambusia affinis*),
- Brown-headed cowbird (*Molothrus ater*),
- House mouse (*Mus musculus*), and
- Roof rat (*Rattus rattus*)

Invasive plans are also a concern for wildland fire fuel loads. Historically, fires in the Mojave Desert were infrequent and small since fuels were discontinuous or did not burn readily. However, with fire-prone nonnative grasses, there is an increasing amount of fuel within desert plant communities, which allows a fire to spread easily and causes the conversion from shrub communities to grass-dominated communities (Randall et al. 2010). It can take decades for native desert vegetation to recover from a fire. During this time, there can be a reduction in habitat and forage value for wildlife, including the desert tortoise.

As conditions and the climate continue to change, new invasions are expected to occur, and the most effective methods to manage invasive plants may change. Coordination among regional land managers is important for sharing information and data to prevent, slow, and reverse invasive species impacting native species.

In 2002, DPW-ENV signed a Memorandum of Understanding (MOU) to join and coordinate activities with the West Mojave Weed Management Association (WMWMA), a regional group of representatives from government lands seeking to control weeds and invasive species. This organization tracks the spread of weeds and exotic species in the Western Mojave Desert and coordinates weed control.

However, a potential conflict exists between removing unwanted plants and management of federally threatened and endangered species that either eat unwanted plants or use their habitat. In particular, the endangered SWFL and the LBVI nest in exotic saltcedar trees, and the desert tortoise readily eats exotic red brome. This means that management efforts need to account for the availability and rapid replacement of suitable native plants.

3.8.3 Management Strategies

Many of these management strategies support removal of invasive species to benefit other resources, such as water resources, rare species, or native wildlife. Invasive species management primarily driven by those resources are discussed in their respective sections and not repeated here.

3.8.3.1 Red Brome, Sahara Mustard, Russian Thistle

Red brome is an introduced, early-emerging annual grass native to the Mediterranean region but is now widespread across the western United States. It establishes in open spaces within shrub and grassland communities. As it matures, red brome provides a fuel source that decomposes slowly and greatly increases the fire potential, intensity, and burn speed in areas it has invaded.

Sahara mustard is an introduced short-lived annual that is native to North Africa, the Middle East, and Mediterranean regions. It occupies a wide variety of disturbed habitats but prefers sandy soils. This fast-growing plant develops dense, monotypic stands resulting in lower diversity of flora and fauna species. The litter material can become a fire hazard capable of spreading into areas where native plants are typically fire intolerant.

Russian thistle is a summer annual native to southeastern Russia and western Siberia and is now widespread throughout the western United States. It thrives in areas with loose, sandy soils and often occurs in disturbed habitats. In late fall and early winter, the mature plant breaks off at ground level, creating tumbleweeds that can be a nuisance and a fire hazard.

These three priority plant species (and some other lower priority plant species) increase fuels and have the potential to change fire frequency. Similar management is needed for these species to minimize their prevalence and reduce the risk of damaging wildfires, although specific control methods vary from species to species.

Bromes are of management concern due to their dryness and flammability in the dry season, which can increase wildfire frequency. Furthermore, brome does not provide adequate nutrients similar to annual forb diets for the desert tortoise. Red brome on the installation is associated with undisturbed north and northeast facing hillsides at higher elevations.

Sahara mustard suppresses native wildflowers and increases fire hazards by easily invading recently burned areas and increasing fire frequency and fuel load. Sahara mustard prefers the banks of arroyos at the base of hills on the installation.

Russian thistle impedes traffic, creates fire hazards, and hosts the beet leaf-hopper, which is an agricultural insect pest. Most of the thistle on post is in the upper central and southeastern regions of the NTC and Fort Irwin, in areas of disturbance where water collects in impoundments, especially along Langford Lake.

Management strategies for plants that increase fire risk include:

- determining areas needing treatment to reduce fuel loads and re-establish native vegetation in key habitats and corridors;
- treating priority areas to reduce fuel loads where fire risk is greatest and to maintain habitat for rare species;
- contributing to phenological datasets to document the effects of climate change and anticipate its management implications;
- continuing communication, collaboration, and coordination with adjacent land managers; and
- revisiting any treated areas regularly for monitoring and surveillance.

3.8.3.2 Smallflower Tamarisk and Saltcedar

Saltcedar species (including smallflower tamarisk), are shrubby trees native to drier areas of Eurasia and Africa that have invaded riparian habitats southwestern United States. Saltcedar is commonly found along streambanks, sandbars, lake margins, wetlands, and moist rangeland, where it forms dense monocultures and competes with native species.

BLM and the U.S. Army have been collaborating on saltcedar removal at Bitter Springs since 1996. During the most recent effort in 2018 and 2019, saltcedar was removed by BLM personnel at Garlic and Bitter Springs. Saltcedar were cut, and stumps were treated with an herbicide to prevent regrowth. However, some areas outside the spring that were not treated remained, and some resprouting from stumps had occurred. These recent efforts with BLM and natural resource contractors have greatly reduced the presence of saltcedar on NTC and Fort Irwin; however, the need still exists for saltcedar control along the length of the Bitter Spring wash system.

A potential conflict exists between saltcedar removal and stewardship of federally listed riparian bird species (SWFL and the LBVI) that are known to nest in saltcedar. Where potential habitat for riparian birds is found, steps that decrease impacts on riparian birds must accompany saltcedar removal. In 2002 and 2004, approximately 30 native riparian trees were planted at Bitter Springs in anticipation of future saltcedar removals. Strategies to minimize the potential effects of removing saltcedar on federally listed birds include the following.

- Native riparian trees, such as desert willow, honey mesquite, and black willow, will be planted. Newly planted trees require maintenance (i.e., watering) to ensure survival. Due to ground disturbance caused by tree planting, coordination with the cultural resource program will be necessary when planting in archeologically-sensitive areas.
- Remove adult saltcedar (greater than a 5-centimeter [cm] base diameter) gradually over several years. Young saltcedar (less than a 5-cm basal diameter) do not provide potential habitats for riparian bird species and can be removed in a single episode without replacement.
- Avoid saltcedar removals during nesting season (unless the absence of nests is confirmed).

Another option beyond manual removal is biocontrol. *Diorhabda carinulata* is a beetle from the same region where saltcedar originated, and it feeds on tamarisk. In previous years, there were discussions about releasing this beetle on NTC and Fort Irwin, but it was not executed for a variety of reasons. Releases from other states, however, made it to California along the Colorado River, and the beetle can now be found along the Mojave River in Barstow and in Owens Valley. It is not currently known to occur on NTC and Fort Irwin, but it may continue to spread. More information is available at the Riparian Invasion Research Laboratory website.

Management strategies for saltcedar on NTC and Fort Irwin include the following.

- Assess tamarisk and removal annually until treatment is successful. One success threshold is the complete removal of all tamarisks under a 5-cm diameter and native species revegetation. The second success threshold is the complete removal of all tamarisk in the spring areas on NTC and Fort Irwin. If tamarisk regrowth is found during yearly monitoring, it will be removed, and management will be reevaluated.

3.8.3.3 Invasive Animals

Mosquitofish are introduced in California to control mosquitos and occur on the installation at Garlic Springs. The brown-headed cowbird prefers open habitats interspersed with shrubs or trees that provide ample forage and host nests. House mice and roof rats occasionally enter buildings on post and can destroy food and gnaw on electrical wires.

A domestic Animal Control Facility (ACF) run by contract staff was added to the DPW Natural Resources Team’s responsibilities in 2017. The primary duty of the ACF is to catch stray (sometimes feral) cats and dogs within the cantonment. Animals are returned to their rightful owners, or if none can be found, they are adopted, transferred to another facility off installation, or if sick/injured, humanely euthanized by the installation veterinarian. In 2021, the Fort Irwin Garrison Commander signed an Intergovernmental Support Agreement with the City of Barstow to run the facility for 10 years.

Africanized bees have been discovered on the NTC and Fort Irwin. Any swarms of bees are considered to be Africanized, and the pest control office should be notified immediately.

Native nuisance wildlife are discussed in Section 3.6. Management strategies for nonnative, invasive animals on the NTC and Fort Irwin include:

- managing rodents inside buildings as described in the IPMP, and
- conducting outreach to minimize human / wildlife conflicts and discourage subsidizing predators.

3.8.4 Regulations and Policies

Regulations: DoDI 4150.07; California Noxious Weed Species; EO 13112; EO 11987; Plant Quarantine Act; Plant Protection Act; Noxious Plant Control Act; Non-Indigenous Aquatic Nuisance Prevention and Control Act; Federal Insecticide, Fungicide, and Rodenticide Act; Animal Damage Control Act

The following are policies implemented at NTC and Fort Irwin to minimize and manage invasive species.

- Implement the IPMP
- Use certified weed-free sources for revegetation and sediment control
- Only use chemical control when non-chemical techniques are inadequate or impractical

3.9 Outdoor Recreation

Outdoor recreation enhances the quality of life for military and civilian personnel and is identified in the Sikes Act as an important element of natural resources management. Examples of outdoor recreation include, horseback riding, picnicking, bird watching, off-road vehicle use, hiking, and camping. Developed outdoor facilities such as golf, tennis courts, baseball facilities, etc., are not included for the purposes of the Sikes Act and this INRMP. The military mission and safety have priority over outdoor recreation. Any private organizations must follow U.S. Army policy as it applies to their activities on NTC and Fort Irwin.

FMWR operates an outdoor recreation equipment issue center, which provides fishing equipment, camping equipment, boats and motors, canoes, camping trailers, etc. A variety of classes are offered here, including boating safety classes, scuba classes, golf, camping, and desert survival. A range of tours are also offered through a commercial vendor that include regional tours (not on NTC and Fort Irwin) and recreational outings (e.g., rock climbing, rafting, skiing, deep seas fishing).

3.9.1 Public Access

General public access is not permitted on NTC and Fort Irwin, except under highly controlled conditions. The military mission and related activities can pose a significant safety risk and include significant security requirements. An example of public access for recreation is guided tours, which can be closely controlled to maintain visitor safety and prevent conflicts with the military mission.

3.9.2 Hunting

There are no fisheries capable of supporting recreational fishing on the NTC and Fort Irwin. Trapping is currently not permitted on the NTC and Fort Irwin. A small-scale hunting program was previously active at the NTC and Fort Irwin dated 4 March 2010 (NTC Reg.420-3). However, an internal evaluation was conducted in 2021 and a determination was made that the program should be suspended until further notice due to security and safety concerns; insufficient staffing for oversight and law enforcement; and lack of interest and participation from the community. If the contributing factors change in the future, Environmental staff will conduct another feasibility study.

3.9.3 Off-Highway Vehicle (OHV) Park

An OHV area (approximately 70 acres) was created in 2003 to provide recreation for off-road enthusiasts but has moved to a new location recently. With the designated area for off-roaders, a strict ban is enforced on OHVs elsewhere on NTC and Fort Irwin. The OHV Park is located within designated recreation lands at the intersection of Fort Irwin Road and NASA Road (**Figure 3-8**). The perimeter is fenced with both desert tortoise-proof fence and two-strand barbed wire, with boundary signs. Potential users of the OHV Park must receive training from the Outdoor Recreation office of the FMWR. Trained OHV users are given keys that unlock the entry gate to the OHV Park. The area is open for use at any time during officially posted hours. OHV users are required to check in at the Outdoor Recreation Center before and after activities. In addition, users must comply with all sign postings and off-limits boundaries.

There are no sensitive natural resources within the OHV Park; adult tortoises were translocated from the park in 2003. Fencing is inspected and maintained to ensure no tortoises accidentally enter the OHV Park.

3.9.4 Non-Military Ranges

The Sportsman Club is a private organization on the NTC and Fort Irwin, open to all members of the Fort Irwin community: military, civilian, dependents, support personnel, and visitors. The club operates rifle, pistol, and archery ranges in the western section of the cantonment area, off Goldstone Road. The shooting range has been located to avoid disruptions with military activity and is open from sunrise to sunset. Proper firearm safety procedures are to be followed at all times. The skeet and trap range (Range 8) is controlled by Range Control and operated by FMWR. When Range 8 is open, firing ranges operated by the Sportsman Gun Club are closed due to overlapping firing fans.

3.9.5 Other Outdoor Recreation

Other outdoor recreation activities include picnicking, wildlife watching, nature photography, bicycling, horseback riding, recreational shooting, and camping. These activities are generally a responsibility of the FMWR, which uses the base operations contract for program implementation. Picnicking is a popular activity on the NTC and Fort Irwin. Picnic facilities are at Jackrabbit Park, Constitution Park, the Pavilion, and small areas near playgrounds and other areas.

There are recreational vehicle hook-up spaces in the cantonment area for use by military and civilian personnel and their dependents. Electricity is the only utility supplied to the area; there are no water or sewer hook-ups at the park. Spaces are available with a per-day charge. Primary users of the recreational vehicle park are contractors performing long-term work on the installation.

3.9.5.1 Equestrian

All horseback riding activities are restricted to the area designated by Range Control; no conflicts are expected to occur between equestrian and military training activities. Equestrians are free to ride within designated areas at their discretion. The High Desert Equestrian Club is a private organization open to all members of the NTC and Fort Irwin community. The club operates a 32-stall stable located in the western section of the cantonment area, off Goldstone Road. Horses are privately owned and maintained by individual owners, who are also expected to maintain the stalls.

3.9.5.2 Desert Explorers Club

The Desert Explorers Club is an NTC and Fort Irwin organization, open to all members of the Fort Irwin community: military, civilian, dependents, support personnel, and visitors. As an educational organization, the Desert Explorers facilitate the stewardship of the natural environment and areas of cultural and/or historical significance by increasing understanding and appreciation of the Mojave Desert ecosystem on the Training Center. Activities include hikes and day trips on and off the installation, meetings, and an occasional speaker on the desert environment. Activities are planned, announced, and open to anyone. The DPW Natural Resources Team has an active partnership with the Desert Explorers Club to facilitate awareness programs (**Section 3.1.4**).

3.9.6 Management Strategies for Outdoor Recreation

Management strategies related to outdoor recreation include:

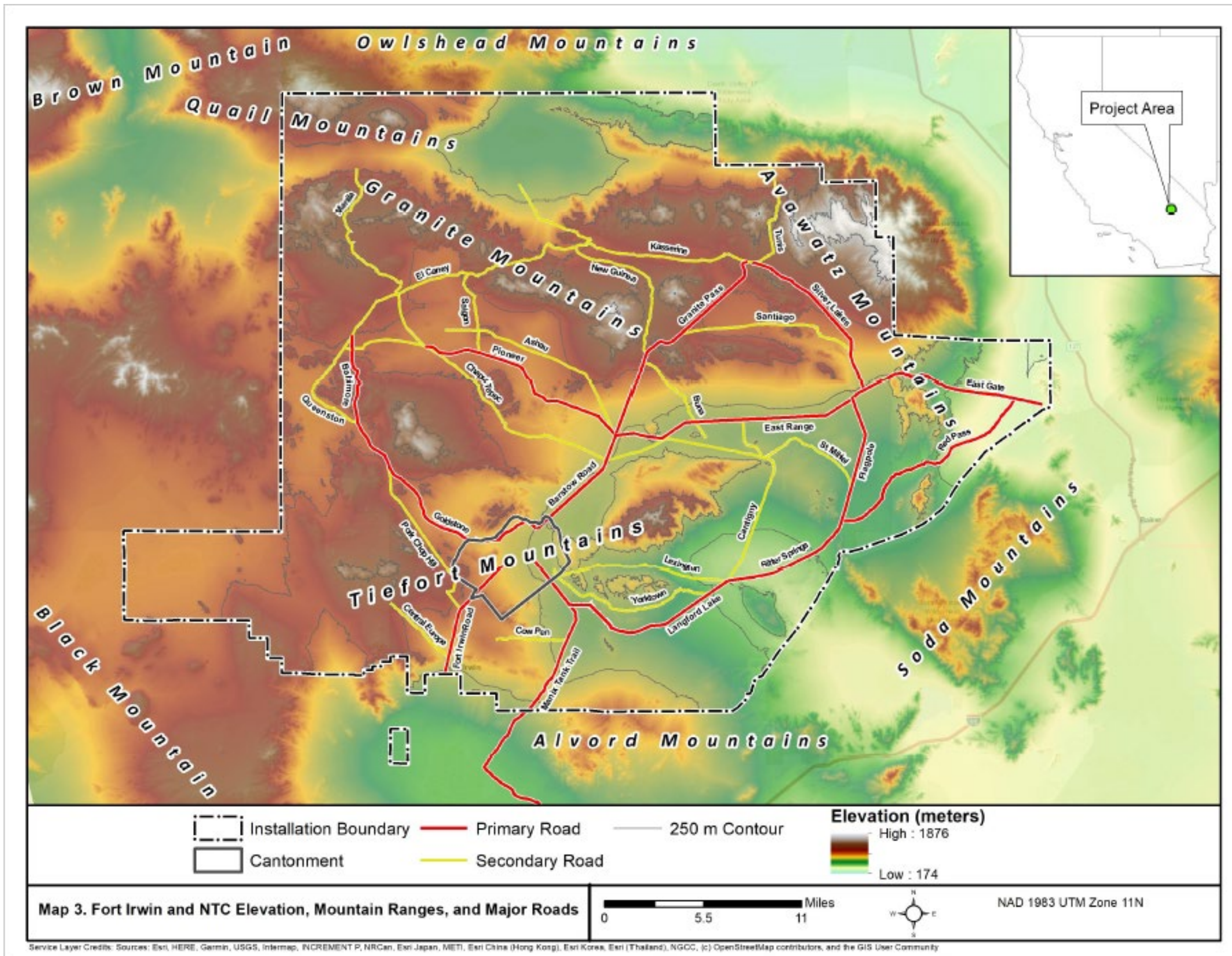
- managing outdoor recreation to minimize impacts on sensitive resources and the military mission, and
- coordinating with CDFW and FWS as needed.

3.9.7 Regulations and Policies

Regulations: Sikes Act; AR 200-1; DoDI 4715.03; NTC Reg 200-1; EO 13443, EO 11988, EO 11989, AR 210-9, AR 215-1, DoDD 6050.2

The following are policies implemented at NTC and Fort Irwin related to outdoor recreation.

- Military training and operations take priority over any recreation activities.
- Desert Explorers Club activities
    - Any trips planned within operational areas must be coordinated with Range Control.
    - If a trip is planned for a down-range area, children are only permitted when accompanied by a parent or legal guardian after attending a range safety briefing.



Map 3. Fort Irwin and NTC Elevation, Mountain Ranges, and Major Roads

Figure 3-8. Fort Irwin and NTC Elevation, Mountain Ranges, and Major Roads

3.10 Climate Resilience

3.10.1 Regional Setting

The degree to which the Mojave Desert's climate changes within the next century will undoubtedly play a role both in the structuring of its communities and influencing the ways in which they function. According to the online U.S. Army Climate Assessment Tool (accessed February 28, 2022), by 2050 (and for 2085), drought is predicted to be the dominant impact on NTC and Fort Irwin under future climate change scenarios. Precipitation means and intra-annual rainfall patterns are not expected to change significantly (Cayan et al. 2008), but the number of rain events is expected to decrease due primarily to a decrease in small rainfall events. Rainfall events will likely increase in intensity (Archer and Predick 2008), leading to more flash flooding and scouring effects in ephemeral streambeds. As these events increase in the future, the conservation of several plant species may be further compromised, as ephemeral streambeds act as important habitats for many plant species on NTC and Fort Irwin.

Consecutive drought years heavily impact western Joshua tree woodlands, where decline and death have been observed in several locations (Sawyer et al. 2009). Similarly, climate change will add to a suite of other threats (military training, mining, OHV activities) for the LMMV. While it is difficult to predict the magnitude or extent of effects on the LMMV, predicted increases in temperatures and drought intensity in the Mojave Desert from climate change, along with these other threats, will act in a synergistic manner (FWS 2014). MGS are highly susceptible to predicted impacts of climate change in the Mojave Desert; reproduction only occurs when there is a certain amount of precipitation (Leitner 2021).

Higher elevation areas on NTC and Fort Irwin, specifically in the Avawatz Mountains, currently provide a climate refugia for many plant and animal species that require cooler temperatures. As the climate changes and temperatures continue to rise in lower elevations, these areas may become essential for desert species as they begin to change distribution in search of refugia from high heat at lower elevations. The result from the future interactions between moving desert species, migratory wildlife, and endemic species in montane habitats are unknown.

The springs on NTC and Fort Irwin will be impacted by a warmer climate as well. Projected mean temperature increases will result in greater evapotranspiration rates, which will have adverse effects on riparian systems, especially tree species, and aquatic habitats associated with desert springs.

Lastly, predicted climate change scenarios will have significant impacts on training land sustainability and rehabilitation project success. Revegetation projects will likely require more supplemental water to achieve the same plant survival rates. More erosion control projects will be required due to increased flash flooding and lack of vegetation reestablishment. Blowing dust from disturbed areas will stress plants in undisturbed areas downwind (R. Sparks, personal communication, 2022). **Appendix C** contains a summary of historical and regional climate trends.

3.10.2 Management Strategies for Climate Resilience

Climate adaptation strategies were identified in 2009 in the California Climate Adaptation Strategy (CDFW 2015). California Natural Resources Agency (CNRA) has published reports on California's climate strategy, with the most recent in 2018: *Safeguarding California Plan: 2018*

Update (CNRA 2018). The Biodiversity and Habitat Sector chapter contains key recommendations that categorize goals to guide actions, including the following.

- Strengthen the climate adaptation component of conservation planning efforts at multiple scales.
- Complete adaptation planning exercises, particularly for resources likely to be sensitive to climate change.
- Enhance habitat connectivity and promote climate refugia through strategic acquisition.
- Increase rehabilitation and enhancement activities to increase climate resiliency of natural and working lands.
- Increase biodiversity monitoring efforts to better understand baseline conditions and make possible the early detection of climate impacts.
- Continue incorporating climate considerations into state investment decision processes related to fish and wildlife conservation.
- Provide educational opportunities to the public and state agency staff regarding climate impacts and adaptation options for ecosystems, fish, wildlife, and plants.

Management strategies for NTC and Fort Irwin include:

- continuing regional collaborations and research,
- maintaining conservation areas to benefit rare species and high-quality habitat, and
- maintaining habitat connectivity to allow species movement as climate changes.

3.10.3 Regulations and Policies

Regulations: AR 200-1, EO 13693, DoDI 4715.03

4 PLAN IMPLEMENTATION

4.1 Project Implementation and Prioritization

Management goals and objectives were developed based on many years of active management and coordination both internally on NTC and Fort Irwin and externally with FWS and CDFW. Section 3 presents the management strategies based on the professional opinions and information gathered from various staff on NTC and Fort Irwin, agency biologists, regional experts, and partner organizations.

This INRMP will be implemented through the various policies and programs described throughout the document, the management presented in **Section 3**. The goals, objectives, implementation timelines, project, and activity lists, and how the projects relate to INRMP implementation are detailed in **Appendix B**.

This INRMP is a living document that is based on short-, medium-, and long-term planning horizons. Short-term tasks include activities and projects that are planned to occur in less than five years, while medium-term tasks include activities and projects in a 6- to 10-year period. Long-term tasks can be programmed beyond 10 years. Goals, objectives, and tasks should be revised over time to reflect evolving environmental conditions, adaptive management, and the completion of tasks as the INRMP is implemented. Projects are developed by DPW-ENV and ITAM programs, with input from other stakeholders. Annual work plans and funding requests occur through separate processes for DPW-ENV and ITAM.

An INRMP is considered implemented if an installation:

- actively requests, receives, and uses funds for priority projects and activities;
- ensures sufficient numbers of professionally trained natural resources management staff are available to perform the tasks required by the INRMP;
- coordinates annually with cooperating agencies and completes a Review for Operation and Effect at least every five years; and
- documents specific INRMP activities and projects undertaken each year.

Table C-1 presents the goals, objectives, and possible criteria that provide the benchmarks for whether the natural resources are being managed as intended on NTC and Fort Irwin. Table C-2 provides an overview of recurring natural resource management activities, which are generally performed in-house by NTC and Fort Irwin staff. The implementation schedule and planned projects for this updated INRMP are detailed in Table C-3, and activities and projects specific to listed species are presented in Table C-4. These tables are used to develop budget requests and schedule annual project requirements. Funding requests will be submitted in accordance with current U.S. Army procedures for conservation projects. Table C-5 presents the current work plan for ITAM, which includes several items that contribute to natural resources management.

The Office of Management and Budget considers funding for the preparation and implementation of this INRMP, as required by the Sikes Act Improvement Act of 1997, to be a high priority. However, the reality is that not all of the projects and programs identified in this INRMP will receive immediate funding in any given year. Projects are generally prioritized with respect to compliance, although many compliance issues having to do with natural resources overlap. At NTC and Fort Irwin, due to the federally listed species, the priority for the natural resources program is to provide support to military and facility activities that require assistance and regulatory compliance related to federally listed species. This is primarily done through the “dig permit” process (see below).

Command support is essential to implementation of this INRMP. This INRMP has the support of the NTC and Fort Irwin Garrison Commander and other personnel in command positions who are needed to implement this INRMP. The Command is dedicated to implementation of this INRMP as required by the Sikes Act and other federal laws. Just as importantly, the Command is dedicated to maintaining and improving the military mission at the NTC and Fort Irwin. Implementation of this INRMP supports the military mission and enables continued training on NTC and Fort Irwin.

4.2 Installation Planning and Project Review Process

All proposed actions are evaluated for potential negative impacts on the environment. As part of compliance with NEPA, DPW-ENV, through the NEPA Manager, provides guidance to project proponents. The review process starts with the proponent filling out a work request (often Form 4283) and completing a REC Checklist. Most downrange projects and military scenario changes are covered by the programmatic Legislative EIS. Those that are not will undergo separate review and documentation under NEPA.

Downrange (i.e., outside cantonment) projects get reviewed for potential environmental impacts via the ITAM downrange “dig permit” process. Project proponents submit construction plans to ITAM that are reviewed by DPW-ENV for NEPA and other environmental (natural, cultural, air, water, etc.) compliance. This process includes pedestrian foot surveys for natural resources. In areas that have not yet been surveyed for cultural resources, it may include up to a 60-day NHPA Section 106 consultation with the SHPO and federally recognized, affiliated tribes.

Once all the potential environmental impact concerns are cleared by the subject matter experts, the dig permit is signed by DPW-ENV and serves as the NEPA document (REC) for the project. In some cases, the proposed work can be approved as a CATEX, especially for activities that tier to the programmatic Legislative EIS. But in other cases, such as large projects or significant land use changes, an EA is required. The result of the EA is a Finding of no Significant Impact or, if the impacts are considerable, an EIS may be required.

4.3 Partners and Cooperative Agreements

There are a number of agreements and partnerships, both formal and informal, that support INRMP implementation and land management on NTC and Fort Irwin. The following summarizes the ones that have currently or recently benefited NTC and Fort Irwin. Others may develop over time, especially related to regional Mojave Desert partners (**Section 1.4.5**).

4.3.1 Regional Universities

Regional universities have provided specialized expertise to help manage natural resources on the NTC and Fort Irwin for decades. Since 1990, many universities have supported the Environmental and ITAM Programs with baseline surveys and applied studies on topics including soil hydrology, possible applications of cryptobiotic crusts for rehabilitation, remote sensing imagery, and fire ecology, amongst others. California State University, San Bernardino, is studying the conservation genetics of the LMMV. The University of Redlands is involved in desert tortoise research. OSU is conducting a DBS project to assess the connectivity and permeability of land usage and to better understand how populations of sheep are being increasingly fragmented by degradation of habitat quality. The NTC and Fort Irwin will continue to use university expertise to assist with its natural resources programs in the future.

4.3.2 Peaceful Valley Donkey Rescue (PVDR)

PVDR is a nonprofit donkey rescue organization based in San Antonio, TX that operates throughout the United States. It is the largest donkey rescue in the country, with 24 sanctuaries and 26 adoption centers nationwide. PVDR shelters and cares for approximately 3,000 donkeys and has rescued over 8,000. In 2018, an agreement was established with PVDR to conduct burro round-ups on NTC and Fort Irwin. PVDR removed burros starting in 2018. Typically, roundups include helicopters and trapping at water sites to remove feral burros.

4.3.3 Western Mojave Weed Management Association (WMWMA)

In 2002, DPW-ENV signed an MOU to join and coordinate activities with the WMWMA, a regional group of representatives from government lands aiming to control invasive species and weeds. This organization tracks the spread of weeds and exotic species in the Western Mojave Desert and coordinates weed control. For more information, see Section 3.8.2. This MOU is currently expired and is pending renewal.

4.3.4 City of Barstow

In 2021, the Fort Irwin Garrison Commander signed an inter-governmental agreement with the City of Barstow to run a domestic animal control facility. The facility catches stray cats and dogs within the cantonment area.

4.3.5 Other Federal Agencies

4.3.5.1 Other Military Installations

The NTC and Fort Irwin coordinates and cooperates with other military installations within the Mojave Desert on numerous programs, including the desert tortoise and burro management. Installations often involved with the NTC and Fort Irwin in these efforts include Edwards Air Force Base, USMC Air Ground Combat Center at Twenty-nine Palms, USMC Logistics Base at Barstow, and NAWS at China Lake. These five DoD installations coordinate on issues of mutual concern via the DMG (Section 1.4.5), particularly involving ecosystem management of the Mojave Desert.

4.3.5.2 United States Army Corps of Engineers (USACE)

The USACE is an engineer formation of the U.S. Army with three primary mission areas: Engineer Regiment, military construction, and civil works. Multiple USACE offices have provided support to NTC and Fort Irwin related to INRMP implementation over the years, primarily by providing contract support. The Los Angeles District is the regulatory agency for Section 404 of the Clean Water Act.

4.3.5.3 United States Geological Survey (USGS)

The USGS is a scientific agency of the U.S. government that studies the landscape of the United States, its natural resources, and the natural hazards that threaten it. The USGS, via the Biological Resources Division, has supported the NTC and Fort Irwin for raven management, desert tortoise surveys, and similar projects. The USGS is also a partner in other regional initiatives and cooperative ventures with the NTC and Fort Irwin.

4.3.5.4 National Parks Service (NPS)

The NPS is an agency of the U.S. federal government within the U.S. Department of the Interior that manages all national parks, most national monuments, and other natural, historical, and recreational properties with various title designations. The NPS manages Death Valley National Park, whose southern boundary is adjacent to the northern boundary of the NTC and Fort Irwin. Death Valley National Park is a partner in regional initiatives and cooperative ventures with the NTC, including funding a 2020 OSU DBS meta-population survey on the NTC and surrounding lands. The purpose of this study is to better understand and improve an interconnected network of DBS populations using DoD and adjacent public lands to promote high genetic diversity and allow populations to recover from drought and disease-induced die-offs. The NTC and Fort Irwin has also used native plant nurseries at Joshua Tree National Park and Lake Mead National Recreation Area for the propagation of grasses and shrubs for the ITAM program.

4.3.5.5 Natural Resource Conservation Service (NRCS)

The NRCS is an agency of the U.S. Department of Agriculture that provides technical assistance to farmers and other private landowners and managers. The NRCS has sporadically supported NTC and Fort Irwin with respect to soil surveys and dust control. There may be more cooperative ventures and/or surveys in the future to support INRMP implementation.

4.3.6 Temporary Personnel

4.3.6.1 Inter-Agency Assignment

The Intergovernmental Personnel Act of 1972 (IPA) provides a means to conduct research or obtain other personnel assistance at the NTC and Fort Irwin. IPA is a system whereby a federal (or state) agency borrows other federal or state agency personnel for a limited time period to do a specific job. The installation pays the borrowed employee’s salary and administrative overhead. There are two advantages: personnel are directly supervised by the NTC and Fort Irwin, and no manpower authorizations are required. The NTC and Fort Irwin is not using IPA agreements in its natural resources program, but it retains the option to use this source of personnel assistance in the future.

4.3.6.2 Oak Ridge Institute of Science and Education (ORISE)

Another “borrowed personnel” option is through ORISE. ORISE involves colleges and universities and a management and operating contractor for the U.S. Department of Energy. The program offers students, postgraduates, and associate degree graduates opportunities to gain experience in their respective fields. Stipends are equivalent to salaries for employees hired with similar educational backgrounds, and a 30% overhead is added. The normal limit on individual ORISE personnel is three years. Installations may assist in the selection of ORISE personnel. ORISE personnel have been used at the NTC and Fort Irwin for biological, archeological, and NEPA assistance.

4.3.6.3 Volunteers

The SCA provides another personnel option, along with the similar California Conservation Corps. This nonprofit national organization has a cooperative agreement with the Department of Army, which provides for internships for students and recent graduates to obtain experience in their fields of study. The NTC and Fort Irwin ITAM program used SCA personnel in 1997 to assist with trail closure projects and may use them in the future.

Volunteers are an occasional source of temporary assistance. As an example, youth groups are involved in various natural resources programs on the NTC and Fort Irwin. Boy Scouts, Cub Scouts, and Girl Scouts have assisted with the construction of Seibert stakes and planting of native vegetation for the ITAM program and often work with installation personnel to complete badges. Other partners described below can also provide volunteers.

4.3.6.4 Contractors

The NTC and Fort Irwin uses contractors for many programs associated with natural and cultural resources, including plan preparation, large cultural resources surveys, training land rehabilitation projects, and dust control. Contractors are heavily used to provide additional assistance and on-site staffing to implement natural and cultural resources programs, including ITAM, cultural resources management, and natural resources management. These contractors often deal with day-to-day activities, including rare plant surveys, new construction project monitoring, pre-activity clearances, and other biological surveys.

4.4 Funding

Natural resources management relies on a variety of funding mechanisms, although at NTC and Fort Irwin, the funding comes primarily from DPW-ENV and ITAM. Below are general discussions about different sources of funding to implement this INRMP. As noted, not all of these are now used by the NTC and Fort Irwin, but may be used in the future.

4.4.1 Staffing

The following staffing is required to implement this INRMP at the NTC and Fort Irwin:

DPW-ENV

Natural and Cultural Resources Program Manager	1	GS-13
NEPA Planner	1	GS-12
Wildlife Biologist	1	GS-12
Wildlife Biologists	3	Contract positions
Biological Technician	1	Contract position
Animal Control Officer	1	Contract position
Animal Control Technician	6	Contract positions
Seasonal Field Biologists	2	Contract positions
GIS Analyst	1	Contract position

ITAM

ITAM Manager	1	GS-12
GIS Coordinator	1	Contract position
GIS Technician	1	Contract position
LRAM Coordinator	1	Contract position
RTLA Coordinator	1	Contract position
Field Crew Lead	1	Contract position
Field Crew Member	4	Contract positions

4.5 Monitoring INRMP Implementation

The INRMP goals and objectives in **Appendix B** provides a basis for evaluating plan implementation, and mission and compliance needs provide a foundation for prioritizing in a given year. The criteria established help determine if the goals and objectives are being met. The Review for Operation and Effect with FWS and CDFW provides an opportunity for evaluating how implementation of the INRMP is proceeding.

DoDI 4715.03 (Enclosure 5) requires monitoring of INRMP implementation based on seven focus areas:

- INRMP project implementation
- Federally listed species and critical habitat
- Partnerships effectiveness
- Fish and wildlife management and public use
- Team adequacy
- Ecosystem integrity
- INRMP impact on the installation mission

Implementation of the INRMP is tracked through the Environmental Performance Assessment System, annual Environmental Quality Data Call, and annual assessments with partner agencies.

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APPENDIX A – ACRONYMS

ABCT Armored Brigade Combat Team

ACF Animal Control Facility

AR Army Regulation

BCT Brigade Combat Team

BLM Bureau of Land Management

BO Biological Opinion

CATEX Categorical Exclusion

CAWSF California Chapter of Wild Sheep Foundation

CDFW California Department of Fish and Wildlife

CESA California Endangered Species Act

CFWC California Fish and Wildlife Commission

cm Centimeter(s)

CNDDB California Natural Diversity Database

CNPS California Native Plant Society

CNRA California Natural Resources Agency

DMG Desert Managers Group

DoD Department of Defense

DoDI Department of Defense Instruction

DPW Directorate of Public Works

EA Environmental Assessment

EIS Environmental Impact Statement

ENV Environmental Division

EO Executive Order

ESA Endangered Species Act

FLPMA Federal Land Policy and Management Act

FMWR Family and Morale, Welfare, and Recreation

FONSI Finding Of No Significant Impact

FORSCOM Forces Command

FWS U.S. Fish and Wildlife Service

GIS Geographic Information System

ICRMP Integrated Cultural Resources Management Plan

IMCOM U.S. Installation Management Command

INRMP Integrated Natural Resources Management Plan

IPA Intergovernmental Personnel Act

IPM Integrated Pest Management

IPMP Integrated Pest Management Plan

ITAM Integrated Training Area Management

IWFMP Integrated Wildland Fire Management Plan

LBVI Least Bell's Vireo

LMMV Lane Mountain Milk-vetch

LRAM Land Rehabilitation and Maintenance

MCAGCC Marine Corps Air Ground Center Memorandum of Agreement (MOA)

MGS Mohave Ground Squirrel

MOU Memorandum of Understanding

NASA National Aeronautics and Space Administration

NAWS Naval Air Weapons Station

NEPA National Environmental Policy Act

NPS National Park Service

NRCS Natural Resource Conservation Service

NTC National Training Center

NTC Reg National Training Center Regulations

OHV Off-Highway Vehicle

OPFOR Opposing Force

OPS GRP Operations Group

ORISE Oak Ridge Institute of Science and Education

PVDR Peaceful Valley Donkey Rescue

PSA Public Service Announcement

RASP Recovery and Sustainment Partnership

RCMP Range Complex Master Plan

REC Record of Environmental Consideration

RTLA Range and Training Land Assessment

RTU Rotational Training Unit

SAIA Sikes Act Improvement Act

SBCT Stryker Brigade Combat Team

SCA Student Conservation Association

SCBS Society for the Conservation of Bighorn Sheep

SHPO State Historic Preservation Office

SPT BDE Support Brigade

SWFL Southwestern Willow Flycatcher

TRI Training Requirements Integration

U.S. United States

U.S.C. United States Code

USACE United States Army Corps of Engineers

USAF United States Air Force

USGS United States Geological Survey

USMC United States Marine Corps

UXO Unexploded Ordnance

WAP Wildland Action Plan

WMWMA Western Mojave Weed Management Association

WSA Wilderness Study Area

WTA Western Training Area (formerly WEA or Western Expansion Area)

YUBR *Yucca brevifolia* (western Joshua tree)

APPENDIX B – IMPLEMENTATION TABLES

Tables B-1 – B-5 are maintained in an Excel spreadsheet and are included in the following pages

Table B-1. Summary of Goals, Objectives and Criteria for NTC and Fort Irwin INRMP

	Objective	Criteria: Green	Criteria: Amber	Criteria: Red	Data Source(s)	Review for Operation and Effect (Green, Amber, Red) FY24	FY25	FY26	FY27	FY28	Notes	Recommended Edits
Goal PM: Manage natural resources compatible with and supporting the military mission while complying with applicable federal, military, and state laws, regulations, and policies												
PM1	Implement INRMP to enhance the land and military mission and result in no net loss of land availability	INRMP reviews completed on schedule; maintain above 95% obligation rate; no vacant positions in natural resources; no additional restrictions on training lands from natural resources	INRMP reviews less than 6 months overdue; maintain above 60% obligation rate; temporary vacant position in natural resources; temporary or small (less than 10 acres) additional restriction on training lands from natural resources	INRMP annual review or ROE more than 6 months overdue; less than 60% obligation rate; vacant position in natural resources for more than 6 months; permanent or large (greater than 10 acres) additional restriction on training lands from natural resources								
PM2	Comply with relevant natural resources laws and maintain appropriate state and federal permits related to natural resources management, including water and wildlife management issues	No permit violations, notice of violations, or lack of permits when necessary	Temporary permit violation, corrected notice of violation, or missing permit obtained	Permit violation, lack of permit when needed, uncorrected notice of violation								

PM3	Continue internal environmental awareness program to minimize adverse environmental impacts	All materials current and readily available; all requested/required training conducted	More than 50% requested/required training completed	Materials out of date; less than 50% of requested/required training completed								
PM4	Continue public outreach in coordination with other regional entities as available and appropriate	All materials current and readily available	n/a	Materials out of date or not available to the public								
PM5	Continue to cooperate with other agencies and local landowners on regional land and natural resources management efforts	Participate in regional meetings/planning when available; cooperate with other agencies when possible	n/a	No participation in any regional efforts or cooperative projects								
PM6	Maintain and improve GIS and other data and availability of use for natural resources management and other planning	All natural resources GIS data is current and updated in master database; submit required data per the IGI&S data strategy.	Less than 3 natural resources datasets are outdated	More than 3 natural resources datasets are outdated								
PM7	Evaluate monitoring and other results annually and modify management as needed	Monitoring data collected annually; compiled and reviewed by NTC and Fort Irwin staff	Monitoring data collected but not compiled or reviewed	Monitoring data not collected								
Goal SO: Manage soils to prevent sediment loss, minimize erosion, and support military mission												

SO1	Manage construction and other development to minimize erosion and soil loss and comply with all regulations and permitting	All exposed soils are managed with appropriate BMPs; no erosion is resulting in sediment loss; no notice of violations	Temporary (less than 1 week) failure of a BMP; small (less than 1/10 acre) erosion feature with sediment loss no more than 20 feet from site; only one notice of violation, corrected within a week	Long-term (more than 1 week) failure of BMP; large (greater than 1/10 acre) erosion feature with sediment loss extending more than 20 feet from site; one or more notices of violation and/or not corrected within a week								
SO2	Minimize long-term impacts due to erosion and soil disturbance by monitoring training activities and repaing damage quickly	Total area impacted by erosion not increased; no area closures due to erosion; all awareness materials include soil conservation	Small (less than 25 acre) increase in area impacted by erosion; only temporary closure (less than a year) due to erosion	Large (greater than 25 acre) increase in area impacted by erosion; long-term closure (more than 1 year) of area due to erosion; soil conservation lacking in awareness materials								
Goal WA: Protect water quality and manage water resources so they remain resilient and with no net loss of acreage or functions and values												
WA1	Maintain all surface water with high water quality and in compliance with state and federal regulations including the Clean Water Act Section 319	No violations of surface water quality standards, SWPPP, ICPs, or other pollution prevention plans/permits	Violation(s) of surface water quality standards,SWPPP, ICPs, or other pollution prevention but in process of correction	Uncorrected violation(s) of surface water quality standards, SWPPP, ICPs, or other pollution prevention								

WA2	Minimize impacts from military training and development to water resources (including desert washes and playas), and comply with all laws and regulations	No impacts to water resources and all necessary permits obtained	Impact to water resources, but in process of mitigation and/or permitting	Loss of water resources due to military training or development and/or uncorrected impacts without a permit								
WA3	Preserve water resources (playas, seeps, springs) to protect functions and values and wildlife habitat, with no net loss of training opportunities	No loss of area or functions and values; no loss of fish and wildlife habitat; no negative change in native communities	Temporary loss of area or functions and values; temporary loss of wildlife habitat; temporary negative change in native communities	Uncorrected/permanent loss of area or functions and values; temporary loss of fish and wildlife habitat; temporary negative change in native communities								
Goal VE: Manage different habitats to promote native species, resilient communities, and support military training												
VE1	Manage native vegetation in a manner that supports military training, protects against wildfire, invasive plants, and provides resilient ecosystems with regionally appropriate biodiversity	No military training conflicts and stable or improving perennial plant cover with low density invasive plants.	Temporary (scheduling or less than one year) military training conflict or moderate loss of perennial plant cover and increasing invasive plants	Natural areas unsuitable for military training (for more than a year) as a result of damage or siginificant loss of perennial plant cover and dominance by invasive plants								
VE2	Ensure grounds maintenance, new construction, and landscaping do not increase	No new invasive plants present in maintained areas	Increase in invasive plants, but a plan developed to	Increase in invasive plants that are impacting native vegetation and								

	invasive plants or negatively impact biodiversity		address the increase	no plan to address them								
Goal FI: Minimize wildland fire risk to support military training and reduce adverse impacts to native vegetation.												
FI1	Ensure IWFMP implemented, all requirements are met, and coordination with partners continues	All standards met; all records complete and updated; all staffing and training requirements completed	Some standards, recordkeeping, staffing, or training not fully implemented but there is a plan to remedy within 1 year	One or more requirements are not being met and there is no plan to remedy within the next year								
FI2	Maintain wildfire response capabilities on NTC and Fort Irwin as identified in IWFMP and in coordination with partners (including equipment, qualifications, and staffing)	Fort Irwin equipment and personnel meet standards; all wildfires are managed with no escapes	Fort Irwin equipment and/or personnel do not meet standards, but plan to remedy is in place	Fort Irwin equipment and/or personnel do not meet standards and no plans to remedy								
FI3	Reduce risk of wildfires, particularly from non-native grasses, using policy, fuel reduction, invasive plant control, and education	No catastrophic or uncontrolled wildfires; planned fuel load management completed	Uncontrolled wildfire(s) contained and limited in impact; more than 50% of planned fuel load and firebreak management completed	Uncontrolled wildfire(s) impacted resources; less than 50% of planned fuel load and firebreak management completed								
Goal WI: Manage wildlife and their habitat to maintain healthy populations while supporting the military mission												

WI1	Maintain healthy populations of native wildlife species, with targeted management for priority species, without impacting the military mission.	Surveys indicate healthy populations of diverse native species, management implemented, and no conflicts with military training or infrastructure	Surveys and/or management temporarily delayed (less than 5 years), or mission activities have been temporarily impacted by a wildlife species or its management	Surveys and/or management delayed more than 5 years, or mission activities have been impacted significantly by a wildlife species or its management								
WI2	Maintain diverse, high-quality wildlife habitat with associated corridors, without impacting the military mission.	Surveys indicate appropriate mix of habitat and corridors, habitat management implemented, and no conflicts with military training or infrastructure	Habitat surveys and/or management temporarily delayed (less than 5 years), or mission activities have been temporarily impacted by habitat management	Habitat surveys and/or management delayed more than 5 years, or mission activities have been impacted significantly by habitat management								
Goal TE: Manage threatened and endangered species and other special status species (by protecting and maintaining populations and habitat) using an ecosystem approach while supporting the military mission.												
TE1	Maintain desert tortoise (DT) populations and their habitat, minimize impacts to DT and their habitat, and complete required consultations, while minimizing impacts to military mission.	No decline of populations, loss of core habitat, compliance with all Section 7 requirements, and no loss of military training/land	Temporary decline of population(s) or core habitat, temporary non-compliance with all Section 7 requirements, and/or temporary loss of military training/land	Permanent decline of population(s) or core habitat, notice of violation from USFWS, and/or permanent loss of military training/land								

TE2	Maintain Lane Mountain milkvetch (LMMV) populations and their habitat, minimize impacts to LMMV and their habitat, and complete required consultations, while minimizing impacts to military mission.	No decline of populations, loss of core habitat, compliance with all Section 7 requirements, and no loss of military training/land	Temporary decline of population(s) or core habitat, temporary non-compliance with all Section 7 requirements, and/or temporary loss of military training/land	Permanent decline of population(s) or core habitat, notice of violation from USFWS, and/or permanent loss of military training/land								
TE3	Maintain rare animal species, including Mojave ground squirrel (MGS), and their habitat, while minimizing impacts to military mission.	No decline of populations, loss of core habitat, and no loss of military training/land	Temporary decline of population(s) or core habitat and/or temporary loss of military training/land	Permanent decline of population(s) or core habitat and/or permanent loss of military training/land								
TE4	Maintain rare plant species, including desert cymopterus (CYDE), and their habitat, while minimizing impacts to military mission.	No decline of populations, loss of core habitat, and no loss of military training/land	Temporary decline of population(s) or core habitat and/or temporary loss of military training/land	Permanent decline of population(s) or core habitat and/or permanent loss of military training/land								
Goal IN: Minimize impacts of invasive and pest species using an integrated pest management approach.												
IN1	Implement IPMP	Policies followed 100%; updated as required	n/a	Policies not followed; IPMP out of date.								

IN2	Minimize impacts of invasive species and pests on the military mission, native species, and sensitive natural resources.	Complete at least 90% of planned annual treatment of priority species and areas	Complete at least 50% of planned annual treatment of priority species and areas	Complete less than 50% of planned treatment of priority species and areas								
IN3	Monitor distribution of invasive species, particularly in priority areas and near sensitive natural resources.	Invasive plant presence included as part of other survey efforts	Invasive plants only sporadically documented	No data on invasive plant presence collected								
Goal RE: Provide recreational opportunities without interfering with the military mission or causing damage to sensitive natural or cultural resources.												
RE1	Provide outdoor recreational opportunities, without causing damage to sensitive resources or the military mission.	No decline in recreational availability; no damage to sensitive resources from recreation; no conflicts with military training	Temporary closures to recreation due to unresolved conflicts; temporary damage to sensitive resources; no conflicts with military training	Loss of recreational availability; permanent damage to sensitive resources; conflicts with military training								
Goal CC: Mitigate the effects of climate change on the natural resources and increase resiliency in order to support the military mission.												
CC1	Protect natural resources sensitive to climate change and increase ecological resiliency.	No loss of rare species or habitats; no decline in formerly common species	Reduction of a climate sensitive species or habitat; small decline in a formerly common species	Loss of a climate sensitive species or habitat; major decline in a formerly common species								

CC2	Continue participating in regional efforts to increase resiliency in all arenas to support the military mission.	Participate in regional planning efforts related to climate resilience	n/a	No participation in available regional planning efforts related to climate resilience								

Table B-2. Routine Activities for NTC and Fort Irwin INRMP Implementation

						Projected to be completed					
Activity		Priority (High, medium, low)	Objective(s) in Table C-1	Ft Irwin Program	Timing	FY24	FY25	FY26	FY27	FY28	FY29
PM1.1	Complete annual INRMP review with key internal personnel and external partners (USFWS, CDFW), with focus on previous year of managmeent, identify areas that need improvement, changes in listed species, and proposed projects for the next year.	H	All objectives	ENV	Annual	X	X	X	X	X	X
PM1.2	Annually update the ITAM Workplan and Range Complex Master Plan.	H	PM1, PM3, PM6, PM7	ITAM	Annual	X	X	X	X	X	X
PM1.3	Annually submit funding requests	H	All objectives	ENV, ITAM	Annual	X	X	X	X	X	X
PM1.4	Respond to data requests/calls regarding projects and implementation	H	PM1	ENV	As Needed						
PM1.5	Coordinate and integrate INRMP with other plans for the NTC and Fort Irwin	H	All objectives	ENV	As Needed						
PM1.6	Complete Review for Operation and Effect with USFWS, CDFW, and internal stakeholders every 5 years	H	PM1	ENV	2028					X	
PM1.7	Provide continuing education for natural resources staff, including mandatory training such as Natural Resources Management and Compliance (CIN: A-4A-0087) and ensure someone attends the NMFWA conference every year	M	All objectives	ENV	As Needed						
PM1.8	Implement and update NTC Regulation 200-1 and 420-3 as needed	H	PM1, PM2, TE1-4, WI1, RE1	DPW, ENV	As Needed						
PM1.9	Coordinate with NASA for management of Goldstone Complex	H	All objectives	ENV	As Needed						
PM2.1	Review of activities in potential jurisdictional waters of the US and in floodplains and complete any permit requirements	H	PM2, WA2, WA3	DPW, ENV	As Needed						
PM2.2	Comply with NEPA requirements and complete relevant documentation	H	All objectives	DPW, ENV	As Needed						
PM2.3	Coordinate with CDFW and others for any conservation law enforcement needs	M	PM2, PM5, WI1	ENV	As Needed						

PM3.1	Maintain, update, and develop new educational awareness materials related to natural resources management including in-processing brief, quarterly post brief, Leader's Handbook, Soldier's Field Card, and various brochures	M	All objectives	ENV, ITAM	As Needed						
PM3.2	Publish and promote environmental stewardship through NTC and Fort Irwin radio, social media, and newspapers	L	All objectives	ENV, ITAM	Ongoing	X	X	X	X	X	X
PM3.3	Provide environmental briefings (O/C Academy, OPFOR academy, LTP, etc) and educational materials to military units.	H	PM, TE, WA, FW, VE	ENV	Monthly	X	X	X	X	X	X
PM3.4	Maintain and enhance educational opportunities at the Desert Tortoise Education Facility, building 606.	L	PM3, PM4, TE1	ENV	As Needed						
PM3.5	Post awareness materials in relevant locations and update posters as needed	M	PM1, PM3, SO2, SO3, WA1, WA2, IN2, WI2, TE1-4	ENV, ITAM	As Needed						
PM3.6	Obtain and install signs to prevent unintentional damage to sensitive resources (see Table C-4 for related activity for T&E species)	H	PM1, PM3, SO2, SO3, WA1, WA2, WI1, WI2, TE1-4	ENV, ITAM	As Needed						
PM4.1	Continue environmental education programs and/or sponsor events in cooperation with local educational institutions, conservation organizations, and public service agencies	M	PM4, PM5	ENV	As Needed						
PM5.1	Participate in and support regional planning, programs, and partnerships such as the Desert Tortoise Recovery Plan, California Desert Conservation Area Plan, California Desert Manager's Group, or other groups engaged in natural resources management	H	PM1, PM5, IN1, WI1, WI2, WA1, TE1, TE2	ENV	As Needed						
PM5.2	Cooperate with landowners and other agencies to facilitate compatible land uses	H	PM1, PM5, FI1-3, TE1-4, CC2	ENV	As Needed						
PM5.3	Coordinate with CDFW to support their wildlife projects	M	PM1, PM5, PM7, WI1, WI2, TE3, TE4	ENV	As Needed						

PM6.1	Continually update, identify and develop digital information (including GIS) to assist with natural resources management and environmental impact analysis	H	PM1, PM6, SO1, SO2, WA1, WA2, TE1-4	ENV, ITAM	As Needed						
PM6.2	Ensure all management activities are documented in GIS with sufficient metadata about date, management accomplished, lead organization, etc	M	PM1, PM6, SO1, WA2, VE1, FI3	ENV, ITAM	As Needed						
PM6.3	Provide GIS data and related maps showing relevant natural resources for NTC and Fort Irwin decision makers	M	PM1, PM6, WA2, TE1, TE2	ENV, ITAM	As Needed						
PM6.4	Provide technical information on desert soils, vegetation, hydrology, rehabilitation techniques, recovery potential, invasive species, wildlife habitat, and ITAM-related needs	M	PM1, PM6, SO1, WA2, VE1, FI3	ENV, ITAM	As Needed						
PM7.1	Monitor populations and management results and adapt management as needed	H	All objectives	ENV, DPW	Annual	X	X	X	X	X	X
PM7.2	Prioritize areas for management annually based on all monitoring and survey results as well as mission needs	H	All objectives	ENV, ITAM, DPW	Annual	X	X	X	X	X	X
PM7.3	Monitor areas following military training (or similar activity) and coordinate to repair any damage	M	PM1, PM6, SO2, WA1, WA2, FI3	ENV, ITAM, DPW	Annual	X	X	X	X	X	X
PM7.3	Update INRMP implementation tables and INRMP appendices annually	M	All objectives	ENV	Annual	X	X	X	X	X	X
PM7.4	Annually provide RTLA land condition data and analyses to support development of the RCMP, INRMP and NEPA documents	M	All objectives	ENV, ITAM, DPW	Annual	X	X	X	X	X	X
PM7.5	Maintain species lists and herbarium mounts, and update as new surveys are completed	L	All objectives	ENV	Annual	X	X	X	X	X	X
SO1.1	Manage the repair of existing roads, trails, and culverts to minimize dust and erosion	M	PM2, SO1, SO2, WA1, WA2	ENV, DPW, ITAM	Ongoing	X	X	X	X	X	X
SO2.1	Monitor dust levels at Fort Irwin and apply soil binders as needed	M	TE1-4, SO2	DPW, ITAM	Ongoing	X	X	X	X	X	X
WA1.1	Implement all stormwater and pollution prevention plans	H	PM1, PM2, SO3, WA1, WA3, VE2	ENV, DPW	Ongoing	X	X	X	X	X	X
WA1.2	Minimize pollution into surface and ground waters through the implementation of BMPs and existing plans	H	PM2, SO3, WA1, WA3	ENV, DPW	Ongoing	X	X	X	X	X	X

WA2.1	Regularly inspect water resources (all types) and associated buffers for erosion, trampling, and other adverse impacts	M	SO1, SO2, WA1, WA2, WA3	ENV	Annual	X	X	X	X	X	X
WA2.2	Work with troop units to ensure compliance with spring protection provisions within Range Regulation 350-3, using the ITAM Office Environmental Awareness program and Range Safety briefings	M	SO1, SO2, WA1, WA2, WA3	ENV, ITAM	As Needed						
WA3.1	Inspect and maintain off-limits fencing, signage, seibert stakes, etc. at springs, playas, and natural/cultural conservation areas (prioritizing LMMV and CYDE conservation areas) where breach is greater than 10 feet to reduce accidental intrusion and subsequent damage to these resources.	H	SO1, SO2, WA1, WA2, WA3, TE2, TE4	ENV, ITAM	Annual (Quarterly rotating)	X	X	X	X	X	X
VE1.1	Provide floral data to regional Mojave Desert initiatives and/or other state databases as requested	L	SO1, SO2, WA1, WA2, WA3	ENV	As Needed						
VE2.1	Follow beneficial landscaping practices (site analysis, careful plant selection, appropriate mulching and trimming, etc.) to reduce maintenance, reduce water use, limit invasive plants, and increase health of plants	M	SO1, SO3, WA1, VE2, IN2, WI2	ENV, DPW	Ongoing	X	X	X	X	X	X
VE2.2	Ensure that new or renovated landscaping includes plants that are regionally native, drought tolerant, and provide a wildlife and/or pollinator benefit, when possible	M	WA3, VE2, IN2, WI2	ENV, DPW	As Needed						
FI1.1	Implement IWFMP, including all training, processes, and reporting requirements and update as needed	M	PM1, PM5, FI1, FI2, FI3	ENV, DPW, Fire	Ongoing	X	X	X	X	X	X
FI1.2	Ensure all fire-related equipment is clean before and after use to prevent spread of invasive species	M	FI1, FI2, FI3, VE1, IN1-3	ENV, DPW, Fire	Ongoing	X	X	X	X	X	X
FI1.3	Maintain a fire history dataset (date, fire intensity, location, and acres in GIS data when possible)	L	PM6, FI1, FI2, FI3	ENV, DPW, Fire	Annual	X	X	X	X	X	X
FI1.4	Establish/maintain MOAs and interagency agreements with surrounding jurisdictions for mutual assistance during wildfires	M	PM5, FI1, FI2, FI3	ENV, DPW, Fire	As Needed						
FI1.5	Identify sensitive resources and identify avoidance and minimization measures needed to protect them	H	PM1, PM6, WA2, WA3, TE1-4, IN2	ENV, Fire	As Needed						

FI2.1	Ensure that personnel involved in wildfire response are trained, meet required standards, and have appropriate personal protective equipment	H	FI1, FI2	ENV, DPW, Fire	Annual	X	X	X	X	X	X
WI1.1	Maintain fencing around the landfill to prevent predator access	L	WI1, TE1-3	DPW	Ongoing	X	X	X	X	X	X
WI1.2	Obtain any necessary permits to handle migratory birds or wildlife when injured or for other management purposes	H	WI1,TE1-3	ENV	As Needed						
WI1.3	Respond to nuisance wildlife calls to minimize human-wildlife conflicts (i.e., bobcat, coyote, snake) and relocate when ecologically sound.	M	WI1, TE1-3	DPW	As Needed						
WI1.4	Coordinate with partners and non-profits to support annual avian surveys/bird counts	L	WI1, PM5, TE3	ENV	Annual	X	X	X	X	X	X
WI2.1	Maintain burro exclusions (allowing bighorn sheep entry) on springs in areas frequented by burros	L	WA3, WI1, WI2, TE3, TE4	ENV	As Needed						
WI2.2	Ensure that vegetation management support wildlife habitat targets	H	WI1, WI2, VE1, VE2, TE1-4	ENV	As Needed						
WI2.3	Follow all measures for water resources protection as essential wildlife habitat and corridors	M	WI1, WI2, WA2, WA3, SO1	ENV	As Needed						
TE1.1	Review any proposed actions (construction, land management, ground disturbance, prescribed fire, vegetation management, etc) for potential to impact listed or other rare species and their habitat and work with proponent to limit impacts	H	PM1, PM2, PM6, VE1, WI1, WI2, TE1-4	ENV	As Needed						
TE3.1	Review list of potential federal and state listed species annually	H	PM1, TE1-4	ENV	Annual	X	X	X	X	X	X
TE3.2	During any biological surveys, ensure field crews are aware of any known or potential rare species and document any sightings or potential habitat	H	PM6, WI1, WI2, TE1-TE4	ENV	As Needed						
IN1.1	Implement IPMP	H	PM1, PM2, PM5, IN1-3	ENV, DPW	Annual	X	X	X	X	X	X
IN1.2	Complete annual IPMP review and reporting requirements, including herbicide applications for invasive plant control	H	PM2, IN1-3	ENV	Annual	X	X	X	X	X	X
IN1.3	Ensure all pest managers are trained and certified for the techniques used	H	PM2, IN1-3	ENV	Ongoing	X	X	X	X	X	X

IN1.4	Control the domestic stray animal population by conducting daily surveys for strays within cantonment and immediate surroundings.	M	PM2, IN1, IN2	ENV, DPW	Ongoing	X	X	X	X	X	X
IN1.5	Promote pet registration through public outreach and education of civilians and soldiers	M	PM2, IN1, IN2	ENV, DPW	Ongoing	X	X	X	X	X	X
IN1.6	Relocate problem rattlesnakes to range areas	L	PM2, IN1, IN2	ENV, DPW	Ongoing	X	X	X	X	X	X
IN2.1	Verify and update priority invasive species lists annually	M	PM1, IN1-3	ENV	Annual	X	X	X	X	X	X
IN2.2	Pursue opportunities for cost sharing or grants for invasive plant management, when they are available	L	PM5, IN1-3	ENV	As Needed						
IN2.3	Participate in cooperative regional efforts for invasive species management and control, particularly the West Mojave Weed Management Association and Cal-IPC.	L	IN1-3, PM5	ENV	As Needed						
IN2.4	Implement protocol for cleaning/inspection of any vehicles entering Fort Irwin to prevent spread of invasive plants	M	IN1, IN2	DPW	Ongoing	X	X	X	X	X	X
IN3.1	Monitor invasive plants in sensitive habitats and recent disturbance areas to supplement any contracted monitoring	M	IN2, IN3, TE1-4, WI2, VE1, WA3	DPW	Ongoing	X	X	X	X	X	X
RE1.1	Continue annual coordination with CDFW related to game species and hunting allowances and continue providing hunting opportunities, as the military mission allows	L	PM5, RE1, WI1,	ENV, MWR, CDFW	Annual	X	X	X	X	X	X
RE1.2	Monitor recreational activities for impacts on sensitive resources	L	RE1, SO1, WA2, TE1-4, WI1	ENV, Range	As Needed						
RE1.3	Update policies for recreation generally and NTC 420-3 related to hunting	L	RE1, PM1, WI1, TE1-4	ENV, DPW	As Needed						
CC1.1	Track special species range shifts with regional agencies	L	CC1, CC2, WI2, TE1-4, IN2, IN3	ENV	As Needed						
CC1.2	Incorporate regional climate change vulnerability assessments for rare and invasive species and modify priorities as needed	M	PM7, CC1, CC2, WI2, TE1-4, IN2, IN3	ENV	As Needed						
CC2.1	Continue participating in regional efforts to improve climate resiliency	M	PM1, PM5, CC1, CC2	DPW, ENV	As Needed						

Table B-3. Proposed Projects for Fort Irwin INRMP Implementation						Project Completion (Or estimated completion)										
Code	Project	Priority (High, medium, low)	Objective(s) in Table C-1	Ft Irwin Program	Projected Date	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31	FY32	FY33
PM7.6	Conduct assessments to determine the status and trends in training land condition relative to training impacts	H	PM7, SO#, VE#	ITAM	Annual	X	X	X	X	X	X	X	X	X	X	X
PM7.7	Conduct monitoring (i.e., plant survival counts, dust monitoring, etc.) to determine ITAM project effectiveness	M	PM7, SO#, VE#	ITAM	Annual	X	X	X	X	X	X	X	X	X	X	X
SO2.2	Continue soil hydrology study with USGS and NRCS	M	PM6, SO2	ENV	TBD											
SO2.3	Monitor soil and vegetation condition on one-third of the permanent plots (95/285) and approximately one-third of ITAM maneuver trails (150/450 miles) each year	H	PM7, SO2, VE1	ITAM	Annual	X	X	X	X	X	X	X	X	X	X	X
SO2.4	Map heavy use sites after each rotation and monitor the condition of those sites over time	M	PM7, SO2, VE1	ITAM	Annual	X	X	X	X	X	X	X	X	X	X	X
SO2.5	Implement dust control on approximately 18 miles (50 acres) of maneuver trails (or critical areas) with chronic dust problems	H	PM7, SO2, VE1	ITAM	Annual	X	X	X	X	X	X	X	X	X	X	X

SO2.6	Execute at least one large training land project (~100 acres) per year using techniques such as: out-planting native Mojave Desert shrubs, installing erosion control structures, and recontouring	M	PM7, SO2, VE1	ITAM	Annual	X	X	X	X	X	X	X	X	X	X	X
SO2.7	Execute training land stabilization by seeding (with a native Mojave Desert seed mix) approximately 150 acres of disturbed training land per year	M	PM7, SO2, VE1	ITAM	Annual	X	X	X	X	X	X	X	X	X	X	X
SO2.8	Execute training land stabilization by applying straw mulch on approximately 60 acres of disturbed training land per year	M	PM7, SO2, VE1	ITAM	Annual	X	X	X	X	X	X	X	X	X	X	X
SO2.9	Execute training site improvement by hardening at least one tactical site per year using techniques such as leveling/compacting, applying gravel mulch, eliminating gullies, re-contouring, and installing erosion control features as needed	M	PM7, SO2, VE1	ITAM	Annual	X	X	X	X	X	X	X	X	X	X	X
WA2.3	Rehabilitate any damage to springs (whether it is caused by military traiing, burros, erosion or flooding)	M	PM7, SO1, WA1, WA2, WA3, TE3, WI2	ENV, ITAM	As needed	X										
WA3.2	Conduct bi-annual survey of all springs and seeps using established protocol for multiple parameters.	H	PM7, WA3, WI2, TE3, TE4, IN3	ENV	Every 2 years		X		X		X		X		X	

WA3.3	Conduct detailed water quality studies at springs as issues are identified	M	PM7, WA3	ENV	As needed											
VE1.2	Update map of soils and vegetation to consolidate existing data from different sources, and fill in gaps, congruent with other Mojave Desert efforts, then update as needed	M	PM6, SO2, VE1, WI2, TE1-4	ENV	2023	X										
VE1.3	Obtain historic satellite imagery of the installation during past wet years to document patterns in vegetation and soils related to water	M	PM6, SO2, VE1, WI2, TE1-4	ENV	Once					X						
VE1.4	Monitor changes in vegetation cover from maneuver impacts, invasive species, fire, and climate change using multi-spectral imagery at least every 5 years	H	PM6, PM7, SO2, VE1, FI3, TE1-4, WI2 CC1	ENV	2029							X				
VE1.5	Plant propagation supporting recovery per ITAM program	M	VE1, TE1-4	ITAM	Annual	X	X	X	X	X	X	X	X	X	X	X
FI3.1	Assess wildfires and rehabilitate any soil or vegetation damage as needed, using methods that minimize invasive species	M	PM6, FI3, SO1, SO2, VE1	ENV, Fire	As needed											
WI1.5	Update comprehensive bird surveys every 5 years, including winter, night, raptor, waterfowl, and other speciality bird surveys, with emphasis on rare species	L	PM6, WI1, TE3	ENV	Every 5 years			X					X			

WI1.6	Update reptile survey every 10 years, with emphasis on rare species	L	PM6, WI1, TE3	ENV	Every 10 years							X				
WI1.7	Update mammal surveys every 10 years, with emphasis on rare species	L	PM6, WI1, TE3	ENV	Every 10 years				X							
WI1.8	Complete surveys for bats following current USFWS guidelines every 5 years	L	PM6, WI1, TE3	ENV	2023	X					X					X
WI1.9	Conduct an insect survey every 10 years, with a focus on rare species	L	PM6, WI1, TE3	ENV	Every 10 years					X						
WI1.10	Complete wildlife surveys of the 9 spring areas every 2 years (with Project WA3.2)	M	PM6, WI1, WI2, TE3	ENV	Every 2 years		X		X		X		X		X	
WI2.4	Provide artificial water sources to improve value of surrounding habitat for wildlife, which may include rain-catchment systems near natural springs or other measures	L	WA3, WI2, TE3	ENV, CDFW	As needed											
WI2.5	Continue PVDR roundups at traps and water sites, particularly at Goldstone, cantonment and high density areas downrange, to control the burro population	M	PM6, WA3, WI2, TE3-4	ENV	Annual	X	X	X	X	X	X	X	X	X	X	X
WI2.6	Upgrade, replace, or add additional burro exclusion fencing around water resources	M	PM6, WA3, WI2, TE3-4	ENV	As needed											

TE3.3	Monitor changes to MGS habitat over time in the WTA	H	PM6, TE3, VE1	ENV	Every 2 years	X	X		X		X		X		X	
TE3.4	Conduct MGS surveys (spring)	H	PM6, TE3	ENV	Annual	X	X	X	X	X	X	X	X	X	X	X
TE3.5	Monitor desert bighorn sheep on Fort Irwin in cooperation with other agencies	L	PM6, TE3	ENV, CDFW	As needed											
TE3.6	Conduct spring and fall Mojave Fringe-toed lizard surveys in known and potential habitat	M	PM6, TE3	ENV	Annual	X	X	X	X	X	X	X	X	X	X	X
TE3.7	Monitor burrowing owl population on Fort Irwin	M	PM6, TE3	ENV	Annual	X	X	X	X	X	X	X	X	X	X	X
TE4.1	Identify baseline conditions for populations (density and cover) and habitat of priority rare plants	H	PM6, VE1, TE4	ENV	As needed											
TE4.2	Monitor desert cymopterus annually	M	PM6, PM7, TE4	ENV	Annual	X	X	X	X	X	X	X	X	X	X	X
TE4.3	Continue to install bat gates that are specific to suspected species at mine openings	L	PM6, WI1, TE4	ENV, ITAM	Ongoing											

TE4.4	Collect distribution and abundance information on Clokey's cryptantha, particularly its overlap with the Lane Mountain milkvetch	M	PM6, PM7, TE4	ENV	TBD											
TE4.5	If removal is possible and timely, re-locate Joshua trees to sites with the same orientation and similar characteristics as their original sites to reduce the risk of tree mortality	L	VE1, TE4	ENV, MILCON, DPW, ITAM	As needed											
IN2.5	Update priority treatment areas and species annually and implement treatments and monitor treated areas (also see Table C-4)	L	PM7, WA3, VE1, FI3, WI2, TE1-4, IN2	ENV, DPW, ITAM	As needed											
IN2.6	Continue tamarisk control around water resources	L	WA3, IN2, TE3-4, WI2	ENV	Every 3 years			X			X			X		
IN2.7	Control the feral cat population by live-trapping feral cats in the cantonment.	M	PM7, WI1, TE1-4, IN2	ENV, DPW	As needed											
IN3.2	Survey for invasive plants and identify management recommendations, prioritizing areas and species based on sensitive resources, ability to control, and mission needs	M	PM7, WA2, WA3, VE1, FI3, WI2, TE1-4, IN2	ENV, DPW	2024		X									
RE1.4	Install, repair or replace any signs related to recreation and off-limits areas	H	PM2, WA2, WI2, TE1-4, RE1	ENV, DPW, MWR	Annual	X	X	X	X	X	X	X	X	X	X	X

CC1.3	Based on results from regional publications, vulnerability assessments, and scaled models, identify management actions and projects to mitigate adverse effects	M	PM5, CC1, TE1-4, WI1, WA3	ENV, DPW	As needed											
CC1.4	Create climate adaptation plan for NTC and Fort Irwin	L	PM5, CC1, TE1-4, WI1, WA3	ENV, DPW	2025			X								

Table B-4. Federal Threatened and Endangered Species Activities and Projects

Project/ Activity	Code	Description	Target Species	Objective(s) in Table C-1	Timing	Ft Irwin Program	FY23	FY24	FY25	FY26	FY27	FY28	FY29
Activity	PM2.4	Complete Section 7 consultation as needed and comply with existing Biological Opinions/Incidental Take Statements	LMMV, DT, SWFL, LEVI	PM2, TE1, TE2	As needed	ENV							
Activity	PM2.5	Maintain any USFWS or CDFW permits (handing/survey) required for T&E species	All	PM2, TE1-4	As needed	ENV							
Activity	PM2.6	Submit annual report to USFWS for DT and LMMV, including updates on population status, monitoring results, invasive plants, pre-construction surveys, habitat damage, documented take, translocations, and mitigation efforts	LMMV, DT	PM2, TE1, TE2	Annual	ENV	X	X	X	X	X	X	X
Activity	PM2.7	Coordinate with Range Operations and Operations Group to enforce environmental restrictions and off limits areas	All	PM2, PM3, TE1-4	Monthly	ENV, ITAM	X	X	X	X	X	X	X
Activity	PM2.8	When new populations of a listed species are found, areas will be reclassified as "No Dig" and limitations may be placed on other uses as compatible with the military mission	All	PM2, PM3, TE1-4	As Needed	ENV							
Activity	PM2.9	Maintain conservation and restricted use areas (Gemini, East Paradise, Brinkman Wash). Maintain off-limits designation around the NASA/Goldstone Complex	All	PM2, TE1-4	Monthly	ENV	X	X	X	X	X	X	X

Project	PM2.10	Monitor conservation areas, restricted access areas, and springs for: fences for breaches, damage or missing warning signs and siebert stakes around them	All	PM2, TE1-4	Quarterly	ENV, ITAM	X	X	X	X	X	X	X
Activity	PM2.12	Conduct pre-construction surveys and construction monitoring (if needed for DT) for downrange dig permit requests and before any damage repair in conservation areas	All	PM2, TE1-4	Ongoing	ENV, ITAM							
Activity	PM3.7	Continue awareness and outreach for rare species (particularly desert tortoise), including display in Bldg 606	All	PM3, TE1-4	Ongoing	ENV	X	X	X	X	X	X	X
Activity	PM7.8	Use aerial photography and site inspection to monitor disturbance (intensive training, flooding, other damage) to species potential habitat in conservation areas; inspection performed on an ad hoc basis	All	PM7,PM2, TE1-4	As needed	ENV							
Project	PM7.9	Repair damaged fences and off-limit signs around conservation and restricted access areas, as well as springs	All	PM7,PM2, TE1-4, WA2, WI2	Annual	ENV, ITAM	X	X	X	X	X	X	X
Project	PM7.10	Repair maneuver damage within conservation areas	All	PM7,PM2, TE1-4, WA2, WI2	As needed	ITAM							
Project	PM7.11	Monitor invasive plants within known and potential habitat for LMMV, DT, MGS, CYDE; submit annual report to the WMWMA and USFWS	DT, LMMV, CYDE, MGS	PM7, TE1-4	Annual	ENV	X	X	X	X	X	X	X
Project	PM7.12	Control invasive plants that pose a threat to listed species, informed by monitoring results	All	PM7, TE1-4	As needed	ENV							

Project	TE1.2	Support studies and research on demographics, population models,disease, behavior, life history, and ecology of listed species	All	TE1-4	As needed	ENV							
Activity	TE1.3	Train convey escorts to protect/avoid DT on Manix Trank Trail.	DT	PM2, TE1	Ongoing	ENV							
Project	TE1.4	Continue rehabilitating unused routes and maintain routes within Western Training Area	DT	PM2, TE1	As needed	ITAM							
Activity	TE1.5	Coordinate with DPW (Roads and Grounds) for grading, culverts, and other road improvements to prevent impacts and benefit desert tortoise	DT	PM2, TE1	As needed	ENV							
Activity	TE1.6	Check the double fencing around URTD holding pens at least twice a year.	DT	PM2, TE1	Annual	ENV	X	X	X	X	X	X	X
Project	TE1.7	Conduct desert tortoise study in the Western Training Area and potential translocation sites to inform translocation plan	DT	PM2, TE1	2020-2024	ENV	X	X					
Project	TE1.8	Translocate all tortoises from the Western Training Area per the approved Translocation Plan.	DT	PM2, TE1	2025	ENV		X	X				
Project	TE1.9	Monitor transmitters on translocated tortoises monthly for five years. Compare with mortality, dispersal, and fecundity of tortoises in unimpacted areas in the Mojave Desert to determine translocation success.	DT	PM2, TE1	2025 - 2030	ENV			X	X	X	X	X
Project	TE1.10	Support the RASP program outside of NTC and Fort Irwin including installing DT exclusion fencing, closing unauthorized routes, and protecting and restoring acreage for DT.	DT	PM2, TE1	Ongoing	ENV							

Project	TE1.11	Obtain USFWS depredation permits for ravens as needed and implement the DoD Raven Management Plan (2022)	DT	PM2, TE1	Annual	ENV	X	X	X	X	X		
Project	TE1.12	Measure vegetative cover in tortoise conservation areas (combined with Lane Mountain milk-vetch monitoring).	DT	PM2, TE1	Annual	ENV	X	X	X	X	X	X	X
Project	TE1.13	Maintain a database of all tortoise take and related tortoise condition. Spatial data is stored in GIS and analyzed for patterns and problem areas.	DT	PM2, TE1	Ongoing	ENV							
Activity	TE2.1	Support conservation of Lane Mountain milk-vetch populations in the surrounding region, particularly with BLM.	LMMV	PM2, TE2	Ongoing	ENV							
Project	TE2.2	Monitor Lane Mountain milk-vetch populations (Long-term Monitoring Plan) and complete annual report	LMMV	PM2, TE2	Annual	ENV	X	X	X	X	X	X	X
Activity	TE2.3	Monitor precipitation at rain gauges, and disseminate data to cooperating scientists	LMMV	PM2, TE2	Ongoing	ENV							
Project	TE3	Conduct survey of Coolgardie Mesa population to identify the presence/absence and/or density of MGS	MGS	PM2, TE3	2024	ENV		X					
Project	TE3	Conduct survey for southwestern willow flycatcher and least Bell’s vireo (and then determine rotation cycle)	LEVI, SWFL	PM2, TE3	2024	ENV		X					
Project	TE3	Implement measures to protect habitat for southwestern willow flycatcher and least Bell’s vireo	LEVI, SWFL	PM2, TE3	As needed	ENV							
Project	TE3	Monitor golden eagles, primarily nests, on Fort Irwin every 5 years	GOEA	PM2, TE3	2023	ENV	X					X	

Table B-5. ITAM Work Plan (FY23)

Project Number	Project Title	Priority	Category	Proponency	Driver	Type	Start Date	End Date	Frequency	Constraints
IRW2023002	FY23 ITAM Program Management	1	B	TRI	Safety, EnvComp, Training	Programmatic	2022/10/01	2023/09/30		
IRW2023003	FY23 Training Requirements Integration	2	B	TRI	Safety, EnvComp, Training	Programmatic	2022/10/01	2023/09/30		
IRW2023004	FY23 SRA Implementation	3	B	SRA	Safety, EnvComp, Training	Programmatic	2022/10/01	2023/09/30		
IRW2023005	FY23 SRP GIS Program Management	4	B	GIS	Safety, EnvComp, Training	Programmatic	2022/10/01	2023/09/30		
IRW2023006	FY23 GIS Support for Range Operations and Downrange Projects	5	B	GIS	Safety, EnvComp	GIS	2022/10/01	2023/09/30		
IRW2023007	FY23 GIS Support for Range Modernization and Development	6	B	GIS	EnvComp	GIS	2022/10/01	2023/09/30		

IRW2023008	FY23 GIS Product Development for Training Mission Support	7	B	GIS	Safety, EnvComp	GIS	2022/10/01	2023/09/30		
IRW2023009	FY23 GIS Data Development and Sustainment	8	B	GIS	Safety, EnvComp	GIS	2022/10/01	2023/09/30		
IRW2023010	FY23 RTLA Implementaion	9	B	RTLA	Safety, EnvComp	Programmatic	2022/10/01	2023/09/30		
IRW2023011	FY23 Soil Condition Assessment	10	C	RTLA		Assessment	2022/10/01	2023/01/31	Annual	Fall/Winter
IRW2023012	FY23 Vegetation Condition Assessment	11	C	RTLA		Assessment	2023/03/01	2023/06/30	Annual	Spring
IRW2023013	FY23 Maneuver Trail Condition Assessment	12	B	RTLA	Safety	Assessment	2022/10/01	2023/09/30	Annual	
IRW2023014	FY23 Heavy Use Site Assessment	13	C	RTLA		Assessment	2022/10/01	2023/09/30	Monthly	
IRW2023015	FY23 Expeditionary RSOI Assessment	14	B	RTLA	Safety	Assessment	2022/10/01	2023/09/30	Annual	

IRW2023016	FY23 Fire Risk Assessment	15	C	RTLA		Assessment	2022/10/01	2023/09/30	Annual	
IRW2023017	FY23 LRAM Implementation	16	B	LRAM	Safety, EnvComp	Programmatic	2022/10/01	2023/09/30		
IRW2023018	FY23 Heavy equipment maintenance and repair	17	B	LRAM	Safety, EnvComp	Programmatic	2022/10/01	2023/09/30		
IRW2023019	FY23 LRAM Site Maintenance and Monitoring	18	B	LRAM - Act	EnvComp	Maintenance	2022/10/01	2023/09/30	3x/year	
IRW2023020	FY23 Off Limits Marking	19	B	LRAM - Act	Safety, EnvComp	Maintenance	2022/10/01	2023/09/30		
IRW2023021	FY23 Maneuver Trail Maintenance	20	B	LRAM - Act	Safety	Maintenance	2022/10/01	2023/09/30		
IRW2023022	FY23 Maneuver Area Clearance	21	B	LRAM - Act	Safety	Maintenance	2022/10/01	2023/09/30		
IRW2023023	FY23 Training Land Stabilization - Watering	22	C	LRAM - Act		Maintenance	2022/10/01	2023/09/30	Monthly	

IRW2023024	FY23 Training Land Stabilization - Seeding	23	B	LRAM - Act	EnvComp	Maintenance	2022/10/01	2023/01/31	Annual	Fall/Winter
IRW2023025	FY23 Training Land Stabilization - Planting	24	C	LRAM - Act		Maintenance	2023/02/01	2023/05/31		Spring
IRW2023026	FY23 Dust Control on Critical Trails/Areas	25	B	LRAM - Act	Safety, EnvComp	Maintenance	2023/03/15	2024/03/14		
IRW2023027	FY23 Training Land Repair - Hill 760	26	B	LRAM - Proj	Safety	Repair	2022/10/01	2024/06/30		
IRW2023028	FY23 Training Site Improvement - Kuhnjab	27	B	LRAM - Proj	Safety, EnvComp	Reconfiguration	2022/10/01	2024/06/30		
IRW2023029	FY23 Training Site Improvement - MillerTime	28	B	LRAM - Proj	Safety, EnvComp	Reconfiguration	2022/10/01	2024/06/30		
IRW2023030	FY23 Trail Improvement - LF4to9	29	B	LRAM - Proj	Safety	Repair	2022/10/01	2024/06/30		
IRW2023031	FY23 Trail Improvement - Langford	30	B	LRAM - Proj	Safety	Repair	2022/10/01	2024/06/30		

IRW2023032	FY23 Erosion Control	31	B	LRAM - Proj	Safety	Repair	2022/10/01	2024/06/30		
IRW2023033	FY23 WTA Preparation	32	B	LRAM - Proj	EnvComp	Reconfiguration	2022/10/01	2024/06/30		TES
IRW2023001	FY23 Site stabilization - additional seeding sites	33	C	LRAM - Act		Maintenance	2022/10/01	2023/02/28		Fall/Winter

Key to abbreviations used in Appendix B	
Activities will be completed either by trained Natural Resource Management staff (as shown in Table B-2, B-4) or Projects through contracts/agreements (as shown in Table B-3, B-4) where appropriate.	
Priority/Funding Class	
Level 0	Recurring conservation requirements that maintain compliance with federal laws and regulations; funding likely
Level 1	Non-recurring conservation requirements that fix noncompliance; funding possible
Level 2	Non-recurring conservation requirement that prevents noncompliance; generally not funded
Level 3	Non-recurring conservation requirement that enhances the environment; generally not funded
Goals and Objectives Abbreviations	
PM	Program Management
SO	Soils Management
WA	Water Resources Management
VE	Vegetation Management
FI	Wildland Fire Management
IN	Invasive Species Management
WI	Wildlife Management
TE	Rare Species Management
RE	Recreation
CL	Climate Resilience
Ft Irwin Program (Potential Army Funding Sources)	
ENV	(DPW) Environmental funding
DPW	DPW Non-Environmental funding
ITAM	Integrated Training Area Management funding
Range	Range Control (not usually funding, activity)
Fire	Emergency Services, but could also be other programs that support wildland fire
Project number is from Environmental (or ITAM) funding requests/project approval system. Blank value indicates that project is not yet programmed within the system	
TE Table Target Species Codes	
BUOW	Burrowing owl
BHS	Desert bighorn sheep
CYDE	Desert cymopterus
DT	Desert tortoise
GOEA	Golden eagle
LEVI	Least Bell's vireo
LMMV	Lane Mountain milk-vetch
MFTL	Mojave fringe-toed lizard
MGS	Mohave ground squirrel
SWFL	Southwestern willow flycatcher

APPENDIX C – PHYSICAL ENVIRONMENT SUMMARY

C.1 Climate

Hot summers, mild winters, infrequent rainfall, and moderate winds characterize the climate of NTC and Fort Irwin, which is located in the Mojave Desert. The Mojave Desert is often considered a cool or winter desert because its annual precipitation typically falls from November through March, with additional precipitation occasionally recorded in October or April in some locations (Redmond 2009).

NTC and Fort Irwin have installed a network of 10 weather stations and 30 automated tipping bucket rain gauges to better monitor weather conditions over the entire installation where localized weather changes are often dramatic. Data are collected monthly and tabulated and stored within a Geographic Information System (GIS) database.

C.1.1 Climate History

Rainfall at the NTC and Fort Irwin varies considerably in both time and space. The average water year (October – September) 2019 precipitation total, across all data collection sites, was 5.14 inches. The local, short-term (2013 – 2021) average water year precipitation, based on an interpolation of data collected on NTC and Fort Irwin, is 3.76 inches and falls mainly during late winter and early spring. The long-term (1 October 1944 – 30 September 2021) water year precipitation averages 3.69 inches at nearby Barstow-Daggett Airport (Station 042257; (WRCC 2021).

The short-term (2012 – 2021) minimum and maximum ambient air temperatures recorded by NTC and Fort Irwin weather stations range from 9.3 °Fahrenheit [F] to 124.3 °F. The long-term (1944 – 2021) minimum and maximum recorded temperature range at Barstow-Daggett Airport from 7 °F to 118 °F (WRCC 2021). Ground surface temperatures fluctuate considerably both daily and seasonally, whereas subsurface soil temperatures at a depth of 27.6 inches are stable over the course of a month and fluctuate very little on a daily basis, making this subterranean location a good refugia for the desert tortoise (*Gopherus agassizii*). Average rainfall and temperature data for the NTC and Fort Irwin are provided in **Table C-1**.

Regional winds are primarily influenced by the Sierra Nevada and Transverse Mountain ranges, the distance inland from coastal northwest winds, and inland winds that flow out across the high desert plains from the Los Angeles Basin. Regional winds are typically from the southwest with a yearly average speed of about 10 miles per hour (mph). Gusts over 80 mph have been recorded.

Winds blowing across State Highway 127, east of the boundary of the NTC and Fort Irwin, show a dominant airflow to the east. Dust generated by NTC and Fort Irwin maneuvers normally parallels Interstate 15 and passes north of Baker. During winter, strong turbulent winds sometimes occur, often accompanying frontal systems, and can reach speeds of 25 to 60 mph. Dust storms often accompany these strong winds.

Table C-1. Average Rainfall and Temperatures for Barstow-Daggett Airport, CA (2000-2021)

Month	24-hr Average Temperature (°F)	Average Minimum Temperature (°F)	Average Maximum Temperature (°F)	Rainfall (Mean inches)
January	49	36	61	0.03
February	53	40	66	0.05
March	59	46	73	0.02
April	65	51	80	0
May	74	60	89	0
June	84	68	99	0
July	90	74	105	0
August	89	73	104	0.02
September	81	66.	96	0
October	69	55	83	0.03
November	56	43	70	0.04
December	48	35	60	0.02
Average	*68*	*54*	*82*	*0.02*
Source: Agricultural Applied Climate Information System **(NRCS 2022a)**				

C.1.2 Climate Projections

The degree to which the Mojave Desert's climate changes within the next century will undoubtedly play a role both in the structuring of its communities and influencing the ways in which they function. Precipitation means and intra-annual rainfall patterns are not expected to change significantly (Cayan et al. 2008), but the number of rain events are expected to decrease due primarily to a decrease in small rainfall events. Rainfall events will likely increase in intensity (Archer and Predick 2008), leading to more flash flooding and scouring effects in ephemeral streambeds. As these events increase in the future, conservation of several plant species may be further compromised, as ephemeral streambeds act as important landscape features for many plant species on NTC and Fort Irwin.

According to the online Army Climate Assessment Tool (accessed 28 February 2022), in 2050 drought is predicted to be the dominant impact on Fort Irwin under future climate change scenarios. The same is reported for the 2085 projection (D. Housman, personal communication, 2022).

Due to a decreasing number of small rain events, long drought periods observed on NTC and Fort Irwin are expected to become more common. Multiple consecutive drought years have been documented to cause highly significant mortality among smaller shrubs and perennial species. Plant diversity is also decreased as less common species in a given area die. Long periods of drought could dramatically decrease plant cover and productivity and favor the recruitment of fast-growing invasive species (McAuliffe and Hamerlynck 2010). Additionally, consecutive drought years heavily impact western Joshua tree woodlands, where decline and death have been observed in several locations (Sawyer et al. 2009).

While mean temperatures are projected to rise in the Mojave Desert throughout the century at an accelerating pace, analysis of temperature trends over the past century indicate nighttime minima are already rising more than daytime maxima (Karl et al. 1995). Nocturnal warming will decrease the amount of freeze events, limiting freezing stress that establishes northern distributional limits of many species from the Sonoran-Mojave ecotone, and many warm-desert species such as creosote bush at the Mojave-Great Basin ecotone (Smith et al. 2009). Relaxing these biogeographical constraints will result in the northern migration of many species, as has been observed in numerous regions of the globe (Walther 2003).

Higher elevation areas on NTC and Fort Irwin, specifically in the Avawatz Mountains, currently provide a climate refugia for many plant and animal species that require cooler temperatures. As the climate changes and temperatures continue to rise in lower elevations, these areas may become essential for desert species as they begin to change distribution in search of refugia from high heat at lower elevations. The result from the future interactions between moving desert species, migratory wildlife, and endemic species in montane habitats are unknown.

The springs on NTC and Fort Irwin will be impacted by a warmer climate as well. Projected mean temperature increases will result in greater evapotranspiration rates, which will have adverse effects on riparian systems, especially tree species, and aquatic habitats associated with desert springs.

Lastly, predicted climate change scenarios will have significant impacts on training land sustainability and rehabilitation project success. Revegetation projects will likely require more supplemental water to realize the same plant survival rates. More erosion control projects will be required. Blowing dust from disturbed areas will stress plants in undisturbed areas downwind (R. Sparks, personal communication, 2022).

C.1.3 Climate Change and Resilience

To assess the potential impacts from climate change on the natural resources at a given facility, the first step is to identify what the projected range of change might be in the future both in the mid- and long-term. The second step is to identify which species or ecological systems are most likely to be affected by the projected range of changes. Climate change vulnerability assessments for individual species can be part of this process, if enough is known about rare and/or invasive species. Finally, the third step is to identify management activities and projects now and in the future that can respond to these challenges. Scenario planning to determine which resources might require altered management to respond to projected climate changes can be a valuable tool. Species or ecosystems likely to be affected at NTC and Fort Irwin and appropriate management priorities for them are identified in their respective management sections.

The California Office of Environmental Health Hazard Assessment researched a variety of indicators highlighting how California's climate is changing and how these changes will affect the state. The 2018 report (OEHHA 2018) compiled indicators into four categories: human-influenced drivers of climate change, changes in the state's climate, impacts of climate change on physical systems such as oceans and snowpack, and impact of climate change on biological systems. The Environmental Protection Agency, too, has been predicting the change in climate in different states (EPA 2016). Major findings from these studies include:

- Atmospheric concentrations of CO_2 continue to increase. CO_2 concentrations have increased from 315 ppm in 1960 to over 400 ppm in 2015.
- Annual average air temperatures have increased in California since 1895 with extremely hot days and nights becoming more frequent since 1950. California has become drier over time with five of eight years of severe to extreme drought occurring between 2007 and 2016. Statewide precipitation has become more variable from year to year.
- Warming temperatures and precipitation changes may affect disease patterns and vector-borne pathogen transmission.
- With a warming climate, there's less snow falling and more snow melts during the winter. Tree lines may shift as a result, decreasing the extent of alpine tundra ecosystems. Decline in snowpack will also limit water supply in some areas.
- Agriculture needing irrigation will be affected by a reduction in water availability or changing temperatures. Wine grape growing areas will shift, and chilling before blooming for fruit trees will be insufficient.
- Since 1950, the land burned by wildfires annually has been increasing as summer and spring temperatures warm and snowmelt occurs earlier. More fires and drier conditions are expected to impact flora and fauna of the area by making California less hospitable.
- When compared to the 1930s, forests today have fewer large trees and more oaks when compared to pines. These changes are associated with increases in climatic water deficit. Decreased water availability and higher temperatures make trees more vulnerable to insects and pathogen infestations which leads to higher tree deaths.

The National Park Service has a list of research needs for its Mojave National Preserve which is to the southeast of NTC and Fort Irwin (NPS 2015). Many of these relate to pressing climate change needs in the Mojave Desert. Specific considerations that may be relevant to NTC and Fort Irwin include:

- Desert tortoise habitat research since habitat may be affected by temperature increases, precipitation changes, and wildfire increases.
- From a fire ecology perspective, increasing temperatures will lead to increased fire frequency and the variability in annual precipitation will lead to more drought conditions. Native shrubs like blackbrush, which is associated with Joshua tree, are predicted to shift upslope. As blackbrush burns more frequently, it will be replaced by invasive species post-fire and will change the composition of the landscape.
- Studying seeps and springs since they support populations of desert bighorn sheep, migratory birds, riparian vegetation, and predators. As the climate dries and there's variation in precipitation, there's an increasing likelihood of extended droughts and thus the loss of springs and seeps.

- Habitat connectivity research due to direct loss of habitat of species including the threatened desert tortoise. Renewable energy projects and mass transit development plans, aimed at helping climate change issues, will cause habitat loss and fragmentation for these species.

C.2 Landforms

The NTC and Fort Irwin is located in the Mojave Desert physiographic province. A physiographic province is a geographic region with specific character, relief, and environment. In the Mojave, high mountain peaks and ridges separate broad alluvial fans and wide, flat valleys. Large basins without external drainage develop playas (very flat, dry lakebeds). The average elevation of the Mojave Desert is approximately 2,500 feet. Individual peaks of isolated mountain areas on NTC and Fort Irwin reach elevations of up to 6,153 feet. Altitude generally increases from southwest to northeast with a low of 1,706 feet at Coyote Lake just off the installation to a high of 6,152 feet in the Avawatz Mountains (Buesch et al. 2018).

C.3 Geology

Rock formations at NTC and Fort Irwin span a vast period of geologic time from the Precambrian (over 600 million years ago) to the Quaternary (2.58 million years ago to present). NTC and Fort Irwin have mountain ranges and ridges that expose pre-Tertiary sedimentary, igneous, and metamorphic bedrock, and also Miocene volcanic and sedimentary rocks. Basins between these ridges have Quaternary to Pliocene deposits that overlie the older rocks (Buesch et al. 2018).

C.3.1 Historical Geology

Metamorphic rocks derived from pre-existing sedimentary, volcanic, and igneous intrusive rocks form a basement complex through the eastern Mojave region. Erosion wore down this landscape over time to a nearly level plain, and when the edge of the North American continent sunk in the ocean, a thick amount of late Proterozoic and Paleozoic sedimentary rocks accumulated on the continental margin. This great carbonate-rich (limestone and dolomite) sedimentary rock section (up to 6.2 miles thick) was preserved in the Mojave region. Around 250 million years ago, Pangaea separated, and North America broke away from now northern Africa and Europe. This westward movement caused the western margin of the continent to change into an active continental margin. Starting in the Jurassic period, a volcanic arc developed across the Mojave region with igneous intrusions (batholiths) encroachment underground. These igneous rocks, consisting mostly of granite, form the cores of many mountain ranges throughout the Mojave region. Granitic intrusions formed in the Jurassic (170 to 140 million years ago) and in the mid-Cretaceous (100 million years ago) times (USGS 2009).

After intrusion and volcanism ended, erosion dominated the Tertiary period. During the late Oligocene (around 30 million years ago), the Great Basin spread apart and a rift-style fault system developed. Throughout the late Tertiary and Quaternary period, large volcanic eruptions occurred fairly frequently in the Great Basin region. Volcanic ash is preserved in the accumulated alluvial deposits in the area. Most of the landscape features in the Mojave today are a result of climatic changes during the last million years (USGS 2009). Broad alluvial fans lead from mountain fronts to wide basins with playas. Geomorphology is controlled by youthful faulting and uplift in some places, but in other places, contain a more stable and mature geomorphology such as pediments and domes (Yount et al. 1994).

C.3.2 Avawatz Mountains

A complex assemblage of consolidated rock types in the region forms mountains and hills and underlies alluvial valleys at depth. The Avawatz Mountains consist of a complex assemblage of pre-Tertiary granitic and metamorphic rocks, Paleozoic sediments, Triassic metasedimentary and metavolcanic rocks, Tertiary sediments, and Tertiary volcanic rocks. The intersection of the Garlock and Death Valley fault zones along the northeastern flanks of the Avawatz Mountains is generally responsible for this stratigraphic complexity. Salt and gypsum deposits occur along this fault zone in the Avawatz Mountains.

C.3.3 Water Derived Features

Alluvial deposits are generally heterogeneous, with coarse sands and gravels occurring in stringers and lenses, intercalated with finer grained sediments. The heterogeneity of the alluvium has important hydrologic implications and can result in localized artesian conditions as clays and silt lenses confine the layers of coarse-grained water-bearing sediments. Alluvial fans grade into playas at terminal drainage points (Buesch et al. 2018).

Several dry lakes (or playas) occur within the NTC and Fort Irwin. Playa deposits accumulated from material in shallow bodies of water that covered lower portions of closed valleys during floods. The thickness of deposits underlying many of these dry lakes is unknown; however, playa deposits of the Mojave Desert generally range from a few feet to as much as 100 feet thick.

C.3.4 Seismicity

Principal faults bounding the Mojave Desert are the San Andreas Fault to the southwest and the Garlock Fault to the northwest (Schermer et al. 1996). The internal wedge between these faults defines the Mojave Desert and is generally referred to as the “Mojave block.” The San Andreas fault is the longest fault in the state and can cause earthquakes with up to a magnitude of 8 (CEA 2022a).

The eastern part of NTC and Fort Irwin is near the intersection of the Death Valley and Garlock fault zones. One major branch of the Garlock fault zone roughly coincides with the north-to-northeast face of the Avawatz Mountains. The Garlock Fault is one of the major east-west trending faults in southern California. The Garlock Fault has historically exhibited seismicity along its western extension where it displaces Holocene age alluvium. It is a strike-slip fault with left-lateral displacement and separates the Basin and Range Province from the Mojave Desert Province. Along the eastern portion of the fault, only minor seismicity has been observed.

The Death Valley Fault is a right-lateral, strike-slip fault and extends along the northeastern Avawatz Mountains and eastern Soda Mountains (Schermer et al. 1996). Segments of the Death Valley Fault have exhibited evidence of Holocene movement.

The Mule Spring Fault extends the length of the northern Avawatz Mountains and separates Tertiary and Quaternary sedimentary strata from the diorite basement. Shutter ridges, perched stream gravels, and other surficial tectonic expressions indicate very recent activity along the Mule Spring Fault.

The historically active Manix Fault roughly parallels Interstate 15 slightly south of the NTC and Fort Irwin. Other Quaternary faults in the area include an unnamed fault between East Cronese Lake and Red Pass Lake, numerous northwest-trending faults in the Soda Mountains, and a fault along the northwest flanks of the Silurian Hills (Jennings 1992).

Like most of southern California, NTC and Fort Irwin have experienced moderate seismicity in the recent past. A general increase in the amount of seismic activity has been documented in the Mojave Desert region following the 7.3 magnitude “Landers” earthquake and 6.4 “Big Bear” earthquake of June 28, 1992. Most recently in July of 2019, an earthquake of 7.1 magnitude, the “Ridgecrest” earthquake, struck 10.5 miles north-northwest of Ridgecrest. Aftershocks of this earthquake were felt into June of 2020 (CEA 2022b). Within inland southern California (Imperial, Riverside, and San Bernardino counties), there’s a 75% likelihood that an earthquake greater than or equal to a magnitude of 7 will strike within the next 30 years (CEA 2022a).

C.3.2 Petroleum and Minerals

Although minerals exist on the NTC and Fort Irwin, no mining or exploration is carried out within the original NTC boundaries due to the exclusion signed by President Roosevelt in the 1940s. An active iron mine is located in Training Area I2 which was purchased and leased to the previous owner for operation, coordinated with training activities, until 2027. The installation has known gold reserves and potentially has silver. There are no known petroleum reserves. Geothermal resources are not hot enough or are too diffuse to have commercial value (C. Woodruff, personal communication, 2022).

C.4 Soils

The NTC and Fort Irwin are in the Mojave Desert portion of the Basin and Range Province, which is dominated by broad alluvial basins stretching between mountain ranges. Eroded mountaintops of outcropping bedrock rise above alluvial fans and valleys filled with sediment. This ecoregion’s soil are mostly Entisols and Aridisols that have a thermic temperature regime (Griffith et al. 2016).

The majority of NTC and Fort Irwin are underlain by shallow bedrock or alluvial and lakebed deposits, formed from erosion and bedrock decomposition. Predominate soil types include silty sandy gravel derived from granitic rocks, silty gravel from volcanic rocks, and rocky soils from alluvial deposits. The coarsest depositional materials derived from mountainous parent rock are generally found on upper regions of high plains; the finest materials are along valley floors. Soils of upper bajadas (coalescent alluvial fans along bases of mountain ranges) consist of coarse gravels grading into loamy gravels toward the toe of alluvial fans. Soils of lower bajadas grade from sandy loams to finer loamy materials. Playas located at the bottom of basins accumulate silts and clays and generally develop saltpans (Yount et al. 1994).

Desert clay and silty soils, along with bacteria, algae, and lichens that are found in the desert, form hardened soil crusts called desert pavement. Cryptogamic crusts stabilize surface integrity and resist wind and water erosion from both drops and water flows. These crusts fix atmospheric nitrogen in low quantities, making it available to desert flora. Vehicles disturb cryptogamic crusts, making the soil vulnerable to erosion by wind and water. The time required for these soils to develop and their recovery rates are unknown. Cryptogamic crusts can be used on the installation as an indicator of ecosystem integrity (Johansen et al. 1999) Several studies at NTC and Fort Irwin investigated the use of inoculating soils to promote the formation of cryptogamic crusts but found that growth rates were too slow for this to be of value as a rehabilitation technique (Johansen et al. 2000, Kubeckova et al. 2001).

Desert soils that develop on the alluvial fill at the Training Center are generally light in color, deficient in phosphorus and nitrogen, and lacking in organic matter. Except on river terraces and a few other older alluvial landforms, soils have little profile development. Higher mountains of NTC and Fort Irwin are excessively drained, very stony or rocky, sandy loams to sands that are derived from nearby parent material. These soils develop on strongly sloping to very steep upland slopes of 9 to 75 percent. Rock outcrops cover 30 to 90 percent of the ground surface area. Where present, soil depth is seldom more than 10 inches (NRCS 2000).

Table C-2 incudes a summary of soil types present on NTC and Fort Irwin and associated water and wind erodibility. For the most part, the exposed bedrock and higher elevations grade down with alluvial fans into playa deposits on lower floors. The highland, bedrock features generally correspond to areas of low erodibility, while the playas generally correspond to areas of high erodibility.

Table C-2. Soil Types and Erosion Potential on the NTC and Fort Irwin

Soil Series and Associations	Acres	Water Erosion Potential (K Factor)	Wind Erodibility Group	Soil Erodibility (T Factor)
Cajon-Arizo (s1143)				
Arizo-Cajon complex	9,056.6	0.1	5	5
Arizo-Granitepass-Bikelake complex	33,478.8	0.1	6	5
Arizo-Twobitter association	11,477.6	0.05	8	5
Badlands	179.4	NA	NA	NA
Burrodrop extremely cobbly sandy loam	1,731.7	0.05	8	5
Cajon-Hollyhills-Spider association	1,031.4	0.05	8	5
Cavespring-Crackerjack eroded-Crackerjack association	3,914.9	0.1	8	2
Carrizo-Orita-Rositas association	7,737.9	0.02	3	5
Coyote-Cronese complex	1,086.1	0.05	8	5
Crackerjack extremely gravelly sandy loam	17,876.2	0.5	8	1
Cronese complex	4,526.2	0.05	6	5
Crosgrain extremely gravelly loam	16,053.3	0.05	8	1

Table C-2. Soil Types and Erosion Potential on the NTC and Fort Irwin

Soil Series and Associations	Acres	Water Erosion Potential (K Factor)	Wind Erodibility Group	Soil Erodibility (T Factor)
Crosgrain-Cronese-Arizo association	2,321.5	0.05	8	5
Fortirwin-Goldivide-Arizo association	4,501.3	0.05	5	5
Garlock-Ambrosia-Arizo complex	8,319	0.2	3	5
Goldivide complex	5,285.4	0.05	8	5
Gravesumit-Cajon-Livefire	23,366	0.1	3	5
Gravesumit-Eastrange association	2,651.7	0.1	6	5
Gravesumit-Goldivide complex	6,833.7	0.1	6	5
Gravesumit-Thermopyl complex	4,744	0.1	3	5
Hollyhills-Spider association	3,486.7	0.05	8	5
Khyber-Venusite complex	3,671	0.02	8	5
Mulespring-Newera-Noble Pass association	1,869.1	0.1	8	1
Nasagold-Livefire-Tipnat family complex	1,965.3	0.17	5	5
Nasagold nearly level-Crackerjack-Nasagold complex	4,945.8	0.17	5	5
Nellake-Arizo association	15,380.1	0.05	8	5
Olympus-Cajon complex	2,884.3	0.05	2	1
Popups-Cronese association	4,030.3	0.1	6	3
Sunrock-Rock outcrop association	2,767.1	0.05	8	1
Thermopyl-Crackerjack-Granitepass association	3,261.1	0.1	6	3
Thermopyl-Nasagold association	1,049.6	0.1	6	3
Twobitter-Langwell complex	1,726.7	0.05	8	2
Twobitter-Arizo association	11,547.5	0.05	8	2
Typic Aquisalids	4,048.8	0.1	6	5
Tyro family	167.7	0.49	6	1
Varwash family-Orita association	837.1	0.1	6	5
Venusite-Uxo association	12,964.9	0.5	8	5
Werewolf-Arizo association	5,140	0.05	8	5
Cajon-Bitterwater-Bitter-Badland (s1128)				
Dalvord association	4,952.2	0.02	8	1
Dalvord-rock outcrop-Langwell complex	10,347.8	0.02	8	1
Dime extremely gravelly coarse sandy loam	10,402	0.02	8	5
Juratrias-Crosgrain association	3,694.8	0.02	8	1
Nickel-Bitter-Arizo (s1142)				
Arizo complex	4,986.8	0.15	5	5
Arizo-Luckyfuse-Fortirwin association	2,420.9	0.05	8	5

Table C-2. Soil Types and Erosion Potential on the NTC and Fort Irwin

Soil Series and Associations	Acres	Water Erosion Potential (K Factor)	Wind Erodibility Group	Soil Erodibility (T Factor)
Blackmagic complex	4,657.6	0.1	8	5
Cavespring-Arizo-Cavespring very cobbly complex	11,392.8	0.1	6	5
Crackerjack -Owlshead	3,731.8	0.05	8	2
Crackerjack -Owlshead-Thermoply complex	14,083.1	0.05	8	1
Crosgrain complex	1,144.7	0.05	8	1
Crosgrain-fortirwin complex	1549.4	0.05	8	1
Crosgrain-Twobitter association	7,573.8	0.05	8	1
Eastrange-Dime association	4,541.3	0.1	6	5
Fortirwin extremely cobbly loam	2,426.5	0.02	8	1
Fortirwin-Crosgrain association	952.1	0.05	8	1
Goldivide-Cajon-Twobitter association	21,575.2	0.15	5	5
Granitepass-Cavespring complex	1,797.1	0.1	6	5
Lanip family	747.2	0.1	6	5
Luckyfuse-Arizo association	3,460.2	0.05	8	2
Luckyfuse-Crackerjack association	1,879.8	0.05	8	2
Owlshead extremely gravelly sandy loam	2,335.4	0.05	8	1
Playas (s1038)				
Arizo very gravelly sandy loam	22,502.6	0.1	6	5
Nasagold-Bluepoint association	2,272.4	0.17	5	5
Rillito-Gunsight (s1140)				
Carrizo-Clegorpass-Carrizo frequently flooded association	2,417.3	0.02	3	5
Crackerjack-Dime association	12,583.6	0.05	8	2
Rock outcrop-Lithic Torriorthents (s1130)				
Dalvord-Angelpoint-Rock outcrop association	24,618.3	0.05	8	5
Dalvord-Etinarg association	42,252	0.02	8	1
Rock outcrop-Etinarg	5,284.7	NA	NA	NA
Xyzoic extremely gravelly sandy loam	3,900.4	0.05	8	2
Rosamond variant-Rosamond-Playas-Gila-Cajon variant-Cajon (s768)	12,416.3	NA	NA	NA
Rositas-Carrizo (s1137)				
Rositas complex	1,389.1	0.2	2	5
Rositas-Carrizo-Bunkerhill association	519	0.2	2	5
St. Thomas-Rock outcrop (s1125)	7,324	NA	NA	NA

Table C-2. Soil Types and Erosion Potential on the NTC and Fort Irwin

Soil Series and Associations	Acres	Water Erosion Potential (K Factor)	Wind Erodibility Group	Soil Erodibility (T Factor)
Tecopa-Rock outcrop-Lithic Torriorthents (s1126)				
Cavespring very cobbly sandy loam	275.3	0.1	6	5
Cavespring very gravelly sand	18,730.3	0.1	6	5
Dalvord-Rock outcrop	15,557.7	0.02	8	1
Juratrias-Mulespring-Newera complex	9,496.2	0.02	8	1
Langwell-Artillery Rock outcrop association	14,709.6	0.17	5	1
Nasagold gravelly fine sandy loam	5,179.9	0.17	5	5
Trigger-Rock outcrop-Calvista (s1134)				
Cajon-Paintrocks-Langwell association	1,768.7	0.1	3	1
Fourcorners extremely gravelly sandy loam	1,760.3	0.02	8	1
Goldivide extremely gravelly-Granitepass-Goldivide complex	27,051.9	0.05	8	5
Paintrocks-rock outcrop complex	17,464.5	NA	NA	NA
Rock outcrop-Paintrocks complex	6,854.5	NA	NA	NA
Shankba family	490.8	0.05	8	2
Upspring-Sparkhule-Rock outcrop (s1127)				
Crackerjack-Fortirwin association	3,933.6	0.05	8	1
Crosgrain-Popups complex	1,346.2	0.05	8	1
Livefire complex	810.6	0.05	3	5
Marsite-Noble Pass complex	2,521.9	0.02	8	1
Noble pass complex	33,177.9	0.02	8	1
Noble Pass-Rock outcrop association	15,536.5	0.02	8	1
Stonegold extremely cobbly loam	2224.9	0.02	8	1

Sources: NRCS detailed soil surveys, supplemented by NRCS State Soils Geographic database **(NRCS 2000, 2022b)**

K Factor = erosion factor indicating susceptibility of soil to sheet and rill erosion by water, higher value means soil is more susceptible to water erosion (values range from 0.02-0.64)
T Factor = soil loss tolerance with a lower value being more indicative to soil loss (values range from 1-5)
Wind Erodibility Group: lower values indicate soils of fine or median sand which erode easily while higher values indicate wet or stony soils not subject to erosion (values range from 1-8)

Note that the finer soil complexes and associations (newer, SSURGO) do not always map exactly to the coarser soil series (older, STATSGO) because of the change in soil system.

The most common soil series on NTC and Fort Irwin is the Cajon-Arizo series . Cajon soils are very deep, excessively drained soils that form from sandy alluvium from mostly granitic bedrock. They are common on alluvial fans, fan aprons, fan skirts, inset fans, and river terraces with slopes of 0-15 percent. Arizo soils form on recent alluvial fans, inset fans, fan aprons, fan skirts, stream terraces, and wash floodplains. Rock fragments make up 35 to 85 percent of the soil.

Soils develop very slowly in the harsh conditions of desert environments and may not be replaced for centuries following disturbance. Desert soils are extremely fragile and vulnerable to disruption, which results in wind and water erosion. Desert soils are also highly vulnerable to compaction. A study on NTC and Fort Irwin determined that sites with recent (<3 years) disturbance were more vulnerable to wind erosion than those with a more distant (> 20 years) disturbance history (Belnap et al. 2007). Soil disturbance such as trampling or vehicular traffic crushes physical crusts, cyanobacterial filaments, lichens, and mosses, and reduces stability and wind speed required to move soil particles. More fine sand in surface soils resulted in greater vulnerability to wind erosion (Belnap et al. 2007).

Wind erosion is dependent on characteristics of climate, soil and vegetation. The wind velocity, direction, duration, and turbulence are important determinants of erosion. As wind velocity and duration of turbulence increases, the quantity of soil loss increases. The wind erosion potential is particularly dependent on the length of unprotected area relative to wind direction and on the amount of protective vegetation on the surface. Soils are assigned to wind erodibility groups (WEG) of 1 to 8 based on the texture of the surface layer. A WEG value of 1 refers to soils consisting of very fine, fine, and medium sand, which erode easily. A WEG value of 8 refers to soils consisting of very wet or stony soils, which are not subject to erosion.

Water erosion potential is dependent on the percent and length of slope, the rainfall intensity, the vegetative cover, and specific soil characteristics like texture. Water erosion increases as slope and rainfall increase and as the vegetative cover and soil particle size decrease.

C.5 Hydrology

Water on NTC and Fort Irwin is quite scarce, with only a few permanent sources of water, in the form of springs.

C.5.1 Groundwater

Few water wells have been drilled at NTC and Fort Irwin, but the USGS has mapped the Irwin Basin Aquifer and some of the Bicycle Lake Aquifer. Historically, groundwater was withdrawn from wells at Denning Spring in the Avawatz Mountains, Riggs Mine in the southwest Silurian Hills, and the southeast end of Silurian Dry Lake (Mendenhall 1909). Bicycle, Irwin, and Langford basins are used to supply current water needs to NTC and Fort Irwin (US Army 1988). Depth to groundwater in these basins is between 200 and 500 feet.

Water from wells in all three basins have high fluoride and arsenic concentrations. The volcanic rocks common to the area are high in fluoride and arsenic, and the natural weathering of bedrock is a potential source of these elements in groundwater. Ninety percent of drinking water wells have fluoride above the California maximum contaminant level of 2 milligrams per liter (mg/L). Arsenic has been detected at concentrations above the Federal and state maximum contaminant level of 10 micrograms per liter in 80 percent of the wells sampled (CH2M Hill, Inc. 2007). All potable water provided on the installation is treated to remove both fluoride and arsenic to standards prior to distribution. This same treatment reduces the total dissolved solids (TDS) found in the ground water from an average of 760 mg/L to 150 mg/L. The quantity of TDS in tertiary treated irrigation water is about 460 mg/L. There is some concern about the TDS in Irwin basin near the wastewater treatment plant where evaporation and leaching of salts in the soil have increased the TDS to above 1,000 mg/L.

The long-term availability of water is a concern in desert environments. Climate projections are mixed on future precipitation in the Mojave Desert, with an approximately even split on whether precipitation will increase or decrease, although aridity is projected to increase under either precipitation scenario because of increased temperatures (Gonzalez 2019). As a result, the following aquifers within the Fort Irwin training areas are being studied for possible development of groundwater wells: Superior Basin, Coyote Basin, Goldstone Basin, Leach Basin, Red Pass Basin, Nelson Basin, and Drinkwater Basin (USGS 2018).

C.5.2 Surface Water

Watersheds

NTC and Fort Irwin is situated in the US Geological Survey (USGS) Northern Mojave Basin (Hydrologic Unit Code [HUC] # 180902). The watersheds are divided into four major basins (HUC 8) with seventeen watersheds (HUC 10) (USGS 2022):

- Death Valley-Lower Amargosa (HUC #18090203)
    - Red Pass Lake-Salt Creek (HUC # 1809020310)
    - Riggs Wash-Salt Creek (HUC #1809020314)
    - Saddle Peak Hills-Amargosa River (HUC #1809020315)
    - Leach Lake (HUC # 1809020316)
    - Buckwheat Wash-Amargosa River (HUC # 1809020317)
    - Owl Lake (HUC # 1809020318)
    - Wingate Wash (HUC # 1809020319)
- Panamint Valley (HUC #18090204)
    - Mesquite Spring (HUC #1809020405)
    - Myrick Spring (HUC # 1809020407)
- Coyote-Cuddeback Lakes (HUC #18090207)
    - Nelson Lake-Bicycle Lake (HUC # 1809020701)
    - Goldstone Lake (HUC # 1809020702)
    - Coyote Lake (HUC # 1809020703)
    - Superior Lake (HUC # 1809020704)
    - Inscription Canyon (HUC # 1809020705)
- Mojave (HUC #18090208)
    - Langford Well Lake (HUC # 1809020815)
    - Cronise Valley (HUC # 1809020817)
    - Silver Lake (HUC # 1809020826)

Washes and Playas

Surface water resources within NTC and Fort Irwin and its vicinity are scarce. No perennial watercourses exist in this region. Washes descending from mountains and other elevated landforms provide intermittent channels that route surface runoff downgrade into topographical depressions (playas) where temporary or ephemeral lakes are formed. This water accumulation occurs during times of greater than average precipitation and can be expected to occur at least once each decade. Surface flows on NTC and Fort Irwin generally drain to one of nine dry lakebeds.

During heavy runoff events, water in washes carries sand, gravel, cobbles, and even boulder-sized rocks as part of the bedload transport. Deposition of this bedload material across areas of less steep terrain has resulted in the formation of alluvial fans commonly observed in this area. Significant subsurface flows may occur in the unconsolidated sand and gravel channel deposits found in washes and alluvial fans, even after surface flows have ceased. Local groundwater recharge may occur along washes because of this subsurface water movement. Without a drainage outlet, surface water in shallow ephemeral lakes is lost through groundwater percolation or evaporation.

When surface flow due to high intensity rainfalls occurs, the water soon percolates into the sandy soil of dry washes and/or collects on any of the playas at the NTC and Fort Irwin. The playas range in size from 340 acres to 1,297 acres. Standing water on playas, a result of low infiltration rates in evaporated clay lakebeds, is a short-lived phenomenon. Evaporation of playa waters results in precipitation of alkali salts at or near the surface of the playa.

Perennial Waters

The only naturally occurring permanent surface water resources on the NTC and Fort Irwin are eight springs and baseflow in Hellwind Canyon that produce meager to small quantities of water. Garlic Springs is a complex of three individual springs (West, Mid, East) which are each surveyed separately as discussed below. Several types of intermittent surface water resources are present on post. Four intermittent springs produce little to no water during summer, depending on the seasonal amount of rainfall (**Table D-3**). Two other springs on the installation are dry: Avawatz Spring and Drinkwater Spring. All streams are intermittent or ephemeral, and all naturally occurring standing water is ephemeral, occurring only during and immediately after heavy rains or thunderstorms. Another spring, Jack Spring (NU 220 898), is located approximately 100 yards south of the NTC's southern border.

Table C-3. Springs on NTC and Fort Irwin	
Springs	**Map Coordinates**
Permanent Springs	
Bitter Spring	NU 519 983
Cave Spring	NV 514 330
Devouge Spring	NV 381 257
Garlic Spring Complex (West, Mid, East)	NU 326 985
Leach Spring	NV 152 342
Two Springs	NV 330 335
Hellwind Canyon	NV 181 338
Intermittent Springs	
Arrastre Spring	NV 545 350
Desert King Spring	NV 259 312
Panther Spring	NV 390 251
No Name Spring	NV 376 230

Healthy seeps and springs are integral components of the vast desert landscape of Fort Irwin, supporting a wide variety of plant and animal species not found outside of desert springs and seeps habitats. Understanding how the seeps at Fort Irwin function and change over time is critical to maintaining the ecological integrity of Fort Irwin's desert environment. There are seven sites at Fort Irwin with a total of nine accessible sources which are surveyed twice annually. Surveyed springs include:

- Bitter Spring
- Cave Spring
- Desert King Spring
- Devouge Spring
- Garlic Springs Complex (West, Mid, East)
- No Name Spring
- Panther Spring

Parameters that are frequently sampled for water quality included pH, water temperature, dissolved oxygen (DO), nitrates, conductivity, salinity, total dissolved solids (TDS), and turbidity. Water quality measurements in spring and fall 2021 were similar to values observed during previous seasons. Vegetation cover at seeps was measured via line-intercept surveys of 29 pre-established transects. All plant and animal species within 50 meters of seeps were inventoried. Where sufficient water was present, aquatic invertebrate samples were taken as a barometer of changes in water quality, since most aquatic organism need oxygen to survive and grow. Tolerance values for water quality for each taxonomic group of aquatic invertebrates on a scale from 0 (highly intolerant) to 10 (highly tolerant) were analyzed. Results suggested that the highest water quality can be found at Bitter Spring, while Devouge Spring has the lowest water quality (D. Davis, personal communication, 2022). Disturbances such as invasive plant species, burro activity, and drought continue to adversely impact the seeps.

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APPENDIX D – BIOLOGICAL ENVIRONMENT SUMMARY

D.1 Ecoregion

NTC and Fort Irwin is located within the Mojave Basin and Range ecoregion (Level III). The Mojave Basin and Range ecoregion stretches across southern Nevada, southwestern Utah, northwestern Arizona, and southeastern California. Topography is generally scattered mountain ranges and broad basins. Typical vegetation in the Mojave includes creosotebush (*Larrea tridentata*), white bursage (*Ambrosia dumosa)*, blackbrush (*Coleogyne ramosissima*), and Joshua tree (*Yucca brevifolia*) and other yuccas. Most of the area is federally owned with wind and water erosion becoming more prominent in some places due to heavy off-road vehicle usage (Griffith et al. 2016).

At a more fine scale, NTC and Fort Irwin is located within the Eastern Mojave Basins, Western Mojave Basins, Eastern Mojave Low Ranges and Arid Footslopes, Western Mojave Low Ranges and Arid Footslopes, and Death Valley/Mojave Central Trough ecoregions (Level IV) (Griffith et al. 2016).

NTC and Fort Irwin comprises approximately 1,254 square miles in the Mojave Desert and, as such, has the typical flora and fauna of the Mojave Desert ecosystem. This area is characterized by mountainous terrain with steep slopes and deep dissected alluvial fans. There are several large valleys which are used for tank maneuvers with mountains, hills, and valleys adding additional “concealment points” for ambushes. The flora of the Mojave Desert consists mainly of creosote bush scrub, characterized by short (usually less than five feet tall) sparse vegetation (Gibson et al. 1994).

D.2 Land Use History & Historic Vegetation

The Mojave Desert today is one of the least populated areas of the western United States, with large contiguous areas of native, undisturbed habitat. However, humans have used the area for millennia (Randall et al. 2010). The indigenous territories of the Newe (Western Shoshone) and Kawaiisu people overlapped NTC and Fort Irwin (Native Land Digital 2021). The NTC and Fort Irwin currently consults with ten affiliated, federally recognized Tribes.

Trails from Santa Fe to Los Angeles brought Euro-Americans through the Mojave Desert around 1829-1830, but few settled in the area. In 1849, gold was discovered at the foot of the Avawatz Mountains, and prospectors flocked to the region. Active and retired open-pit and underground mines are found throughout the ecoregion. Railroads connected the desert to other areas in the late 1800s and early 1900s (Randall et al. 2010).

Today, there are many year-round residents in the Mojave Desert due to extraction of local water resources and air conditioning. Many houses have been constructed in the area due to urban expansion associated with the Los Angeles Basin and Las Vegas Valley metropolitan areas. Irrigated agriculture is prevalent, and there are many dairy cattle feedlots (Randall et al. 2010).

Since Euro-American settlement, vegetation has been altered by livestock grazing, exotic species introduction, native people removal, off-road vehicle use, urbanization, and military activities.

Livestock grazing has significant local effects on plants with the almost complete destruction of perennial plants in some instances. Mining was a major industry in the desert since the late 1880s: construction of roads and the presence of pits themselves were two of the major destructive issues. The introduction of exotic plants like saltcedar (*Tamarix ramosissima*) and bromes (*Bromus spp.*) have increased the frequency and fuel load of fire in an area poorly adapted to fire (Lovich and Bainbridge 1999).

Vegetation within the Mojave Desert has been heavily impacted by military activities. Military use of the area spans from 1940 to the present. At abandoned military camps in the eastern Mojave, studies showed that long-lived species such as creosotebush were dominant in control areas but reduced in percentage cover and density in impacted areas. Disturbed areas were dominated by pioneer species like bursage and cheesebush *(Ambrosia salsola)* (Prose and Metzger 1985, Prose et al. 1987).

Historic vegetation within the Mojave Desert was in general more plentiful and less impacted by humans. Plants within California deserts consist of plants that dominated southern California during the Tertiary and a variety of plants from other places. For example, creosotebush was probably carried to Mexico from Argentina or Chile by migrating birds and then moved into Californian deserts in the late interglacial and Holocene time (Thorne 1986).

In the Marble Mountains, southeast of NTC and Fort Irwin, fossil packrat middens show that vegetation dated 10,500 years ago was different from vegetation of today. Fossils of extralocal Mormon tea (*Ephedra californica*) and wolf-berry (*Lycium sp*.) were abundant at low elevations (1,476-1,558 feet), and Death Valley sage (*Salvia funereal*) was one of the only plants represented still here today. At medium elevations (2,756-2,953 feet), the oldest macrofossil assemblages (10,200 and 9,500 years old) have no woodland species. Brittle-bush (*Encelia farinosa)* was the first of the dominant woodland plants to arrive: it was common 9,500 years ago. Creosote bush and white bursage did not become common in the fossil record until about 7,900 years ago (Spaulding 1990).

D.3 Plant Diversity

The Mojave Desert is divided into five floristic regions (Rowlands et al. 1982). The NTC and Fort Irwin is located in the Central Region, near its border with the Southwestern and South-Central regions. The Central Region is expected to have the fewest species because it is the smallest of the five regions and has only a few mountain peaks. The Avawatz Mountains in the northeastern corner of NTC and Fort Irwin are the only peaks above 5,248 feet, and only rising to 6,117 feet. Topographic relief in the form of mountains and incised bajadas increases structural and microclimatic characteristics of an area and therefore increases floral diversity.

In 1994, previous plant surveys on the NTC and Fort Irwin and pertinent species at the Rancho Santa Ana Botanic Garden were combined to produce a plant checklist for the Training Center (Gibson et al. 1994). This list included 425 native species and 39 introduced species from 57 families. In 2018, prior survey points were revisited, along with surveying of 30 new locations, and a new checklist of 587 plant species was compiled (RJRudy LLC et al. 2018). Their survey emphasized the area surrounding 200 Range and ITAM transects and is not comprehensive.

The annual plant community changes from year to year due to variable and unpredictable precipitation (Tierra Data 2009). A total of more than 650 plant species or subspecies have been identified on the installation, based on multiple surveys. Lane Mountain milk-vetch is the only federally protected plant species documented on the installation.

D.4 Vegetation Communities

Vegetation communities on NTC and Fort Irwin were categorized based on the qualitative scheme developed by Holland (1986) and updated to current California Manual of Vegetation and National Vegetation Classification (NVC) classifications. The following discussions of vegetation communities rely heavily on recent reports by Gibson et al. (1994) and Chambers Group, Inc. (1994).

Table D-1. Current Vegetation on the NTC and Fort Irwin, CA

NVC Classification (Group) (USNVC 2021)	**Manual of California Vegetation Alliance(s)** (CNPS 2021)	**USGS Mapping Unit(s)** (Thomas et al. 2002)	**Acres (%)**	**Climate Vulnerability** (Thorne et al. 2016)	**Fire Response**
Desert Wash & Colluvial Slope Group	Cheesebush-sweetbush scrub	Desert Wash System	9,221 (2%)	Moderate	
Intermountain Shadscale-Saltbush Scrub	Fourwing saltbush scrub, Allscale scrub, Spinescale scrub	Saltbush	1,309 (<1%)	Moderate	
Intermountain Shadscale-Saltbush Scrub	Shadscale Scrub	Shadscale	1,616 (<1%)	Moderate	
Mojave Mid-Elevation Mixed Desert Scrub	Blackbrush Scrub	Blackbrush	56,742 (8%)		Severe Damage
Mojave Mid-Elevation Mixed Desert Scrub	Joshua Tree Woodland	Joshua Tree	1,114 (<1%)		Moderate-Severe Damage
Mojave Mid-Elevation Mixed Desert Scrub	Mojave Yucca Scrub	Mojave Yucca	3,207 (<1%)		Low Damage
Mojave Mid-Elevation Mixed Desert Scrub	Nevada Joint Fir-Anderson's Boxthorn-Spiny Hop Sage Scrub	Nevada Joint-Fir	2,498 (<1%)		
Mojave-Sonoran Bajada & Valley Desert Scrub	Creosote Bush Scrub Creosote Bush-White Bursage Scrub	Creosote	658,926 (87%)	Moderate	Moderately Damaged
Mojave-Sonoran Bajada & Valley Desert Scrub	Creosote Bush-Brittle Bush Scrub	Creosote-Brittlebrush	475 (<1%)	Moderate	

NVC Classification (Group) (USNVC 2021)	Manual of California Vegetation Alliance(s) (CNPS 2021)	USGS Mapping Unit(s) (Thomas et al. 2002)	Acres (%)	Climate Vulnerability (Thorne et al. 2016)	Fire Response
North American Desert Alkaline-Saline Marsh & Playa	Alkali-weed – salt grass playas and sinks	Playa	8,359 (1%)		
North American Desert Alkaline-Saline Wet Scrub	Iodine Bush Scrub	Iodine Bush-Bush Seepweed	30 (<1%)		
North American Warm Desert Riparian Low Bosque & Shrubland Group	Mesquite Thickets	Mesquite	106 (<1%)		Neutral
North American Warm Semi-Desert Dune & Sand Flats	Mojave-Sonoran Desert Dunes	Dunes	6,159 (<1%)	Moderate	N/A
N/A	N/A	Unmapped Seeps and Springs	Unknown		
N/A	N/A	Mining	159 (<1%)		
N/A	N/A	Rural Development	2,994 (<1%)		
N/A	N/A	Sparse Vegetation	19 (<1%)		
N/A	N/A	Urban	1,829 (<1%)		

Sources: Fire response is from a variety of sources (Loik et al. 2000, Brooks and Matchett 2003, Abella 2009, DeFalco et al. 2010). See written descriptions below.

This USGS vegetation type data was collected in 1994. There is higher resolution data available but only from a small area on the southern boundary and on the WTA. It can be found here: https://wildlife.ca.gov/Data/GIS/Vegetation-Data under the Mojave Vegetation for the DRECP (CDFW) shapefile download.

D.4.1 Fire and Species of Management Concern

Historically, fires in the Mojave Desert were infrequent and small, since fuels were discontinuous or did not burn readily. Today, due to the prevalence of invasive species, there's a large amount of fuel within desert plant communities, allowing fire to spread easily, and causing the conversion from shrub communities to grass-dominated communities (Randall et al. 2010).

One species of management concern for vegetation is the bristly fiddleneck (*Amsinckia tessellata*). While this species is native, it has become prolific and a localized fire hazard. It was considered in invasive species monitoring and prediction on the installation in 2008. (Tierra Delta citation). In a 2008 installation survey, bristly fiddleneck was detected at 316 out of 419 survey sites at the highest concentration out of the weedy species studied. This plant preferred lower portions of north and northeast facing slopes. Central Goldstone had populations at very high density that expanded into the gentle slopes and flats (Tierra Data 2009).

D.4.2 Desert Wash & Colluvial Slope

Mojave Desert Wash Scrub

Mojave Desert wash scrub is a low, shrubby, diverse community occurring in open washes, arroyos, and canyons throughout the desert. Periodic flooding in these areas maintains the open character of this community. Representative shrubs include desert senna (*Senna armata*), rayless encelia (*Encelia frutescens*), cheesebush, desert almond (*Prunus fasciculata*), indigo bush (*Psorothamnus arborescens*), and sandpaper plant (*Petalonyx thurberi*). In some areas this community may have scattered small tree species.

D.4.3 Intermountain Shadscale-Saltbush Scrub

Saltbush and Shadscale Scrub

Saltbush scrub is characterized by the dominance of one or more species of saltbush (*Atriplex* species). Saltbush scrub is associated with moderately alkaline soils toxic enough to inhibit most desert shrubs that occur in the creosote bush scrub. It commonly occurs on lower bajada slopes and plains and around playas throughout most of the desert (Holland 1986). Good examples of saltbush scrub can be found on playas along margins of dry lakes on the NTC and Fort Irwin. The California Wildlife Action Plan identified shadscale-saltbush scrub as a priority conservation vegetation target in the Mojave Desert (CDFW 2015).

Common saltbushes include shadscale (*Atriplex confertifolia*), Mojave saltbush (*A. spinifera*), four-winged saltbush (*A. canescens*), and allscale (*A. polycarpa*). Other shrubs found in association with saltbush scrub include budsage (*Artemisia spinescens*), winter fat, hopsage, and Anderson’s boxthorn. Typically, one strongly dominant species of saltbush is found in association with a smaller number of saltbush species in a particular area.

D.4.4 Mojave Mid-Elevation Mixed Desert Scrub

Blackbrush Scrub

Blackbrush scrub replaces creosote bush scrub above elevations of 3,600 feet and is found up to 5,900 feet. Blackbrush scrub occurs on upper alluvial fans and mountain slopes. It often occurs as monotypic stands; however, on NTC and Fort Irwin it grows with several shrubs, including turpentine bush (*Thamnosma montana*), Mormon tea (*Ephedra nevadensis*), goldenbush (*Ericameria linerifolia*), hopsage, and needle grass (*Stipa speciosum*). Scattered junipers (*Juniperus californica*) occur as a canopy for blackbrush scrub and are discussed separately below. Blackbrush scrub occurs on slopes above Drinkwater Springs in the Granite Mountains and in higher elevations of the Avawatz Mountains in the vicinity of Cave Springs.

Blackbrush scrub, a long-lived, late successional dominant, is severely impacted by fire. One study showed that blackbrush declined 15-fold post-fire, with shorter-lived plant species replacing blackbrush (Abella 2009). Another study showed that fire caused a 60% lower cover by woody species in burned sites compared to unburned sites. Non-native species cover also increased by 191% in burned sites over unburned sites (Brooks and Matchett 2003).

Joshua Tree Woodland

Joshua tree woodland is open woodland that occurs on gentle alluvial slopes with well-drained sandy, loamy, or gravely soils. The Joshua tree (*Yucca brevifolia/jaegeriana*) is usually the only native arborescent species and, when it occurs in higher densities, constitutes a woodland setting. Associated shrub species include creosote bush, bursage, California buckwheat, hopsage, bladdersage, and range rhatany. Joshua tree woodland is weakly developed on the NTC and Fort Irwin. It is best developed in the northern part of Goldstone and on bajada slopes in the Avawatz Mountains. There are extensive stands with large, many-branched individuals in the Western Training Area.

In the Avawatz Mountains, there are Joshua tree-juniper woodlands, with California juniper (*Juniperus californica)* and Utah juniper (*Juniperus osteosperma)*. This community occurs on steep slopes and ridges and is a diverse assemblage of low shrubs and small juniper trees. Associated species include California buckwheat, Blackbrush, desert sandwort (*Eremogone macradenia*), and needle grass. Climate change is likely to reduce this community on NTC and Fort Irwin.

Joshua trees are becoming more susceptible to fire with climate change impacts. A study documented the resprouting of Joshua trees after fire and disturbance (Loik et al. 2000). However, a more recent study showed that fire, paired with drought, decreased the probability of Joshua tree survival, even if the individual trees had not been damaged directly by fire. This survival probably was much lower than that of an unburned site (DeFalco et al. 2010). The Cima dome fire in the Mojave National Preserve in 2020 killed up to 1.3 million Joshua trees. Research shows that if the top 1/3 of a Joshua tree is unburned, the plant may survive. Since these trees were fully scorched, they won’t be able to recover (NPS 2020).

Mojave Yucca Scrub

Mojave yucca scrub is a heterogeneous assemblage of shrubs that grows in steep, rocky, granitic, or volcanic slopes. Species include many cacti, Mojave yucca (*Yucca schidigera*), and species *of Brickellia, Ericameria, Ephedra, and Encelia*. Examples of this scrub type on granitic soils occur in southern passes in Leach Lake Gunnery Range and steep slopes of the Avawatz and Granite mountains. Some of the areas with this vegetation type do not have a clear dominant species. Due to slope steepness, this vegetation typically would not be disturbed by training maneuvers.

Mojave yucca is not greatly affected by fire. One study showed that 64-86% of Mojave yucca re-sprouted post-fire; this was the highest sprouting among the nine species measured (Abella 2009).

Nevada Joint-Fir

Nevada Joint Fir is characterized by dominants or co-dominants of Nevada joint fir (*Ephedra nevadensis*), spiny hop sage (*Grayia spinosa*), Anderson's boxthorn (*Lycium andersonii*) and/or peach thorn *(Lycium cooperi*) in the shrub canopy. Shrubs are less than 10 feet, and an herbaceous layer is sparse to intermittent (CNPS 2021).

D.4.5 Mojave-Sonoran Bajada & Valley Desert Scrub

Mojave Desert Creosote Scrub

Creosote bush scrub is the most common vegetation type in the region, dominating about 70% of the Mojave Desert and dominated by creosote bush as a large shrub (Holland 1986). Likewise, creosote bush scrub is the most widespread community of NTC and Fort Irwin, occurring below 3,600 feet on alluvial slopes, valley floors, and mountain slopes (Gibson et al. 1994). Creosote bush scrub occurs on about 85% of the installation (RJRudy LLC et al. 2018).

A variant of this vegetation type is the creosote-burrobush scrub based on the codominance between creosote bush and burrobush (white bursage). Burrobush is a much smaller shrub that may often be numerically more abundant than creosote bush, but canopy cover and volume is generally dominated by creosote bush. Griffith (1993) found burrobush to be more abundant than creosote bush on NTC and Fort Irwin, occurring on 99.5% of the plots surveyed (compared to 47.9% for creosote bush). In localized sites, creosote bush may represent the only woody species; however, it is conspicuously absent around playas because of high salinity (Wallace and Romney 1972) and/or dense fine-textured basin soils low in oxygen (Lunt et al. 1973). Creosote bush and burrobush size and vigor are strongly influenced by water availability, and the largest individuals are characteristically found along edges of washes and roads.

Many subdominant shrubs occur in creosote bush scrub, including range rhatany (*Krameria erecta*), silver cholla (*Cylindropuntia echinocarpa*), Anderson's boxthorn (*Lycium andersonii*), desert straw (*Stephanomeria pauciflora*), wishbone bush (*Mirabilis laevis*), and cheesebush. At higher elevations, subdominants include California buckwheat (*Eriogonum fasciculatum*), hopsage (*Grayia spinosa*), winter fat (*Krasheninnikovia lanata*), and bladdersage (*Scutellaria mexicana*).

In creosote-brittlebush vegetation, creosote bush and brittle bush (*Encelia farinosa)* are co-dominant in this vegetation type and include other species such as desert agave (*Agave deserti),* white bursage*,* desert holly (*Atriplex hymenelytra),* sweetbush (*Bebbia juncea*)*,* and teddy bear cholla *(Cylindropuntia bigelovii*). Emergent trees or small shrubs may be present at low cover. Shrubs are under 10 feet, the canopy is open to intermittent, and the herbaceous layer is open with seasonal annuals (CNPS 2021).

Creosote bush is moderately damaged by fire. In one study only 3-37% of creosote bush plants sprouted after fire (Abella 2009).

D.4.6 North American Desert Alkaline-Saline Marsh & Playa

Playas

Several dry lakes (or playas) occur on the installation. Playas range in size from 340 acres to 1,297 acres. There is little vegetation associated with playas but typically some saltbush is around these areas.

D.4.7 North American Desert Alkaline-Saline Wet Scrub

Iodine Bush Scrub

Alkali sink scrub occurs where soil salinities are very high and, as such, supports only the growth of halophytic plants. Alkali sink scrub occurs on poorly drained, usually clay soils that have a high water table and high alkalinity. The only known site of alkali sink scrub on the installation is found within a narrow belt, west of Bitter Spring. Plant species that make up this community include iodine bush (*Allenrolfea occidentalis*), bush seepweed (*Suaeda nigra*), and saltgrass (*Distichlis spicata*).

D.4.8 North American Warm Desert Riparian Low Bosque & Shrubland

Mesquite Thickets

Honey mesquite (*Prosopis glandulosa*) and/or screwbeam mesquite (*Prosopis pubescens*) is dominant or co-dominant in a small tree canopy with Fremont's cottonwood (*Populus fremontii*), coyote willow (*Salix exigua*), arroyo willow (*Salix lasiolepis*) or elder (*Sambucus nigra*). Trees are under 35 feet, and the canopy is open to continuous. Shrub and herbaceous layers are open to intermittent (CNPS 2021).

This vegetation type is only found near springs. Screwbean mesquite, a species less tolerant of salt, occurs at Paradise Springs along with honey mesquite. Both species of mesquite are found at Garlic Springs, where a rich assemblage of species occurs. Equally diverse, but very different, aquatic flora occur at Two Springs and the lower zone of Leach Spring.

D.4.9 North American Warm Semi-Desert Dune & Sand Flats

Dunes

Mojave-Sonoran desert dunes are characterized by desert sand-verbena (*Abronia villosa*) and desert dicoria (*Dicoria canescens*) in the herbaceous and subshrub layers. Herbs and subshrubs are less than 3 feet fall, and cover is sparse to intermittent with seasonal annuals and scattered perennials (CNPS 2021).

D.4.10 Unmapped Vegetation Types

Seeps and Springs

NTC and Fort Irwin has been surveyed, and no wetlands have been found. All potential wetlands on the NTC – six springs and four seeps – are off-limits to military training. These serve as important habitats for wildlife species, especially rare species.

Unique assemblages of low-growing perennial herbs and phreatophytic trees and shrubs occur in the vicinity of the permanently wet or moist soils around seeps and springs. These types of species occur at most springs on NTC and Fort Irwin. The volume of water and nature of the seep or spring usually dictate the abundance and diversity of the vegetation. Emergent aquatic species may include common reed (*Phragmites australis*), cattails (*Typha*), and rushes (*Juncus*). Honey mesquite (*Prosopis glandulosa*), desert willow (*Chilopsis linearis*), and species of willow (*Salix*) and cottonwoods (*Populus*) are also present.

Springs and seeps provide valuable habitat for special status animal and plant species.

D.5 Invasive Species

D.5.1 Documented Invasive Plants

The NTC and Fort Irwin has documented 69 species of non-native plant species, with 25 species identified as invasive species. The greatest concerns for invasive plants at Fort Irwin are those species that increase fuel loads and fire risk and those that occur near seeps and springs. Table D-2 summarizes the documented priority invasive plant species on NTC and Fort Irwin, along with their fire fuel and state rating.

Table D-2. Documented Invasive Plant Species on the NTC and Fort Irwin, CA

Common Name ***Scientific Name***	**Cal-IPC Rating** (Cal IPC 2022)	**Fire Fuel** (Cal IPC 2022)	**Priority**
Grasses			
Ripgut grass ***Bromus diandrus***	Moderate	Yes	Medium
Red brome ***Bromus rubens***	High	Yes	High
Cheatgrass ***Bromus tectorum***	High	Yes	Medium
Bermuda grass *Cynodon dactylon*	Moderate	No	Low
Italian ryegrass *Festuca perennis*	Moderate	Yes?	Low
Foxtail *Hordeum murinum*	Moderate	Maybe	Low

Common Name ***Scientific Name***	**Cal-IPC Rating** (Cal IPC 2022)	**Fire Fuel** (Cal IPC 2022)	**Priority**
Annual beard grass *Polypogon monspeliensis*	Limited	Yes?	Low
Mediterranean grass ***Schismus barbatus***	Limited	Yes	Medium
Herbaceous Plants			
Five-hook bassia *Bassia hyssopifolia*	Limited		Low
Sahara mustard ***Brassica tournefortii***	High	Yes	High
Flixweed *Descurainia sophia*	Limited		Low
Red-stemmed filaree *Erodium cicutarium*	Limited	Yes	Low
Gazania *Gazania sp.*	Moderate		Low
Horehound *Marrubium vulgare*	Limited		Low
Russian thistle ***Salsola tragus***	Limited	Yes	High
London rocket *Sisymbrium irio*	Moderate		Low
Puncture vine *Tribulus terrestris*	Limited		Low
Woody Plants			
Australian salt bush *Atriplex semibaccata*	Moderate	Yes	Low
Australian tea tree *Leptospermum laevigatum*	Watch	Yes	Low
Tree tobacco *Nicotiana glauca*	Moderate	Maybe	Low
European olive *Olea europaea*	Limited		Low
California pepper tree *Schinus molle*	Limited		Low
Athel tree *Tamarix aphylla*	Limited	Yes	Low
Smallflower tamarisk ***Tamarix parviflora***	High	Yes	High
Salt cedar ***Tamarix ramosissima***	High	Yes	High

Common Name *Scientific Name*	Cal-IPC Rating (Cal IPC 2022)	Fire Fuel (Cal IPC 2022)	Priority
Cal-IPC categorizes non-native invasive plants into High, Moderate, or Limited, reflecting the level of each species' negative ecological impact in California. **High:** Severe ecological impacts on physical processes, plant and animal communities, and vegetation structure. Tends to moderate to high rates of dispersal and establishment and widely distributed ecologically. **Moderate:** Substantial, but generally not severe, ecological impacts on physical processes, plant and animal communities, and vegetation structure. Tends to moderate to high rates of dispersal, though establishment is generally dependent upon ecological disturbance. May have limited range or be widespread. **Limited:** Invasive but ecological impacts are minor on a statewide level or not enough information. Tends to low to moderate rates of invasiveness. Distribution is limited but may be locally persistent and problematic.			

The proliferation of invasive plants is an emerging concern in the Mojave Desert. Non-native, weedy plants become established and can pose fire hazards, inhibit the recolonization of native plants, and reduce habitat and forage value for native plants and wildlife, including the federally listed desert tortoise (*Gopherus agassizii*). Invasive plants, when occurring in dense quantities, can increase the risk and severity of fire. Since desert shrubs recover slowly from fire, these invasives can proliferate continuously as flammable fuel and create a feed-back loop of high fire frequency, eliminating native plants from the area (Tierra Data 2009). Species of concern on the installation include red brome, Mediterranean grass, Sahara mustard, and Russian thistle, since these are at dense levels that will better carry fire.

Most invasive, non-native plant species in the Mojave Desert are annual species that tend to outcompete native annual species due to germination earlier in the season, which allows establishment before native annuals germinate. The most common and widespread invasive, non-native annual species found in the Mojave Desert include red brome, Mediterranean grass, cheat grass, red-stemmed filaree, and biennial mustard (*Hirschfeldia incana*).

Climate change is expected to affect invasive species with altered rainfall patterns, temperature increases, increases in the soil and atmospheric concentration of nitrogen and carbon dioxide, and changes in the wildfire regime all being factors (Tierra Data 2009).

D.5.2 High Priority Invasive Plants

Red Brome

Bromes become very dry and flammable during the dry season, which can increase wildfire frequency. When wildlife frequency increases, shrublands and woodlands are converted to grasslands (Cal IPC 2022). In a 2008 installation survey, red brome appeared at 28 out of 419 sample sites and was associated with undisturbed north and northeast facing hillsides at higher elevations (Tierra Data 2009).

One study showed that desert tortoises fed some invasive grasses, such as red brome, were negatively impacted in growth, overall body condition, immune function, and survival. Conversely, desert tortoises eating a diet of native plants (forbs or combined forbs and grasses) achieved high survival rates, gaining mass and achieving appropriately functioning molecular immune responses. Invasive grasses lacked the nutrients (higher moisture content, fat, protein, potassium, copper, zinc, etc.) that native annual forb diets contain (Drake et al. 2016).

Sahara Mustard

The most recent invasive, non-native species to enter the area is Sahara mustard. Sahara mustard is a weed initially introduced in the Colorado Desert that has been spreading into the central Mojave Desert along roadsides and utility corridors. This mustard is native to the Mediterranean and is thought to have arrived in North America during the early 1900s. Periods of high rainfall and human-induced increases in seed mobility probably contributed to the rapid spread of this plant. This plant typically invades sandy soils or silty/rocky soils along the sides of paved roads (Brooks 2005). Sahara mustard is an annual weed growing up to 3.5 feet high. This plant suppresses native wildflowers and increases fire hazards in desert scrub ecosystems (MWMA 2022). It easily invades recently burned areas and increases fire frequency and fuel load. An increase of fire frequency can cause a conversion from shrub habitat to grasslands since native shrubs are not adapted to recurrent fires (Cal IPC 2022). This plant is ranked by the Mojave Weed Management Area as a problem weed (MWMA 2022).

In a 2008 survey, Sahara mustard was detected at 20 out of 419 sample sites across the installation with low densities across the central, eastern, and southeastern portions of NTC and Fort Irwin. The most robust individuals preferred the banks of arroyos at the base of hills (Tierra Data 2009).

Russian Thistle

Russian thistle tolerates salty soils and is an annual spherical shrub up to five feet wide and high. When the thistle matures, it detaches from its roots and becomes a tumbleweed. This plant is ranked by the Mojave Weed Management Area as a problem weed (MWMA 2022). Other negative impacts of this plant include impeding traffic, creating fire hazards, and hosting the beet leaf-hopper which is an agricultural insect pest (Cal IPC 2022).

The invasive Russian thistle, commonly known as tumbleweed, can often be found in saltbush scrub, especially in sandy areas. A large, dense stand of Russian thistle occurs in the southwestern portion of Langford Lake, around Drinkwater Lake, and in sandier portions of the Central Corridor. In 2008, Russian thistle was observed at 75 out of 419 sample points on the installation, with most locations in upper central and southeastern regions of NTC and Fort Irwin. This species was most prevalent in areas of disturbance where water collects in impoundments, especially around Langford Lake (Tierra Data 2009).

Smallflower Tamarisk and Salt Cedar

Tamarix species are associated with fire frequency, major changes in geomorphology, groundwater availability, soil chemistry, and plant community composition (Cal IPC 2022). Salt cedar, an invasive non-native species, is a tree or shrub averaging 15 feet or higher that is widespread in California deserts. Salt cedar uses much more water than native plant species and outcompetes natives by concentrating salt near the top of the soil. This plant is known to cause flood problems and reduce wildlife habitat. It is ranked by the Mojave Weed Management Area as a problem weed (MWMA 2022).

An identified population of salt cedar occurs at Bitter Spring and a few individuals occur at Garlic Spring in the Southern Corridor. Control efforts implemented at Bitter Spring and Garlic Spring to reduce and perhaps eradicate this species have included manual removal and herbicide sprays. Using a beetle that feeds on tamarisk as a biocontrol may be utilized in the future. For more about management of Tamarix, see **Section 3.8**.

D.5.3 Potential Priority Invasive Plants

Table D-3 identifies those invasive plants not yet documented at Fort Irwin, but if they were to occur would be considered a priority for management.

Table D-3. Potential Invasive Plant Species on the NTC and Fort Irwin, CA

Common Name ***Scientific Name***	**Cal-IPC Rating** (Cal IPC 2022)	**Fire Fuel** (Cal IPC 2022)	**Priority**
Grasses			
Giant Reed *Arundo donax*	High		MWMA
Crimson Fountain Grass *Pennisetum setaceum*	Moderate	Yes	MWMA
Herbaceous Plants			
Yellow Starthistle *Centaurea solstitialis*	High		MWMA
Halogeton *Halogeton glomeratus*	Moderate		MWMA
Perennial Pepperweed *Lepidium latifolium*	High		MWMA
Spanish Broom *Spartium junceum*	High	Yes	MWMA
Woody Plants			
Tree of Heaven *Ailanthus altissima*	Moderate		MWMA
MWMA: ranked as a problem weed by the Mojave Weed Management Area (MWMA 2022)			

D.5.4 Invasive Animals

California has a list of prohibited terrestrial and aquatic animals that have been confirmed in the state. Some of these species may be present or are likely to occur in the near future on the NTC and Fort Irwin. Table D-4 summarizes the priority animals identified for the NTC and Fort Irwin.

Table D-4. Documented Invasive Animal Species on the NTC and Fort Irwin, CA

Common Name ***Scientific Name***	**State Rank** (CDFW 2022)	**Priority**
Mosquitofish *Gambusia affinis*	None	Yes
Brown-headed cowbird *Molothrus ater*	C-INV	Yes
House mouse *Mus musculus*	None	Yes
House sparrow *Passer domesticus*	None	
Roof rat *Rattus rattus*	None	Yes
Eurasian collared-dove *Strepopelia decaocto*	None	
European starling *Sturnus vulgaris*	None	
C-INV indicates a species identified as invasive by CDFW.		

Mosquitofish

Mosquitofish is native to the southeastern United States and is commonly introduced in California to control mosquitos. This small, live-bearing fish is dull grey or brown in color. with a short body, a rounded tail and a flattened head (USGS et al. 2021). The introduced mosquitofish occurs in Garlic Springs. No other native, introduced, or non-native fish species are known to occur on the installation.

Brown-Headed Cowbird

The brown-headed cowbird (*Molothrus ater*) is a stocky black bird with a distinctive finch-like beak. Males have black glossy feathers and a brown head whereas females are brown. This migratory bird is a brood parasite, and does not construct nests; rather, females will lay their eggs in the nest of another bird, usually one that contains eggs of smaller size than its own (The Cornell Lab of Ornithology 2019). Cowbirds are native to the Great Plains region of the US but expanded west with people as forests were cleared and agriculture and livestock became more prevalent. These birds prefer open habitats interspersed with shrubs or trees that provide ample forage and host nests. Nest parasitism enabled brown-headed cowbirds to quickly create new populations and expand their distribution (CDFW 2022).

House Mice and Roof Rats

Rats and mice occasionally enter buildings at Fort Irwin and can destroy food and gnaw on electrical wires. Management for these species can be found in the installation Integrated Pest Management Plan (Glassey and Thompson 2022).

D.6 Wildlife

In spite of its relatively uniform appearance, NTC and Fort Irwin supports a variety of wildlife habitats due to its large undeveloped areas and variety of wildlife habitats available. Wildlife habitats are generally based on vegetation types that occur in a particular area. The installation consists primarily of creosote bush scrub habitat; however, each vegetation type contains similar faunal components and often supports species that occur more abundantly or solely in those habitat types. For example, the zebra-tailed lizard (*Callisaurus draconoides*) occurs in nearly all vegetation communities on the NTC and Fort Irwin, but it is more common in desert washes; the common night lizard (*Xantusia vigilis*) occurs almost exclusively in Joshua tree woodland.

Most wildlife species on the installation are adapted to desert scrub habitats that provide little cover and xeric conditions. However, seeps and springs provide perennial sources of water and a high concentration of vegetation and cover that contribute to increased wildlife diversity in these areas. Large mammals, such as the desert bighorn sheep (*Ovis canadensis nelsoni*), coyote (*Canis latrans*), and desert kit fox (*Vulpes macrotis*), use these water sources and return to them regularly; bats typically forage over these areas because of increased abundance of invertebrate prey. Bird species that migrate in the spring and fall (and are not usually associated with the desert environment) may forage and rest in these areas as well as at the wastewater treatment area during their migration. The wastewater treatment impoundments are also used by bat species, coyote, and other desert animals.

Rocky terrain, such as the Avawatz, Granite, and Tiefort mountains, as well as other mountainous and hilly ranges, provide habitat for many reptile, rodent, and bird species. Along with different vegetation communities that normally occur with increasing elevation in these ranges, differences in slope and aspect result in microhabitats that support different wildlife species. Notable species that occur in these areas include bats, which rely on rocky outcrops for roosting sites, and raptors, which use cliff faces and rocky ledges for roosting or nesting.

Playas provide little wildlife habitat because they are basically devoid of vegetation. They do contain, however, endemic microbiological communities of algae that support fairy and tadpole shrimp. Migratory waterfowl and large mammals may visit these areas after periods of heavy rainfall.

As is typical of most desert systems, large animal species are uncommon, widely dispersed, and often nocturnal. Smaller mammals and reptiles are highly adapted to harsh desert conditions, much more common, and often either secretive, nocturnal, or active for only short periods of the year. Birds are among the most conspicuous species, usually occurring in greatest concentration in the vicinity of washes and springs where more structured and complex vegetative assemblages occur. With some exceptions, wildlife species (such as birds and larger mammals) are generally more mobile and not limited to a single habitat type. Therefore, large portions of the NTC and Fort Irwin are likely used in the course of an organism's daily and seasonal activity patterns, particularly for larger and/or more mobile species. Some species (e.g., fish, amphibians, and some reptiles and mammals) are highly adapted for one habitat type and restricted to these specialized areas. Lack of specialized habitats likely contributes to the absence of native amphibian and fish populations on the installation.

The NTC and Fort Irwin have a rich and diverse fauna. Various inventories have confirmed the occurrence of numerous birds, mammals, reptiles, and invertebrates on the installation. Additional species of insects and other less studied fauna are suspected to live or migrate through the installation. The following sections summarize the biological diversity on the NTC and Fort Irwin. Each vertebrate taxonomic group is addressed.

D.6.1 Mammals

More than 40 mammal species have been documented on the installation over the years. Small mammal surveys on the NTC and Fort Irwin began in 1993 (Recht 1995a, 1995b, 1996, 1998). Most desert mammals are nocturnal, but a few may be seen by day. Small mammals most frequently observed throughout the installation include the blacktailed jackrabbit (*Lepus californicus*), desert cottontail (*Sylvilagus audubonii*), and whitetailed antelope squirrel (*Ammospermophilus leucurus*). Small rodent species include the desert kangaroo rat (*Dipodomys deserti*), Merriam's kangaroo rat (*D. merriami*), Panamint kangaroo rat (*D. panamintinus*), chisel-toothed kangaroo rat (*D. microps*), long-tailed pocket mouse (*Chaetodipus formosus*), little pocket mouse (*Perognathus longimembris*), desert pocket mouse (*Chaetodipus penicillatus*), deer mouse (*Peromyscus maniculatus*), cactus mouse (*P. eremicus*), canyon mouse (*P. crinitus*), southern grasshopper mouse (*Onychomys torridus*), round-tailed ground squirrel (*Xerospermophilus tereticaudus*), and desert woodrat (*Neotoma lepida*). Also present is the Botta's pocket gopher (*Thomomys bottae*), but it is rarely seen due to its fossorial (underground) inhabitance.

Larger mammal species on the NTC and Fort Irwin include the American badger (*Taxidea taxus*), kit fox, grey fox (*Urocyon cinereoargenteus*), coyote, bobcat (*Lynx rufus*), and mountain lion (*Felis concolor*). The coyote is expected to occur throughout the post, whereas the others are localized and fairly rare. Other large mammals on the NTC and Fort Irwin are desert bighorn sheep and wild burros. CDFW and Army have collaborated on bobcat studies in the past.

Abandoned mines, natural caves, trees, and manmade structures throughout the installation provide potential roosting habitat for bats. Bats also use the many cliff faces and rocky ledges of mountain ranges as sites for roosting, and they have the potential to use Joshua trees as night roosts. Eleven bat species have been detected on the NTC and Fort Irwin (Brown 1994, Brown and Berry 2006, Brown and Rainey 2012); however, there are 14 species of bats whose range overlaps Fort Irwin's boundaries.

Most recently, bats were surveyed from 2010-2012 at six long-term monitoring stations on the installation, via acoustics, mist netting, and roost surveys. Seven species were detected during this study with four species using mines for roosts. Two of these bat species were thought to be regional or long distance migrant species passing through in spring or fall migration (red bat [*Lasiurus blossevillii*] and the hoary bat [*Lasiurus cinereus*]). The California myotis (*Myotis californicus)*, canyon bat (*Parastrellus hesperus)*, Townsend's big eared bat (*Corynorhinus townsendii)*, and pallid bat (*Antrozous pallidus)* are likely residents, while the Mexican free-tailed bat (*Tadarida brasiliensis)* occurs in seasonal variation.

The following rare mammal species are known on NTC and Fort Irwin:

- Federally Listed or Protected: none
- State Listed (Appendix E.2): Mohave Ground Squirrel (*Xerospermophilus mohavensis*)
- State Protected (Appendix E.2): Desert Bighorn Sheep, Desert Kit Fox

There are also a few mammal species of management priority on the NTC and Fort Irwin: coyotes and wild burros.

- Coyotes are wide-ranging animals that commonly occur in a variety of habitat types, including severely disturbed areas and urban edges. They frequently dig for rodents and other prey species and readily dig up refuse buried at bivouac sites. They are a nuisance at the cantonment area where they take advantage of foods in the form of trash and pet dogs and cats. This is especially true at the post landfill where coyotes dig up the buried trash and spread it around. In doing so it makes the refuse more accessible to other pest species like the raven (*Corvus corax*). The Installation Integrated Pest Management Plan has specific recommendations for management and control of coyotes on the installation.
- Wild burro

D.6.2 Birds

More than 220 bird species have been documented on the NTC and Fort Irwin. There have been many general avian surveys on the installation, beginning in the early 1990s (Brydolf 1994, 1995a, 1995b, 1996a, 1996b, 1998, 1999, Hanrahan et al. 1997, Harmsworth Associates 2003, 2004, Franklin 2010, Moreton and Rathbun 2011, Rathbun 2011, Tetra Tech 2016).

Most bird species that occur on the NTC and Fort Irwin are representative of creosote scrub habitat. Some common bird species include the black-throated sparrow (*Amphispiza bilineata*), white-crowned sparrow (*Zonotrichia leucophrys*), house finch (*Haemorhous mexicanus*), horned lark (*Eremophila alpestris*), and sage sparrow (*Artemisiospiza nevadensis).* The verdin (*Auriparus flaviceps*) and black-tailed gnatcatcher (*Polioptila melanura*) are more common in desert wash systems.

The greatest bird activity is concentrated in the immediate vicinity of water. NTC and Fort Irwin springs as well as the wastewater treatment impoundments are a valuable resource to most resident and migratory bird species. Not only is there increased structural diversity of the vegetation and habitat, but invertebrates that become abundant in the vicinity of springs during spring and summer provide an important food source to resident species. Common water-dependent species include the ruddy duck (*Oxyura jamaicensis)*, American coot (*Fulica americana)*, eared grebe (*Podiceps nigricollis)*, and northern shoveler (*Anas clypeata)*. Other representative species include the house finch (*Carpodacus mexicanus*), phainopepla (*Phainopepla nitens*), northern mockingbird (*Mimus polyglottos*), and song sparrow (*Melospiza melodia*). Numerous birds occur as winter or summer residents or migrants that occur only during brief periods in the spring and fall. Some common species include the yellow-rumped warbler (*Dendroica coronata*), cliff swallow (*Hirundo pyrrhonata*), ruby-crowned kinglet (*Regulus calendula*), and white-crowned sparrow (*Zonotrichia leucophrys*).

Red-tailed hawks (*Buteo jamaicensis*), northern harriers (*Circus cyaneus*), golden eagles (*Aquila chrysaetos*), and prairie falcons (*Falco mexicanus*) are some raptors that occur on the installation. Many raptor species use cliff faces and rocky ledges of mountain ranges as sites to roost or nest. Owl species that occur on the NTC and Fort Irwin include the burrowing owl (*Athene cunicularia*), barn owl (*Tyto alba*), and short-eared owl (*Asio flammeus*).

There have been several rare bird species documented on the installation; almost all bird species that occur on the NTC are protected under the Migratory Bird Treaty Act (MBTA). The following rare bird species are known on the NTC and Fort Irwin:

- Federally Listed (Appendix E.1): Southwestern Willow Flycatcher (*Empidonax traillii extimus*), Least Bell's Vireo (*Vireo bellii pusillus)*
    - The parent species of these birds have occurred on the installation. The subspecies identification is very difficult.
- Federally Protected (Appendix E.1): Golden Eagle
- State Listed (Appendix E.2): Sandhill Crane (*Antigone canadensis canadensis/tabida*), Swainson's Hawk (Buteo swainsoni), Bank Swallow (*Riparia riparia*)
- State Protected (Appendix E.2): White-Tailed Kite (*Elanus leucurus*), Peregrine Falcon (*Falco peregrinus anatum*)
- State Species of Concern or BLM Sensitive (Appendix E.3): 34 species

Due to their status as subsidized predators on desert tortoises, regional management strategies for ravens have been developed.

Ravens are native birds in the Mojave Desert. However, their numbers have increased significantly over the past several decades because of expanding human use of the desert. Raven populations have grown beyond the natural carrying capacity of the desert environment because of resources provided by humans. These resources have included food (landfills), water (wastewater treatment ponds), and nest and perch sites (trees, utility lines, fences, and buildings). Data from the USGS Breeding Bird Survey Program covering 1966 to 2019 shows about a 2.71% per year increase in raven numbers in the Sonoran and Mojave Deserts (USGS et al. 2019). Ravens are known to prey on juvenile desert tortoises and increases in raven numbers could have negative impacts on the desert tortoise populations on the NTC and Fort Irwin. Management of ravens is undertaken to protect desert tortoises.

There are five areas on the NTC where conditions are conducive to increasing the raven populations or where ravens pose a significant threat. Those areas are the cantonment area, the landfill, the wastewater treatment ponds, the area south of the 90 grid line, and the various training areas. The cantonment area, the landfill, and the wastewater treatment ponds are areas that help proliferate the raven population.

- The cantonment area provides many nesting and perching locations as well as supplemental food and water. Because of the year round availability of food, the landfill receives, by far, the greatest use by ravens of any area in the cantonment area (Chambers Group 1996).
- Ravens are especially numerous at the landfill during winter and summer, when natural food supplies are at their lowest. This food subsidy likely helps to increase survivability of ravens resulting in an increased population. Although the landfill has been fenced to prevent entry by coyotes, coyotes are still entering the area through open gates and digging up garbage after it had been covered with dirt, thus exposing it to ravens.
- The wastewater treatment impoundments are also a major attraction site for ravens, although they receives significantly less use than the landfill (Chambers Group 1996). The site provides ravens with a year-round source of water and tamarisk trees for roosting. The site receives heaviest use by ravens in the summer when natural water supplies are at their lowest.
- The southern boundary contains some of the least disturbed land on the NTC, relatively high densities of desert tortoises, and comparatively low numbers of ravens (Chambers Group 1996). Foraging ravens from the cantonment may prey on juvenile tortoises in the area. Ravens are attracted to the remote training areas chiefly when soldiers are bivouacked, and are attracted to any food, water, and any trash left by soldiers.

D.6.3 Reptiles and Amphibians

More than 35 reptile species have been documented on the installation through several surveys, beginning in 1993 (Morafka 1994, 1997, Brown and Nagy 1995a, 1995b, 1998, Neihaus 1996, RDN 1996, MacAller 2004, MacAller and Woodward 2004). No amphibians have been observed on the Training Center; however, any active spring (occurrence may be restricted at some springs by water quality) could support amphibian species, even springs that are active only part of the year.

Rich, diverse reptilian populations known to occur on the post are characteristic of those found in creosote scrub habitat. Some diurnal lizards are widespread, while others are habitat specialists. Widespread species include zebra-tailed lizards (*Callisaurus draconoides*), side blotched lizards (*Uta stansburiana*), desert spiny lizard (*Sceloporus magister*), and western whiptails (*Cnemidophorus tigris*). Other lizard species that are widespread but less abundant include the desert horned lizard (*Phrynosoma platyrhinos*), long-nosed leopard lizard (*Gambelia wislezenii*), and desert iguana (*Dipsosaurus dorsalis*). Habitat specialists include the collared lizard (*Crotaphytus collaris*), chuckwalla (*Sauromalus obesus*), long-tailed brush lizard (*Urosaurus graciosus*), and common (desert) night lizard (*Xantusia vigilis*) (Morafka 1994, 1997, Brown and Nagy 1998).

Common snake species include the coachwhip (*Masticophis flagellum*), gopher snake (*Pituophis catenifer*), western patch-nosed snake (*Salvadora hexalepis*), western shovel-nosed snake (*Chionactis occipitalis*), and sidewinder (*Crotalus cerastes*) (Brown and Nagy 1998). Less common species include the ground snake (*Sonora semiannulata*). Unlike lizards, most of which are primarily diurnal, most snake species on the installation are nocturnal.

There are several rare reptile species on the installation. The desert tortoise (*Gopherus agassizii*) occurs in varying densities throughout the area. There are two populations of Mojave fringe-toed lizard (*Uma scoparia*), on the NTC and Fort Irwin. The main population is found in the dunes just north of Bitter Springs (Morafka 1997). The other population is in the dunes just east of Red Pass Lake.

The following rare reptile species are known on NTC and Fort Irwin (see **Appendix E** for details):

- Federally Listed: Desert Tortoise
- Federally Protected: none
- State Listed or Protected: none
- State Species of Concern or BLM Sensitive (Appendix E.3): 1 species

There are also some reptile species of management priority (**Section 3.6.3**) on the installation. Speckled, Mohave, and sidewinder rattlesnakes *(Crotalus* spp.) occasionally are found in developed areas on NTC and Fort Irwin, particularly the Cantonment area.

D.6.4 Fish

Although several active perennial springs are located on the Training Center, no documentation exists of native fish species occurring in any springs.

D.6.5 Invertebrates

Although wildlife surveys typically do not focus on invertebrate species, invertebrates are an essential component of desert ecosystems, providing food for numerous vertebrate species and acting as pollinators for many plant species. The seasonal reproductive cycle of some insect species results in an “explosion” of the population in a relatively short period of time. This swarming of individuals provides an important prey base for insectivores, such as smaller birds, reptiles, amphibians, and bats.

The NTC and Fort Irwin has studied its invertebrate species, particularly insects, and part of those studies involve basic inventory. Work from the 1990s on the NTC and Fort Irwin suggests that high levels of invertebrate diversity can be found in isolated areas. Because the diversity of insects is often correlated with the diversity of plants in an area, springs on the installation are particularly important to invertebrate populations. The Avawatz Mountains above 4,000 feet msl exhibit high levels of endemism for a number of insect species (G. Pratt, Dec. 12, 1996, personal communication with M. Quillman).

Pratt and Alley (1998) evaluated the use of invertebrates as indicators of the effects of military use on the installation, using the Langford Impact Zone as a study area. They identified 17 arthropod species in the study area, and there likely are more than 4,000 invertebrate species on the installation. Other invertebrates have been identified during biological surveys, such as studying the installation's springs and seeps (Backus and Leander 2021).

A snail was discovered inhabiting talus slopes in Red Pass and southwest of Eastgate. *Cahuillus sp.* has been previously documented on talus slopes near that general area on Fort Irwin. It is confirmed these were members of that genus, but the snail could not be identified to species level.

One insect species of management priority are Africanized bees (*Apis mellifera*). Any swarms of bees on the installation should be considered Africanized, and the pest control office should be notified immediately.

D.7 Wild Burros

Many negative impacts caused by burros in the desert arise from alteration of the soil. The creation of frequently used trails, wallows (dust baths), and congregation of herds around water sources lead to lower water infiltration rates and increased compaction. In addition to soil impacts, burros directly affect vegetation and wildlife. Burros eat nearly every species of woody plant and can consume more than native herbivores like desert bighorn sheep. With the destruction of vegetation comes the reduction of forage, shade, and escape cover, which are important requirements affecting short- and long-term survival of many wildlife species. The continued use of springs by wild burros (*Equus asinus*) has resulted in highly disturbed areas that now require maintenance.

Wild burros are a management concern because of negative impacts on soils, vegetation, and water quality in the areas where they persist. Burros are primarily found in the northern and northwestern portions of the Training Center. In the mid-1990s, the population was estimated at about 1,000 burros (Dave Sjaastad, BLM Horse and Burro Manager, Ridgecrest, CA., personal communication, 1998). Since 2018, through a MOU with Peaceful Valley Donkey Rescue (PVDR), NTC and Fort Irwin has rounded-up and transferred off NTC over 400 burros for adoption. It is estimated that this number is 10% of population (based on a UC Davis collar study) and that burros are able to recruit at 18% levels.

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APPENDIX E – PROTECTED SPECIES SUMMARIES

This section summarizes the documented plants and animals of the NTC and Fort Irwin that are federally protected or species-at-risk (SAR) as determined by the installation.

E.1 Federally Protected Species

This section summarizes the five federally protected plant and animal species that have been documented at the NTC and Fort Irwin. As shown in Table E-1, one plant and two animal species are federally endangered, one animal is federally threatened, and one animal is protected under federal law.

Table E-1. Federally Protected Species Documented at the NTC and Fort Irwin

Species	Status	Documented?	Comments/Habitat
Plants			
Lane Mountain Milk-vetch *Astragalus jaegerianus*	FE, 1B.1, S2	Yes	Associated with Joshua tree woodland and Mojavean desert scrub habitats and granitic micro habitat. Sometimes occurs in gravelly and sandy micro habitats.
Birds			
Golden Eagle *Aquila chrysaetos*	BGEPA, CDFW FP, S3, CDFW WL, USFWS BCC	Yes	Habitat is open and semi-open country such as mountains up to 12,000 feet, canyonlands, rimrock terrain, and riverside bluffs and cliffs. Nests on cliffs and steep escarpments.
Southwestern Willow Flycatcher *Empidonax traillii extimus*	FE, SE, S1, NABCI RWL	Yes, as the parent species. Verified subspecies ID is extremely difficult. Rare.	Riparian and wetland thickets dominated by willows or tamarisk. Nesting sites usually occur near standing water or saturated soil. Riparian areas on the NTC and Fort Irwin are low quality habitat.
Least Bell's Vireo *Vireo bellii pusillus*	FE, SE, S2, NABCI YWL	Yes, as the parent species. Verified subspecies ID is extremely difficult. Rare.	Riparian areas with dense brush, mesquite, willow-cottonwood forests. Nesting sites usually occurs in willows. Riparian areas on the NTC and Fort Irwin are low quality habitat.
Reptiles and Amphibians			
Desert Tortoise *Gopherus agassizii*	FT, ST, S2S3	Yes	In the Mojave Desert, occurs in creosote scrub, creosote bursage, shadscale, and Joshua tree habitat. Well drained sandy loam soils in plains, alluvial fans, and bajadas. Often subterranean when inactive.

Sources: California Native Plant Society (CNPS), California Natural Diversity Database (CNDDB), NatureServe Explorer
FE = federally endangered, FT = federally threatened, SE = state endangered, ST = state threatened
BGEPA = protected under the Bald and Golden Eagle Protection Act
CDFW FP = protected by the California Department of Fish and Wildlife
USFWS BCC = bird of conservation concern to the USFWS
CDFW WL = watch list of the CDFW
State (S-rank) Rank: indication of condition of plant or animal throughout range within California
S1: Critically imperiled in the state, at high risk of extirpation in state
S2: Imperiled in state, at high risk of extirpation in the state
S3: Vulnerable, at moderate risk of extirpation in the state
CA Rare Plant Rank (CRPR): ranking developed by CNPS to define rare California flora
1B.1: rare, threatened, or endangered in California and elsewhere; high degree and immediacy of threat
North American Bird Conservation Initiative (NABCI): watch list of bird species in need of conservation help
RWL: species with extremely high vulnerability
YWL: species that may be range restricted or more widespread but with declines and high threats

E.1.1 Lane Mountain Milk-vetch

Species Summary

Lane Mountain Milk-vetch (LMMV) was listed by the US Fish and Wildlife Service (USFWS) as endangered in 1998 due to its small population size and limited distribution in Joshua tree woodland, mixed Mojave scrub, and creosotebush scrub in poorly developed sandy or granitic gravely soils. Known populations are generally at elevations between 3,100-4,200 ft (US Army 2020).

LMMV is a perennial herb with thin, delicate stems that become somewhat woody during the growing season. Plants are usually found growing through and within small desert shrubs. LMMV individuals require a host (nurse) shrub as a form of structural support for its spindly stems. Plants are 12 to 27.5 inches tall, with light gray to greenish leaves that have 7–15 narrow leaflets 0.2-1 inch long (USFWS 2014).

LMMV inhabits areas in Mojave creosote bush scrub and Mojave mixed woody scrub communities with diverse shrub assemblages. The most common potential host shrubs for the LMMV in 2021 across all populations were dead shrubs (31.6%), bursage (*Ambrosia dumosa*-12%), Cooper's goldenbush (*Ericameria cooperi* -7.4%), cheesebush (*Ambrosia salsola* -7.3%), and California buckwheat (*Eriogonum fasciculatum* -5.8%) (Skandalis 2021).

A recovery plan was drafted for the LMMV in 2001 by the USFWS, but it has not been released. With the 5-year review in 2008, the USFWS recommended a down listing of status to threatened. Critical habitat is "a specific geographic area(s) that is essential for the conservation of a threatened or endangered species and that may require special management and protection" (USFWS 2014). Critical habitat for LMMV was proposed in 2005 and updated in 2011 to 14,069 acres. No critical habitat has been designated within the bounds of Fort Irwin, due to the conservation and management benefits as provided in this INRMP.

Status on NTC and Fort Irwin

Several extensive surveys have been conducted for LMMV and the distribution of this species has been carefully mapped (Prigge 1988, Bagley 1989, 1992, 1994, Charis Professional Services Corporation 2002). The range is now known to be limited to a small area with distinct habitat (Charis Professional Services Corporation 2002). It is possible that an additional population may exist in the Granite or Avawatz Mountains, because these areas were not thoroughly surveyed previously.

In 2001, an extensive baseline survey for LMMV was performed on potential habitat on NTC and Fort Irwin lands, within the proposed expansion area, and in the surrounding areas. The survey results determined three primary findings: (1) there are many more plants than originally estimated, (2) there is a fourth population (NTC-Gemini Population), and (3) all plants are found within well-defined population boundaries (Charlton 2007).

LMMV is narrowly endemic, growing only in four populations over 21,000 acres (Charlton 2007). LMMV is present in three populations (East Paradise, Brinkman Wash, and NASA Goldstone) on the NTC and Fort Irwin, all in or near the Western Training Area (WTA). The East Paradise population occurs within the East Paradise Milk-vetch Conservation Area, the Brinkman Wash population occurs within the Brinkman Wash Restricted Access Area, and the NASA Goldstone population occurs within the Gemini Milk-vetch Conservation Area. Both the Brinkman Wash and East Paradise populations are within the WTA. A fourth, and largest, population (Coolgardie Mesa) is found south of the NTC on BLM land.

Long-term monitoring on the LMMV at Fort Irwin began in 2005 to track population numbers, determine military impacts, and determine impact of global processes such as climate change (Skandalis 2021). Monitoring on the installation has informed USFWS management recommendations (USFWS 2014). Even though the Coolgardie Mesa LMMV population is not on Fort Irwin, annual monitoring includes surveying this population. Surveying in 2021 revealed 13 live LMMV plants, and 1 new plant that was tagged. The total plants tagged since 2005 were 557: 94 in Brinkman Wash, 258 in Coolgardie Mesa, 118 in East Paradise, and 87 in NASA Goldstone. See Figure E-1 below for a chart of living LMMV observed over the survey history. There was no significant difference in dust deposition among populations (Skandalis 2021).

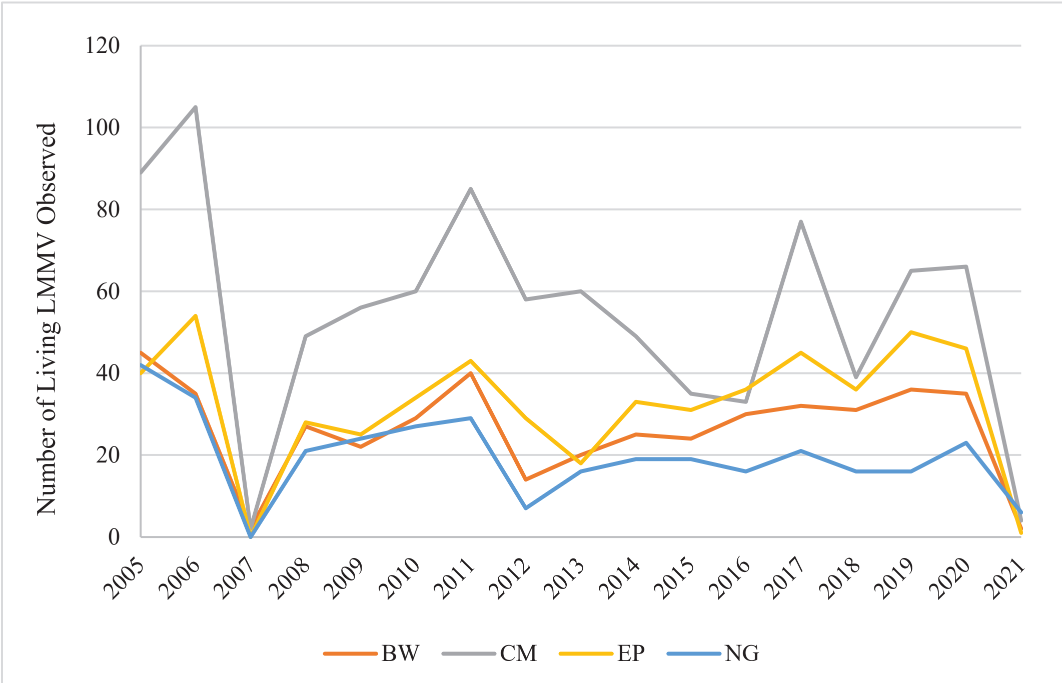

Figure E-1. Number of Alive Observed LMMV Plants (Previously Tagged and Newly Tagged) by Population over the Census History (2005-2021)
BW = Brinkman Wash, CM = Coolgardie Mesa, EP = East Paradise, NG = NASA Goldstone
Source: (Skandalis 2021)

Results from Army monitoring and UCLA indicate that the LMMV population size has decreased substantially since 1999 (see Table E-2 below). The decrease appears to be dependent on precipitation amount and frequency within that same period. If future trends continue via climate change and dry years outnumber wet years, the population size of LMMV is predicted to continue to decline (USFWS 2014).

Additional surveys within the NTC, conducted during tortoise surveys and Range and Training Land Assessment (RTLA) sampling, would add to the body of knowledge on this rare endemic. Future monitoring should focus on looking for new populations (range expansion), understanding the life history, reproductive biology, conservation genetics, and physiology of the species – information that can be used to conserve and manage this narrowly endemic species.

Table E-2. Population Information for the Lane Mountain Milk-vetch Since Listing			
Population Status	**1998 (Time of Listing)**	**2008 (5-Year Review)**	**2013-2014 (USFWS Species Report)**
Abundance (individuals in all populations)*	950 known; Estimated population size is 2,200+	5,723 reported from 1999-2001; Estimated population size may be slightly larger or smaller	686; Estimated population size is 1,535 in 2013
Distribution	3 populations	4 populations	4 populations
Areal Extent	355 acres	Not calculated	Before military training: 21,256.3 acres; after military training: 4,561.4 acres

Source: USFWS Species Report for Lane Mountain Milk-vetch 2014
*This summary is range-wide but a large amount of the population is on the NTC and Fort Irwin

Relevant Biological Opinions

USFWS consultations regarding LMMV on NTC and Fort Irwin began in 2001 with the Eastgate, Southern Expansion Area, and Western Expansion Area Proposal. Since then, consultation and management has resulted in the creation of three LMMV conservation areas. These are maintained through fencing, road monitoring, invasive plant control, and military training restrictions. Any changes made to these conservation areas must be approved by the USFWS during a 5-year review.

The 2021 *Biological Opinion for the Recovery and Sustainment Partnership Initiative, Use of Additional Maneuver Training Lands, and Operations and Activities at the National Training Center and Fort Irwin, San Bernardino County, California* (FWS-SB-20F0163-21F1366) provides stipulations for avoiding, reducing, and offsetting impacts of military actions on Lane Mountain milk-vetch.

Species Threats:

- Small populations of the LMMV, like those of other species, are vulnerable to extirpation simply by chance due to fluctuating environmental conditions and demographic stochasticity.
- Change in vegetation community structure due to global climate change.
- Change in precipitation regimes due to global climate change.
- Increased abundance of non-native grasses due to global climate change.
- Mining causing loss of plants and habitat (CNPS 2021).
- Vehicles damaging plants and habitat (CNPS 2021).

Threats from Military Training:

Military threats to the LMMV were identified by the USFWS as one reason for listing (USFWS 1998). Direct threats include:

- Direct damage to plants and from wheeled and tracked vehicles during military training. Tracked vehicles are particularly destructive.
- Long-term habitat loss or conversion caused by military training, testing, and construction activities.
- Increase of non-native grasses spreading from road grading and other ground disturbing activities increases the potential for fire frequency and species competition, and may have long-term deleterious effects on LMMV.
- Fugitive dust, which has been shown to hinder LMMV shoot growth (Wijayratne et al. 2009), and by extension, other growth and reproductive functions as well.
- Soil erosion and compaction.
- Fragmentation of populations, consequently reducing genetic diversity and increasing the likelihood of extinction in small subpopulations.
- Prolonged periods of extreme weather and drought.

E.1.2 Golden Eagle

Bald and golden eagles are protected by three federal laws: Bald and Golden Eagle Protection Act (BGEPA), Migratory Bird Treaty Act, and Lacey Act. The BGEPA provides nearly the same level of protection as a species listed under the Endangered Species Act for individuals.

The NTC and Fort Irwin will continue to monitor the status of this important species and take actions to protect them whenever possible. Golden eagles were observed in 1994 during walking and driving transect surveys and in 1995 during walking transects (Brydolf 1995a, 1996a). A golden eagle was observed in 1997 on the installation (Brydolf 1998). A golden eagle was documented during bird surveys in 2011 on a transect (Rathbun 2011). Sixteen golden eagles (twelve during surveys and four incidentally during transit) were observed during the last general avian survey at the installation. Those observed during the surveys were observed at Bitter and Devoge Springs as well as in bursage-big galleta, bursage-creosote, desert wash, and mixed montane habitat (Tetra Tech 2016). In 2016, a focused golden eagle survey documented 34 golden eagle nests, all of which were on cliffs or rocky outcrops. Five active and occupied nests contained eggs, but only three produced a total of four chicks. Based on this data, the researchers concluded there are approximately 20 active golden eagle territories at Fort Irwin (Tetra Tech 2016). In 2018, four active nests fledged eight young (BioResource Consultants Inc. 2018). PacArctic and BioResources (2019) conducted golden eagle nesting surveys within the Fort Irwin boundary. Aerial surveys conducted in March and May of 2019 resulted in five active golden eagle nests, with two nests failing and three nests fledging four chicks.

E.1.3 Southwestern Willow Flycatcher

Species Summary

The southwestern willow flycatcher (SWWF) is one of four subspecies of the willow flycatcher. Willow flycatchers are small, drab, olive-brown Neotropical migratory avian species that average ~6 inches in length. The willow flycatcher, including all its subspecies, was listed as a state endangered species in 1991. The SWWF subspecies was listed as federally endangered in 1995 due to extensive habitat destruction by humans and modification of streams and rivers due to cattle grazing, agriculture, flood control, and water course divergence. The SWWF breeds in riparian woodland habitats with willows, cottonwoods, and/or alders with dense vegetation close to the ground. Willow flycatchers occur in the Fort Irwin vicinity during breeding season (The Cornell Lab of Ornithology 2019).

The USFWS published a recovery plan for the SWWF in 2002, and critical habitat was finalized in 2013. To facilitate the recovery of the species, 24 management units have been identified, totaling 1,227 stream miles encompassing a total area of 208,973 acres in southern Nevada, southern Utah, southern Colorado, Arizona, California, and New Mexico (USFWS 2013). None of the 24 management units are located within the NTC and Fort Irwin.

Status on NTC and Fort Irwin

Many willow flycatchers have been observed on the installation, and some of those may be the SWWL subspecies. The SWWF is a summer resident in the region and is not expected to occur regularly because of a lack of appropriate habitat. It may occur during brief periods of migration at springs and riparian areas (Chambers Group 1998). The SWWF occasionally uses NTC springs (Bitter, Garlic, and Cave) as a stopover during spring migration (Harmsworth Associates 2003). Potential nesting habitat is found only at Bitter and Garlic Springs (Harmsworth Associates 2003), although it is unlikely the SWWF will nest at these springs because of the relatively poor habitat. The riparian habitat on the installation is degraded or offers minimal, sparse vegetation. Suitable breeding habitat is found 60 miles away along the Amargosa River (D. Davis, NTC and Fort Irwin, personal communication, January 18, 2022).

A single willow flycatcher (subspecies unknown) was observed in mid-spring in the Hellwind Canyon drainage system (located in the Leach Lake Impact Area) during general wildlife surveys conducted there in 1993 and 1994 (USFWS 1994). During avian surveys conducted on the NTC and Fort Irwin in spring 1994, several *Empidonax* species were observed during walking transects at two locations in the Avawatz Mountains in juniper and creosote bush dominant habitat, and near Bitter Springs (Brydolf 1996a). A few *Empidonax* species were observed in the Avawatz Mountains in 1995 and 1996 avian surveys (Brydolf 1995a, 1996b). No nesting SWWF were observed in either 2003 or 2004 (Harmsworth Associates 2005). However, a transient willow flycatcher (subspecies unknown) was observed at King Springs during 2003 avian surveys) (Harmsworth Associates 2003). In spring of 2012 surveys, two willow flycatchers were seen at Garlic Spring and Bitter Spring (Erickson 2012).

Two willow flycatchers were observed in the most recent bird survey in 2015-2016, one along a driving transect and one at the wastewater treatment impoundments (Tetra Tech 2016).. No SWWF were recorded on the installation in the most recent general bird survey (Tetra Tech 2016). While a SWWF was thought to be observed at the Garlic Spring complex in 2020 when performing springs and seeps monitoring, it was later verified to be just the parent willow flycatcher (Backus and Leander 2021).

The SWWF will not be monitored annually on the NTC because this species does not breed on the installation and potential habitat on the NTC was limited to Garlic and Bitter Springs (Harmsworth Associates 2003). A follow-up survey in 2004 (Harmsworth Associates 2005) determined that the species does not breed at either of the springs.

<u>Species Threats</u>

- The SWWF is endangered because of the extensive loss of riparian vegetation along streams and rivers caused by cattle grazing, agriculture, flood control, and watercourse divergence.
- Brood parasitism by the brown-headed cowbird is also a significant factor contributing to the endangered status of the SWWF.
- There are no direct threats posed by military activities. All potential SWWF habitat is completely protected on Fort Irwin because all springs are off-limits to military activities.
- Intrusion into off-limits spring areas by soldiers, burros, and cattle is an indirect impact.
- Removal of tamarisk, an invasive tree species, can have an indirect impact. The SWWF can successfully nest and fledge young in tamarisk, and the USFWS considers it potential habitat for the species (S. Sfera, USFWS, personal communication, May 21, 2003).

E.1.4 Least Bell's Vireo

Species Summary

Least Bell's vireos (LBVI) are small neotropical migratory birds that are ~4.5-5 inches long. They have short, rounded wings and short, straight bills. They have faint white eye rings. LBVI is one of four subspecies of the Bell's vireo species. The LBVI breeds in low-elevation, riparian habitat and prefers areas of dense mulefat (*Baccharis salicifolia*) with an overstory of willows. Ideal habitat contains both canopy and shrub layers. This bird prefers to nest in willows.

The LBVI was listed as endangered under California law in 1980, and under the federal ESA in 1986. A draft recovery plan was published in 1998, but it was never finalized. Critical Habitat was designated by the USFWS in 1994, but none is located within the NTC and Fort Irwin. Various LBVI monitoring and brown-headed cowbird trapping programs are in progress at known breeding sites in southern California.

Status on NTC and Fort Irwin

The LBVI is only a summer resident in this region and is not expected to occur on the installation regularly because of the lack of suitable habitat. It may occur near springs for brief periods during migration. Avian surveys (USFWS 1994, Brydolf 1995b) detected the presence of Bell's vireos (subspecies unknown). In 1997, a Bell's vireo was observed on Fort Irwin at Bitter Springs (Brydolf 1998). An unconfirmed Bell's vireo identification was reported in 2009 (P. Craig, NTC and Fort Irwin, personal communication, March 11, 2022). No LBVI were recorded in the latest 2016 bird survey on the installation (Tetra Tech 2016).

The LBVI will not be monitored annually on the NTC because this species does not breed on the installation, and potential habitat on the NTC is limited to Garlic and Bitter Springs (Harmsworth Associates 2003). A follow-up survey in 2004 (Harmsworth Associates 2005) determined that the species does not breed at either of the springs. The riparian habitat on the installation is degraded or offers minimal, sparse vegetation. Suitable breeding habitat is found 60 miles away along the Amargosa River (D. Davis, NTC and Fort Irwin, personal communication, January 18, 2022).

Species Threats

- Parasitism by the non-native brown-headed cowbird (*Molothrus ater*) is among the most significant factors in the decline of the LBVI.
- The least Bell's vireo is threatened by the extensive loss of riparian vegetation caused by cattle grazing, agriculture, flood control, and water course divergence along streams and rivers.
- There are no direct threats posed by military activities. All potential LBVI habitat is completely protected on Fort Irwin because all springs are off-limits to military activities.
- Intrusion into off-limits spring areas by soldiers, burros, and cattle is an indirect impact.
- Removal of tamarisk (*Tamarix spp*), an invasive tree species is an indirect impact. Tamarisk may be used as nesting habitat for the vireo.

E.1.5 Desert Tortoise

Species Summary

Desert tortoises were listed as endangered under California law in 1989, followed by federal listing of the Mojave sub-population as threatened under the ESA in 1990 (USFWS 1990). The listing was in response to documented population declines over large portions of its range, thought to be due to loss of habitat, direct disturbance by human activities, upper respiratory tract disease, predation by ravens, and habitat conversion from livestock grazing.

The desert tortoise is a large, herbivorous reptile found throughout much of the Mojave and Sonoran deserts; its range roughly approximates the distribution of creosote bush scrub. It has a high domed shell and stocky, elephant-like limbs and a short tail. The carapace (upper shell) is brown and the plastron (lower shell) is yellow, both exhibiting prominent growth lines between the scutes.

The desert tortoise spends most of its time in burrows, rock shelters, and pallets to regulate body temperature and reduce water loss. It is most active during spring, summer and fall with mating occurring in late summer to early fall) and after seasonal rains. It is inactive most of the year. One study from 1995 modeling desert tortoise habitat requirements on Fort Irwin found that tortoises prefer southwest exposures and loamy soils, while avoiding stony soils, north exposure, and low plant cover areas. Parent materials and soil composition are important for the determination of tortoise habitat suitability (Andersen et al. 2000).

A final recovery plan was written for the Mojave population of the desert tortoise in 1994 and revised in 2011 (USFWS 2011). Critical habitat for the Mojave tortoise population was designated by the USFWS in 1994. A portion of the NTC (south of the UTM 90 line and Brinkman Wash) is located within the Superior–Cronese Critical Habitat Unit (CHU) for this species. In addition, the entire WTA is located within the Superior-Cronese CHU; no Critical Habitat occurs in the Eastern Expansion area.

Status on NTC and Fort Irwin

The desert tortoise on the NTC and Fort Irwin is well studied with many studies related to the distribution and estimated size of tortoise populations (Krzysik 1985, 1991, Lee and Ro Consulting Engineers 1986, Chambers Group 1990a, 1990b, 1994, 1996a, 2000, Sierra Delta Corporation 1990, Woodman and Goodlett 1990, Krzysik and Woodman 1991, US Army 1991, Morafka 1994, RDN 1996, Berry 1998, 1999a, 1999b, 1999c, Berry et al. 1998, 2006, Andersen et al. 2000, Gardner and Brodie 2000). The desert tortoise is known to occur throughout the NTC and Fort Irwin in low to moderate numbers.

In 1991, the approximate number of desert tortoises ranged from 5,228 to 7,797 individuals at the NTC and was thought to occupy approximately 352 square miles, or 35% of the installation. Approximately 83% of the tortoises were located in eight, disjunct populations. The largest of these areas, located along the southern boundary of the NTC, supported the highest densities of tortoises (Krzysik and Woodman 1991). The relative abundance of tortoises in that area is attributed to its proximity to the southern boundary of the NTC and the absence of military training in that region. Tortoise densities along the southern boundary have been estimated in the past (Woodman and Goodlett 1990, Chambers Group 1994). The most recent estimates of tortoise densities along the southern boundary of the NTC (UTM 90 area) are 526-565 individuals (Karl 2002). The most recent population study on the base was from 1997-2003 and estimated a density range of 0-73 tortoises/mi^2 (Berry et al. 2006). The decline in individuals is attributed to several consecutive years of drought conditions.

The Cantonment area and its immediate vicinity do not support any known desert tortoise populations, primarily due to the lack of suitable habitat. Tortoise habitat is minimal in this area due to development and greater activity and disturbance levels from military training and operations. Any tortoises located within this area would likely be an incidental that had strayed from better quality habitat nearby.

A population of desert tortoises does exist within the Goldstone Complex. This population during the 1980s had fairly high tortoise densities, especially the area south of Goldstone Lake. One survey (Berry 1997) found few live tortoises and many shell/skeletal remains. The cause of this die-off is not known.

The Leach Lake Impact Area may have tortoise habitat, even though it supports high-intensity training activities and no tortoise or tortoise sign has been found during surveys in accessible areas located along the periphery of the impact zone. The extent and quality of suitable habitat in this region cannot be determined due to restricted access and safety limitations.

Recent tortoise surveys in 2020 focused on the Western Training Area Translocation Site (WTATS) which is an off-post area southwest of the installation. The WTATS is considered a potential site for translocated tortoises from the WTA in the future, and surveys there have informed habitat suitability models.

Tagging tortoises on the installation began in 2010 as a passive system to identify and monitor individuals encountered on the installation (Bari 2012). At the most recent update in 2018, 297 total tortoises were identified with unique tags, and 27 were re-observed at least once (US Army 2019).

Relevant Biological Opinions

USFWS consultations regarding desert tortoise on the NTC and Fort Irwin began in 1991 with the Modified Coyote Basin Alternative proposed expansion. Since then, consultation and management has resulted in the creation of several tortoise conservation areas. These are maintained through fencing, road monitoring, and military training restrictions.

The 2021 *Biological Opinion for the Recovery and Sustainment Partnership Initiative, Use of Additional Maneuver Training Lands, and Operations and Activities at the National Training Center and Fort Irwin, San Bernardino County, California* (FWS-SB-20F0163-21F1366) supersedes all previous biological opinions and provides stipulations for avoiding, reducing, and offsetting impacts of military actions on desert tortoise and Critical Habitat (USFWS 2021a). The Army will implement or fund various activities developed in coordination with USFWS, other military installations, and the DoD. The installation continues to provide annual reports to USFWS detailing activities where desert tortoises are encountered, including moving from harm’s way, injuries, and deaths.

<u>Species Threats:</u>

Populations of desert tortoise have been declining throughout their historic range because of direct threats including:

- habitat destruction and fragmentation
- increased numbers of subsidized predators, including ravens, coyotes, and feral dogs
- road kills
- spread of disease
- illegal collecting
- military activities

E.2 State Protected Species

This section summarizes the state protected animal species that have been documented at the NTC and Fort Irwin. As shown in Table E-3, there are three mammals, five birds, and one plant on the installation that are protected by the State in some way.

Table E-3. State Listed Animals Documented at the NTC and Fort Irwin

Species	Status	Documented?	Comments/Habitat
Mammals			
Desert Bighorn Sheep *Ovis canadensis nelsoni*	CDFW FP, S3	Yes	Mountainous terrain above the desert floor in visually open, steep, and rocky terrain.
Desert Kit Fox *Vulpes macrotis arsipus*	Fur bearing mammal, status under CA state review	Yes	Open desert, shrubby or shrub-grass habitat. In the Mojave desert, occurs in creosote bush.
Mohave Ground Squirrel *Xerospermophilus mohavensis*	ST, S2S3	Yes	Occurs in desert areas with flat or moderately sloping topography, deep sandy or gravelly friable soils, and annual herbaceous vegetation.
Birds			
Sandhill Crane *Antigone canadensis canadensis/tabida*	*A.c.tabida:* ST, S2, CDFW FP	Yes, at least one of the subspecies, only at WWT impoundments	Breed in open wetland habitats with shrubs or trees surrounding. Roost in shallow lakes or rivers and appear daily in pastures, grasslands, wetlands, or irrigated croplands.
Swainson's Hawk *Buteo swainsoni*	ST, S3, USFWS BCC	Yes, rare, transient	Need open habitat for foraging. Nest in scattered groups of trees near grasslands and agricultural fields.
White-Tailed Kite *Elanus leucurus*	CDFW FP, S3S4	Yes, rare, transient	Grasslands such as savannas, desert grasslands, marshes, and open woodlands.
Peregrine Falcon *Falco peregrinus anatum*	CDFW FP, S3S4, USFWS BCC	Yes, rare, transient	Forages over wetlands or habitats within large amounts of birds. Nests on high cliffs or buildings/structures in urban areas.
Bank Swallow *Riparia riparia*	ST, S2	Yes, only at WWT impoundments	Low areas along streams, ocean coasts, rivers, and reservoirs. Nest in vertical cliffs or banks. Forage in open areas.
Species	**Status**	**Documented?**	**Comments/Habitat**
Western Joshua Tree	SC; WJTCA	Yes	

Table E-3. State Listed Animals Documented at the NTC and Fort Irwin			
Species	**Status**	**Documented?**	**Comments/Habitat**
Yucca brevifolia			

Sources: California Natural Diversity Database (CNDDB), NatureServe Explorer, The Cornell Lab of Ornithology, King 2019
SE = state endangered, ST = state threatened, SC = state candidate for listing
Fur bearing mammal = fully protected from take under State of California Code of Regulations
CDFW FP = fully protected by CDFW
State (S-rank) Rank: indication of condition of plant or animal throughout range within California
S1: Critically imperiled in the state, at high risk of extirpation in state
S2: Imperiled in state, at high risk of extirpation in the state
S3: Vulnerable, at moderate risk of extirpation in the state
S4: Apparently secure, at fairly low risk of extirpation in the state
USFWS BCC = USFWS Birds of Conservation Concern – highest conservation priorities of birds
WJTCA = Western Joshua Tree Conservation Act
WWT = wastewater treatment

E.2.1 Desert Bighorn Sheep

Species Summary

Desert bighorn sheep (DBHS) are large mammals characterized by their cloven hooves, ruminant stomachs, and large curling horns. They are brown with white muzzles, rumps, and bellies and weigh up to 250 pounds (Safford 2015). In 1985, a population of DBHS was observed in the Avawatz Mountains, which was estimated at 35 individuals (CNDDB 2021a).

Status on NTC and Fort Irwin

In the desert Southwest, DBHS live primarily on islands of mountain habitat in a sea of low- lying, largely uninhabitable desert. On the NTC and Fort Irwin, there are five potential mountain ranges for DBS: Avawatz, Granite, Quail, Soda, and Eagle Crag. DBHS move between these "islands," or habitat patches, which allows them to respond to fluctuating resource availability and competition and facilitates natural recolonization after local extinction within a patch (Bleich et al. 1990, Epps et al. 2010). Individual patches and populations may change over time, but connectivity promotes the persistence of this large metapopulation. Human-mediated changes to the landscape can influence this process; habitat development and fragmentation has substantially altered patterns of DBHS connectivity, and global threats like climate change can contribute to local extinction events (Epps et al. 2005, 2006). Managing any single DBHS population thus requires a broader understanding of the surrounding herds and habitat patches, and updated information as conditions change.

The CDFW has been monitoring DBHS in the Avawatz mountain range. About half of the 76 individuals are radio-collared and locations are recorded. The CDFW introduced two males to the population to improve the sex ratio, and the population has increased. This population moves on and off the NTC and Fort Irwin. Fort Irwin Natural Resources personnel participate in monthly meetings with CDFW and Oregon State University to discuss DBHS in the western Mojave.

Studies on Fort Irwin were conducted on the DBHS in 2010, 2011, and 2012 (Moreton 2010, 2011, Fowler 2012). Fifteen to sixteen individuals were identified in 2010 and 2011 (Fowler 2012). In 2012, scat sites, bedding areas, tracks, and a herd were spotted on the Soda and Avawatz Mountains. From the distribution of sign on transects, it appeared that DBHS congregate around springs in the Avawatz Mountains (Fowler 2012). Camera studies and walking transect surveys were performed from 2017-2018, but there were not enough sightings to estimate the small number of DBHS. The study did find evidence of scat, bedding sites, tracks, carcasses of dead individuals, and pictures of live sheep. Personnel from a mining operation in 2016 saw a group of 17 sheep, which may be a fairly accurate number of DBHS in the area (PacArctic LLC and BioResource Consultants Inc. 2018).

Helicopter surveys in the Avawatz Range in the fall of 2018 only resulted in sightings of 6 sheep with an estimated population size of less than 25 individuals. However, the full extent of the range could not be assessed during this survey. CDFW captured and collared 5 adult DBHS in 2018, and their movements show that the DBHS range within and outside of installation boundaries (Aiello 2020a). Oregon State University conducted scat surveys in 2020 on the Avawatz Mountain, Soda Mountain, and Fort Irwin Granite Mountain ranges. Preliminary analysis showed that no recent use by sheep was seen in the Granite Mountain range. Within the Avawatz Mountain range, though, recent or older fecal pellets were observed on and off the installation. There were visual sightings of DBHS in the Soda Mountains just southeast of the installation. Further analyses of this data are pending (Aiello 2020b).

E.2.2 Desert Kit Fox

Desert kit foxes are small and slim with large ears and long tails with black tips (Reid 2006). The kit fox is fully protected under the California Code of Regulations as a fur bearing mammal, and its status is under review to be listed as state threatened. Desert kit foxes may be affected by the expansion of wind and solar projects into their habitat (King 2019). Desert kit foxes occur throughout the installation and have been documented in recent surveys (US Army 2017, 2020, King 2019, Backus and Goodman 2020).

E.2.3 Mohave Ground Squirrel

Species Summary

The Mohave ground squirrel (MGS) is a small squirrel with head and body measuring about 6 inches in length and tail measuring 2.5 inches. The MGS was designated state threatened in 1971, and the species is on the BLM sensitive species list (CNDDB 2021b). The MGS generally occurs in habitat that consists of large alluvial filled valleys with deep fine- to medium-textured soils vegetated with creosote scrub, shadscale scrub, or alkali sink scrub in the absence of desert pavement and shallow eroded soils (Aardahl and Roush 1985). The MGS is primarily granivorous, foraging on annual grasses and forbs within creosote scrub and shadscale scrub.

Status on NTC and Fort Irwin

The NTC and the Western Training Area (WTA) are located within the geographic range of this species. A low concentration of MGS is known to exist within the Granite Mountain Range and Goldstone Complex on the NTC. Since NTC and Fort Irwin is at the northeastern edge of the range, the distribution can be presumed to be patchy (Krzysik 1994).

There have been many surveys for MGS conducted on the installation. Early surveys indicated the presence of this species at 12 sites, including several in the vicinity of Goldstone Lake, the Echo site, Nelson Lake, Bicycle Lake, Drinkwater Lake, the north end of Lucky Fuse, and Lizard Gulch (Krzysik 1991). Surveying six sites on the installation showed a reduction in MGS captured in 1994 when compared to 1993 and little change from 1994 to 1995 (Recht 1995). A survey in the spring and early summer of 2006 revealed MGS in all the eight grids surveyed in the WTA. In total, 34 MGS were trapped and marked with implanted PIT tags that year (Shomo 2006).

A field study was conducted during 2006-2007 to collect data on the status, distribution, and habitat preferences of this species in the WTA. Most of the WTA appears to provide excellent habitat for the MGS. The presence of MGS at 10 of the 12 trapping grids plus incidental records at 7 other locations indicates that the MGS are widespread in the WTA. A total of 36 MGS were captured at these trapping grids (Leitner 2007).

More recent surveys include one done in 2017 in the proposed multipurpose range complex (MPRC) where camera traps were utilized for 14 days, but no MGS were seen (US Army 2017). A comprehensive study summarizing data from 2013-2020 revealed that MGS were still found in their four core areas around its range. MGS were present at five sites in the WTA in 2015 and 2016 camera trap studies. However, camera studies in 2018 showed that round-tailed ground squirrels had replaced MGS at many of the Fort Irwin sites but not the WTA. The appearance of round-tailed ground squirrels was surprising since the area is about 19 miles west of the historical eastern boundary of the MGS range. The current theory is that the round-tailed ground squirrel is more tolerant of disturbance than the MGS (Leitner 2021).

In 2023 the Assistant Secretary of the Army Installation, Energy, and Environment (ASA IE&E) in partnership with the United States Fish and Wildlife Service (USFWS) requested funding proposals for Installation Climate Change Conservation Resilience Projects. Fort Irwin along with the USFWS submitted a proposal under this program to study MGS genetics and translocation projects. In late 2023 the USFWS also began considering development of a Recovery and Sustainment Partnership (RASP) program for MGS that Fort Irwin will consider participation in when the program is more fully fleshed out. This RASP program is anticipated to provide greater flexibility to military training while undertaking actions to avoid Federal listing of the MGS.

Species Threats

MGS have adapted to drought by postponing reproduction during periods of excessive dryness (Krzysik 1994). As a result, prolonged periods of drought may cause localized extinctions of MGS populations. Animals surviving in source locations usually repopulate these sink areas when juveniles disperse during more favorable times. However, due to urban sprawl, increased amounts of OHV travel, and a high military presence throughout MGS habitat, these sink areas may not be repopulated due to severe habitat fragmentation (CDFW 2019). Thus, these sources may become isolated islands of habitat that are extremely vulnerable to random environmental and climactic effects, fires, and diseases. Furthermore, habitat loss may reduce preferred forage and increase conspecific competition.

- Habitat loss, fragmentation, and conversion
- Drought
- Wheeled and tracked vehicles (recreational OHVs and military vehicles)
- Urban sprawl
- Overlap of round-tailed ground squirrels
    - RTGS better adapted to disturbance and warmer and drier temperatures (Leitner 2021)
    - Climate change; MGS range may extend northward (Leitner 2021)

- Invasive species, particularly Sahara mustard (*Brassica tournefortii*) and cheat grass (*Bromus madritensis* and *B. tectorum*) form monocultures that exclude natives used as forage for MGS, and increase fire intensity.

E.2.4 Sandhill Crane

Species Summary

The greater sandhill crane subspecies was listed as state threatened in 1983 (CNDDB 2022). These cranes winter in the southern US and northern Mexico and spend their days around pastures, grasslands, wetlands, or irrigated croplands (The Cornell Lab of Ornithology 2019).

Status on NTC and Fort Irwin

During the most recent avian survey on the installation in 2015-2016, a sandhill crane was documented in the winter near the wastewater treatment impoundments (Tetra Tech 2016). However, it is unclear if the subspecies of sandhill crane documented was the *Antigone canadensis tabida* which is the greater sandhill crane and is currently listed as state threatened. Since it is not specified in the report, it may also have been a lesser sandhill crane (*Antigone canadensis canadensis*). The lesser sandhill crane is still a state SSC but is not listed as threatened (CNDDB 2021b).

E.2.5 Swainson’s Hawk

Species Summary

The Swainson’s Hawk was designated state threatened in 1983 (CNDDB 2021b). Swainson’s hawks have pointed wingtips and long wings which they usually hold slightly raised when flying. Light morph adults have dark flight feathers and a brown upper breast which looks like a hood or thick collar (The Cornell Lab of Ornithology 2019). The Swainson’s hawk was once a widespread breeder in the non-forested areas of northern California and the Central Valley. Conversion of the Central Valley and other grassland areas from pastureland to cropland has probably been a major factor in the population’s decline (Remsen 1978). Swainson's hawks are locally common to rare breeders in California, with the majority of known territories located in the Central Valley and Great Basin bioregions (Woodbridge 1998). The Swainson’s hawk winters in South America. This species is migratory and is not expected to occur regularly at the NTC and Fort Irwin or forage in the area for prolonged periods.

Status on NTC and Fort Irwin

Swainson's hawks were first observed at Bitter Springs in 1994 or before (Brydolf 1996a). During 2010-2011 avian surveys, a Swainson's hawk was incidentally observed (Rathbun 2011). In the spring of 2012, two Swainson's hawks were seen at Bitter Spring, Garlic Spring, or the wastewater treatment impoundments (Erickson 2012). A Swainson's hawk was documented in allscale habitat in the spring during 2015-2016 avian surveys (Tetra Tech 2016). Recent degradation at Bitter Springs due to feral burro encroachment has adversely impacted habitat for this species.

E.2.6 White-Tailed Kite

Species Summary

White-tailed kites are pale, small hawks and can be found in savannas, marshes, grasslands, and open woodlands. White-tailed kites are fully protected by the state (CNDDB 2021b). They have a limited distribution in California, and the vicinity of Fort Irwin appears to be just east of its year-round habitat (The Cornell Lab of Ornithology 2019).

Status on NTC and Fort Irwin

A white-tailed kite was observed on the Fort Irwin installation incidentally during the 2010-2011 avian surveys (Rathbun 2011).

E.2.7 Peregrine Falcon

Species Summary

The peregrine falcon was delisted from federal endangered status in 1999 and delisted in California in 2009, but it is fully protected by the state and is a USFWS BCC. Peregrine falcons are dark gray large falcons with long, pointed wings and strongly barred underwings and flanks (The Cornell Lab of Ornithology 2019). The subspecies listed in Table F-3 is found primarily in the western United States. During winter they can be found throughout most of California. Summer range is more restricted to northern California, along the coast from Santa Barbara northward, and in the Sierra Nevada Mountains. Peregrine falcons are permanent residents in the Fort Irwin area.

Status on the NTC and Fort Irwin

A peregrine falcon was observed at Bitter Springs in 1997 (Brydolf 1998), along Langford Road in 2003, and at the wastewater treatment impoundments during the latest general avian survey (Tetra Tech 2016).

E.2.8 Bank Swallow

Species Summary

The bank swallow was listed as state threatened in 1989. Bank swallows are small songbirds with small heads and tiny bills. Bank swallows nest in colonies on the sides of banks or sandy cliffs and dive for insects over water. They only occur within Fort Irwin during migration (The Cornell Lab of Ornithology 2019).

Status on NTC and Fort Irwin

Three bank swallows were observed at the wastewater treatment impoundments during 2010 surveying on the installation (Franklin 2010). Bank swallows were observed around the wastewater treatment impoundments in the most recent comprehensive avian survey on the installation (Tetra Tech 2016).

E.2.9 Western Joshua Tree

Species Summary

The Western Joshua Tree is currently a state candidate for listing, and was afforded additional protection in California in July 2023 when the Western Joshua Tree Conservation Act was enacted. Its distribution and density are limited on the NTC and Fort Irwin. In 2019, a petition to list the Joshua tree (both species) was considered but rejected for listing by the FWS. It is currently under federal (FWS) review for listing (Conley 2021). In March 2022, CDFW recommended that western Joshua trees not be listed as state threatened (Bonham 2022). To the extent possible, construction projects will be directed to avoid disturbing Joshua trees, and habitat management for this species is described in **Section 3.7.5.2**.

E.3 Species-at-Risk

Tables E-4 and E-5 detail species found in technical reports and literature reviews that will be considered for development of an installation-specific Species-at-Risk (SAR) list to be presented to CDFW and USFWS during the first annual INRMP review period. The SAR list will be based on several factors, including local and regional distribution, potential to impact mission activities on the installation, and input from regulatory agencies. The SAR list will include, at a minimum, desert cymopterus, Mohave ground squirrel, and western Joshua tree.

Table E-4. Other Protected and Rare Animals Documented at the NTC and Fort Irwin			
Species	**Status**	**Documented?**	**Comments/Habitat**
Mammals			
Pallid Bat *Antrozous pallidus*	CDFW SSC, S3, WBWG H	Yes	Desert habitats.
Townsend's Big-Eared Bat *Corynorhinus townsendii*	CDFW SSC, S2, WBWG H	Yes	Arid western desert scrub and pine forest regions. Roost in mines, caves, or buildings.
Western Mastiff Bat *Eumops perotis californicus*	CDFW SSC, S3S4, WBWG H	Yes, but not since 1994	Variety of terrestrial habitats. Roosts in crevices and shallow caves on rock walls and cliff sides.
California Leaf-Nosed Bat *Macrotus californicus*	CDFW SSC, S3, WBWG H	Yes, but not since 1994	Sonoran and Mojave Desert scrub habitats in the Colorado River region in southern California, Nevada and Arizona, and throughout western Mexico.
Mountain Lion *Puma concolor*	CDFW SPS	Yes, rare	Variety of habitats throughout California. Generally found wherever deer and other prey are present, but foothills and mountains comprise prime habitat.
American Badger *Taxidea taxus*	CDFW SSC, S3	Yes	Open areas and brushlands with little groundcover. Resides in underground burrows when inactive.
Birds: Raptors			
Cooper's Hawk *Accipiter cooperii*	CDFW WL, S4	Yes	Forests and woodlands
Sharp-Shinned Hawk *Accipiter striatus*	CDFW WL, S4	Yes	Forest and forest edges, require dense forests for breeding.
Short-Eared Owl *Asio flammeus*	CDFW SSC, S3	Yes, rare	Live in large open areas with small vegetation.
Long-Eared Owl *Asio otus*	CDFW SSC, S3?	Yes, rare	Roost in dense vegetation and forage in shrublands, grasslands, open coniferous, or deciduous woodlands.

Table E-4. Other Protected and Rare Animals Documented at the NTC and Fort Irwin			
Species	**Status**	**Documented?**	**Comments/Habitat**
Burrowing Owl *Athene cunicularia*	CDFW SSC, S3, USFWS BCC	Yes	Open, treeless areas with low, sparse vegetation. Often associated with high densities of burrowing mammals like ground squirrels, tortoises, and prairie dogs.
Ferruginous Hawk *Buteo regalis*	CDFW WL, USFWS BCC, S3S4	Yes, rare	Prairies, deserts, and open range of the West.
Northern Harrier *Circus cyaneus*	CDFW SSC, S3	Yes	Western populations breed in dry upland habitats. Use variety of habitats in winter.
Merlin *Falco columbarius*	CDFW WL, S3S4	Yes, rare	Nest along river, forested openings, and edges. Found in grasslands, open forests, and coastal areas during migration and winter.
Prairie Falcon *Falco mexicanus*	CDFW WL, USFWS BCC, S4	Yes	Breed in open areas throughout the West near bluffs and cliffs where they build their nests.
Osprey *Pandion haliaetus*	CDFW WL, S4, CDF S	Yes, rare	Shallow, fish-filled water.
Birds: Songbirds			
Olive-Sided Flycatcher *Contopus cooperi*	CDFW SSC, S3, USFWS BCC, NABCI YWL	Yes, rare	Open woodlands, breed mostly in western coniferous forests. Nest in openings or close to streams. Riparian areas on the NTC and Fort Irwin are low quality habitat.
Yellow-Breasted Chat *Icteria virens*	CDFW SSC, S3	Yes, but not since 1995	Shrubby habitats.
Loggerhead Shrike *Lanius ludovicianus*	CDFW SSC, S4, USFWS BCC	Yes	Open country with low vegetation and well-spaced short trees or shrubs, especially those with spines or thorns.
Virginia's Warbler *Leiothlypis virginiae*	CDFW WL, S2, USFWS BCC, NABCI YWL	Yes, but not since 1994 or earlier	Breed in open pinyon-juniper and oak woodlands with scrubby drainages and steep slopes.
Black-Tailed Gnatcatcher *Polioptila melanura*	CDFW WL, S3S4	Yes	Scrub like parched arroyos and thorny scrublands with mesquite, creosote bush, ocotillo, and cactus.

Table E-4. Other Protected and Rare Animals Documented at the NTC and Fort Irwin			
Species	**Status**	**Documented?**	**Comments/Habitat**
Vermilion Flycatcher *Pyrocephalus rubinus*	CDFW SSC, S2S3	Yes but not since 1996	Open country including arid scrublands, deserts, and canyon mouths. Reliant on stream corridors. Riparian areas on the NTC and Fort Irwin are low quality habitat.
Yellow Warbler *Setophaga petechia*	CDFW SSC, S3S4, USFWS BCC	Yes	Open woodlands, spend breeding season in thickets and regrowing habitats especially along wetlands and streams.
Brewer's Sparrow *Spizella breweri*	USFWS BCC, S4	Yes	"Sagebrush obligate" bird species. During winter, occupy variety of desert scrub habitats including saltbush and creosote.
Bendire's Thrasher *Toxostoma bendirei*	CDFW SSC, S3, USFWS BCC, NABCI RWL	Yes, but not since 1997	Desert habitats such as shrublands, arid grasslands, sage-juniper desert, Joshua tree.
Crissal Thrasher *Toxostoma crissale*	CDFW SSC, S3	Yes, but not since 1994 or earlier	Deserts and dry, scrubby or brushy habitats.
LeConte's Thrasher *Toxostoma lecontei*	CDFW SSC, S3, USFWS BCC, NABCI RWL	Yes, rare	Low, sandy, open deserts. Prefer small arroyos, open flats, or dunes.
Gray Vireo *Vireo vicinior*	CDFW SSC, S2, USFWS BCC, NABCI YWL	Yes, but not since 1994 or earlier	Nests, migrates, and winters in desert habitats.
Yellow-Headed Blackbird *Xanthocephalus xanthocephalus*	CDFW SSC, S3	Yes, rare	Breed in wetlands and shallow parts of ponds, rivers, and marshes. Forage in grasslands, croplands, or savanna.
Birds: Hummingbirds and Swifts			
Costa's Hummingbird *Calypte costae*	USFWS BCC, S4	Yes, rare	Desert – in the Mojave Desert, scrub and woodlands near streams and springs with saltbush and cottonwoods.
Vaux's Swift *Chaetura vauxi*	CDFW SSC, S2S3	Yes, rare	Uses old-growth mixed and coniferous forests for nesting.
Rufous Hummingbird *Selasphorus rufus*	USFWS BCC, S1S2, NABCI YWL	Yes, rare	Habitat is open woodlands, sometimes breed in forests,

Table E-4. Other Protected and Rare Animals Documented at the NTC and Fort Irwin			
Species	**Status**	**Documented?**	**Comments/Habitat**
			meadows, swamps, and thickets.
Birds: Waterfowl, Wading Birds, and Seabirds			
Redhead *Aythya americana*	CDFW SSC, S3S4	Yes, rare	Nest on reservoirs, sewage ponds, streams, and cropland ponds.
Brant *Branta bernicla*	CDFW SSC, S2?	Yes, rare	Breeds in Arctic and migrates south to winter on saltmarshes, barrier beaches, lagoons, and estuaries
Black Tern *Chlidonias niger*	CDFW SSC, S2	Yes, but only at WWT impoundments and not since 1995	Nest in large freshwater wetlands but migrants use many wetland habitats
Caspian Tern *Hydroprogne caspia*	USFWS BCC, S4	Yes, rare, transient	Breeds in open flat areas along coastlines, migrates through continent interior, winters in coastal zones.
Least Bittern *Ixobrychus exilis*	CDFW SSC, USFWS BCC, S2	Yes, rare	Mostly live in brackish and freshwater marshes with vegetation like cattails.
California Gull *Larus californicus*	CDFW WL, S4	Yes but only at WWT impoundments	Breed on islands in inland lakes and ponds. Forage in open areas during breeding season.
American White Pelican *Pelecanus erythrorhynchos*	CDFW SSC, S1S2	Yes, rare, transient	Breed on islands in shallow, interior wetlands. Winter on coastal waters and bays.
White-Faced Ibis *Plegadis chihi*	CDFW WL, S3S4	Yes, rare, but only at WWT impoundments	Forage in shallow wetlands, nest in shallow marshes with some larger emergent vegetation.
Reptiles and Amphibians			
Mojave Fringe-Toed Lizard *Uma scoparia*	CDFW SSC, S3S4	Yes	Sparsely vegetated windblown sand of dunes, flats, riverbanks, and washes. Requires fine, loose sand for burrowing.

Sources: California Natural Diversity Database (CNDDB), NatureServe Explorer, Bat Conservation International, The Cornell Lab of Ornithology, (CDFW 2022)
State (S-rank) Rank: indication of condition of plant or animal throughout range within California
S1: Critically imperiled in the state, at high risk of extirpation in state
S2: Imperiled in state, at high risk of extirpation in the state
S3: Vulnerable, at moderate risk of extirpation in the state
S4: Apparently secure, at fairly low risk of extirpation in state but with possible cause for some concern

CDFW SPS = CDFW specially protected species
CDFW SSC = CDFW Species of Special Concern – vulnerable to extinction
CDFW WL = CDFW Watch List
USFWS BCC = USFWS Birds of Conservation Concern – highest conservation priorities of birds
WBWG H = Western Bat Working Group High – high bat priority in California
North American Bird Conservation Initiative (NABCI): watch list of bird species in need of conservation help
RWL: species with extremely high vulnerability
YWL: species that may be range restricted or more widespread but with declines and high threats

Table E-5. Other Rare Plants Documented at the NTC and Fort Irwin

Species	Status	Documented?	Comments/Habitat
Ferns			
Wooton's Lace Fern *Myriopteris wootonii*	2B.3, S2	Yes but not since 1974	Joshua tree "woodland," pinyon and juniper woodland
Monocots			
Great Basin Onion *Allium atrorubens var. atrorubens*	2B.3, S2	Yes but only once in 1939	Great Basin scrub and pinyon and juniper woodlands with sometimes rocky or sandy soil
Small-Flowered Androstephium *Androstephium breviflorum*	2B.2, S2?	Yes	General habitat is desert dunes and Mojavean desert scrub (bajadas)
Alkali Mariposa Lily *Calochortus striatus*	1B.2, S2S3,	Yes but not since 1994	General habitat of chaparral, chenopod scrub, Mojavean desert scrub, and meadows and seeps. Micro habitat is alkaline and mesic
Cooper's Rush *Juncus cooperi*	4.3, S3	Yes	Meadows and seeps (mesic, alkaline or saline)
Crowned Muilla *Muilla coronata*	4.2, S3	Yes but only once in 1986	General habitat is chenopod scrub, Joshua tree "woodland," Mojavean desert scrub, and pinyon and juniper woodland
Western Joshua Tree *Yucca brevifolia*	SC, under review for federal listing	Yes	Gentle alluvial fans, ridges, gentle to moderate slopes with coarse sands, very fine silts, gravel, or sandy loams
Dicots			
Providence Mountains Lotus *Acmispon argyraeus var. notitius*	1B.3, S2	Yes	Pinyon and juniper woodland
Curved-pod Milk-vetch *Astragalus mohavensis* var. *hemigyrus*	1B.1, S1	Yes but not since 2001	Carbonate soils in Joshua tree "woodland" and Mojavean desert scrub
Providence Mountains Milk-vetch *Astragalus nutans*	4.3, S3	Yes	Joshua tree "woodland", Mojavean desert scrub, pinyon and juniper woodland, and Sonoran desert scrub

Table E-5. Other Rare Plants Documented at the NTC and Fort Irwin			
Species	**Status**	**Documented?**	**Comments/Habitat**
Mojave Spineflower *Chorizanthe spinosa*	4.2, S4	Yes	General habitat is chenopod scrub, Joshua tree “woodland,” Mojavean desert scrub, and playas with a sometimes alkaline microhabitat
Clokey’s Cryptantha *Cryptantha clokeyi*	1B.2, S3	Yes	General habitat is Mojavean desert scrub
Ribbed Cryptantha *Cryptantha costata*	4.3, S4	Yes	General habitat is desert dunes and Mojavean or Sonoran desert scrub. Prefers sandy micro habitat
New York Mountains Cryptantha *Cryptantha tumulosa*	4.3, S4	Yes but not since 1993	Mojavean desert scrub and pinyon and juniper woodland
Desert Cymopterus *Cymopterus deserticola*	1B.2, S2	Yes	General habitat is Joshua tree “woodland” and Mojavean desert scrub with sandy micro habitat
Booth’s Evening-Primrose *Eremothera boothii ssp. boothii*	2B.3, S3	Yes but not since 1993	Joshua tree “woodland,” pinyon and juniper woodland
Clark Mountain Buckwheat *Eriogonum heermannii* var. *floccosum*	4.3, S4	Yes	Pinyon and juniper woodland (carbonate)
Abrams’ Spurge *Euphorbia abramsiana*	2B.2, S2	Yes	Mojavean and Sonoran desert scrub with sandy micro habitat
Death Valley Sandmat *Euphorbia vallis-mortae*	4.2, S3	Yes	Mojavean desert scrub that’s gravelly and sandy
Utah Vine Milkweed *Funastrum utahense*	4.2, S4	Yes	General habitat is Mojavean desert scrub and Sonoran desert scrub with a sandy or gravelly micro habitat
Munz’s Bedstraw *Galium munzii*	4.3, S4	Yes but not since 1937	Great Basin scrub, lower and upper montane coniferous forests, pinyon and juniper woodlands
California False Pennyroyal *Hedeoma nana ssp. Californica*	4.3, S4	Yes but not since 1937	Joshua tree “woodland,” pinyon and juniper woodland
Darlington’s Blazing Star *Mentzelia puberula*	2B.2, S2	Yes but not since 1978	Mojavean and Sonoran desert scrub

Table E-5. Other Rare Plants Documented at the NTC and Fort Irwin			
Species	**Status**	**Documented?**	**Comments/Habitat**
Coville's Purple Mat *Nama demissa var. covillei*	1B.3, S3	Yes but not since 1994	Mojavean desert scrub
Cespitose Evening-Primrose *Oenothera cespitosa* ssp. *crinita*	4.2, S4?	Yes but not since 1994	Pinyon and juniper woodland, subalpine coniferous forest, and Sonoran desert scrub
Parish's Phacelia *Phacelia parishii*	1B.1, S1	Yes	Mojavean desert scrub and playas
Mojave Indigo-Bush *Psorothamnus arborescens var. arborescens*	4.3, S4	Yes	Mojavean desert scrub and riparian scrub
Mojave Fish-Hook Cactus *Sclerocactus polyancistrus*	4.2, S3	Yes	General habitat is Great Basin scrub, Joshua tree "woodland" and Mojavean desert scrub with usually a carbonate general micro habitat
Striped Horsebrush *Tetradymia argyraea*	4.3, S4	Yes	Rocky soil within pinyon and juniper woodland

Sources: California Native Plant Society (CNPS), California Natural Diversity Database (CNDDB)
SC = California state candidate for listing
State (S-rank) Rank: indication of condition of plant or animal throughout range within California
S1: Critically imperiled in the state, at high risk of extirpation in state
S2: Imperiled in state, at high risk of extirpation in the state
S3: Vulnerable, at moderate risk of extirpation in the state
S4: Apparently secure, at fairly low risk of extirpation in the state
CA Rare Plant Rank (CRPR): ranking developed by CNPS to define rare California flora
1B: rare, threatened, or endangered in California and elsewhere
2B: rare, threatened, or endangered in California but common elsewhere
4: limited distribution, watch list
Threat Rank: CRPR threat rankings
0.1: seriously threatened in CA
0.2: moderately threatened in CA
0.3: not very threatened in CA

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APPENDIX F - LANE MOUNTAIN MILK-VETCH LONG-TERM MONITORING PLAN

Monitoring Plan
Lane Mountain Milk-vetch
(Astragalus jaegerianus) 2024

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Introduction

The Lane Mountain milk-vetch (*Astragalus jaegerianus*, LMMV) is a federally endangered, perennial herb that grows within the boundary of Fort Irwin, California. While there are over 250 other species of milkvetch, LMMV is unique in that, much like a vine, it requires a small host shrub to support its stems. Each summer the leaves undergo abscission (when leaves drop) where some stems may die, leaving a perennial rootstock that re-sprouts the next year and/or persistent stems that leaf out again. The species is cryptic, with stems hidden in the host canopy. Therefore, an accurate census requires trained observers, established study plots, and tagged plants. Three of the four known LMMV populations are located within Fort Irwin, and two of the Fort Irwin populations are within the Western Training Area (WTA), a 70,045-acre area acquired by Fort Irwin for future military training. The Army is committed to protecting core parts of all three LMMV populations from military training and to conducting annual monitoring for population viability.

Long-term monitoring began in 2005, and the 2024 census will be the 20th annual census. An annual report has been submitted since 2006 and archived in the DPW-Environmental Division Environmental Management System. The overall goal of monitoring has changed as monitoring has progressed. While the primary goal has always been to track population numbers annually, the secondary goal was initially to distinguish military impacts from military training activities and global impacts, such as climate change (DPW-Env. 2005). The secondary monitoring goal has gradually come to focus on improving the understanding of the demography and natural history of LMMV to better inform and assess conservation management decisions.

Goals and Objectives

Goals

The goal of monitoring the LMMV in 2024 is to assess the status of populations and to accurately measure the demography of the species.

Objectives

1. Determine the number of live LMMV on study plots.
2. Find, map, and tag new recruits.
3. Measure mortality, re-sprouting, survivorship, and dormancy of tagged plants.
4. Measure reproductive output of plants.
5. Assess host plant cover at permanent transects.
6. Measure dust deposition.

Methods

Objective 1: Determine the number of live LMMV on study plots.

Each of the four populations, Coolgardie Mesa (CM), East Paradise (EP), Brinkman Wash (BW), and NTC Gemini (NG) contain ten sampling plots. To ease the surveying process and ensure all host plants are examined, plots are divided into five, 10-m-wide belt transects using 50 and 100 m fiberglass transect tapes. During windy days when fiberglass tapes get wind-whipped and can damage both host and LMMV plants, pin flags will be used to create the belt transects. Each belt transect is carefully searched through for existing (tagged) and newly recruited LMMV by 2 – 3 biologists walking side-by-side down one transect, then up the next. Previously tagged LMMV should have a pin flag in the host plant near the base of the LMMV, as well as an ID tag affixed outside the host plant canopy. UTMs on the datasheet can be used to navigate back to any plants not found on the pass through the plot. Record whether the plant is Alive or Dead (Note: The entry Dead is used to categorize plants that have no green leaves or stems but could also be dormant. The term ABO ("almost budded out") was used in one year, which should have just been recorded as Alive. Therefore, entries on plant status in 2024 will be restricted to only New, Alive, Dead, or CNF (could not find). Also, confirm the host plant(s) on the datasheet, and update, if necessary, in the Excel file you will create for 2024.

Prior to 2014, degree and distance data had been collected for each tagged plant (i.e., the compass direction and distance from the stake holding an ID tag to the base of the LMMV). These data were not collected during the 2014 or 2015 survey efforts, when photos of the plants and ID tags were taken instead. In 2015 there was confusion as to whether a plant was old or possibly a new recruit when the ID tag, placed outside the host canopy, was not nearby the "milk-vetch side" of the host. To avoid this, the old degrees and distances were confirmed for live plants in 2016, and new degrees and distances were recorded if they did not coincide with the LMMV location or if there was a new seedling. Some plants that were dead or dormant could not be found or recorded, so these measurements will need to be recorded if they re-sprout. It should also be noted that there is a chance the ID tag may have been moved in previous years or uprooted by rodents. Therefore, if there is only one LMMV found and the data do not match, a new degree and distance measurement should be recorded. If, however, there are two LMMV clearly distinguishable under a single host and only one tag, then assume one is new and needs to be tagged. To determine which is the old plant the degree and distance data are used. If these coordinates do not match either plant, then the closer of the two plants to the ID tag is considered the old plant. The new plant will need its own ID tag and degree/distance.

Objective 2: Find, map, and tag new recruits.

LMMV recruits (plants that have not been observed in a previous census) are marked with uniquely numbered aluminum tags nailed securely into the ground at the base of each host plant (outside the host canopy on the side nearest to where the LMMV is growing). One pin flag should be placed next to the ID tag and another pin flag should be placed through the host plant canopy into the soil by the LMMV caudex to aid in locating the plant in future years. Biologists will trace the central stem of the LMMV recruit to the point where it enters the ground and will determine by touch or a small dental mirror if there is evidence of previous stem growth. Stems that are clearly young should have cotyledons and lack nodes or bud scars, while stems that are old are thicker, with a zig-zag pattern of growth at the base. Unfortunately, most stems are not clearly young or old, but if cotyledons are present, it is an indicator that it is a seedling and new recruit for that year. Seedlings often go unobserved because they are difficult to see and are present only during wet winters. Great care must be taken not to break or interfere with the stem. In fact, the stem can be easily broken simply by moving the host plant canopy.

For newly tagged LMMV, surveyors should record on the data sheet the degree (using a compass that has been set for declination) and distance (in centimeters) from the tag to the basal stem of the plant. Photos should be taken that show the tag, plant tag number, and LMMV if possible (Note: since LMMV are cryptic it is hard to clearly see both tag and plant, but the pin flag placed in the host near the LMMV caudex will aid in determining its location). Record the UTM coordinates in the easting and northing columns and the plant status as New on the data sheet.

Objectives 3 and 4: Measure mortality, re-sprouting, survivorship, and dormancy of tagged plants *and* Measure reproductive output of plants.

During the belt transect search for LMMV recruits, biologists will look under each plant carefully for new recruits, while also looking for pin flags and tags that indicate previously tagged LMMV. The previously tagged plants will be assessed and recorded as live or dead (live plants have green leaves or at least some part of the stem that is green). The number of flowers and fruits will be counted on all previously tagged and newly tagged plants.

Objective 5: Assess host plant cover at permanent transects.

Once plot data have been collected from all 40 study plots, the cover of LMMV host plants is measured using 44 paired permanent cover transects (Note: BW has 10 paired cover transects, CM has 12, EP has 10, and NG has 12). Each transect consists of two parallel, 100 m lines, placed 8 m apart. Transect location is random and independent of study plots, however, transects within the three Fort Irwin populations (BW, EP, and NG) are stratified so that one is placed close to the conservation area boundary, and another is placed at least 1 km inside the conservation area boundary. Transects at CM are random throughout the LMMV population area. The 0, 25, 50, 75, and 100 m points on each transect are marked with rebar. Any perennial plant which intersects the transect tape will be identified to the species level if possible and the part of the plant under or over the tape will be measured. Annual plants are not recorded because they cannot serve as host plant cover. Dead shrub (DS) cover (i.e., standing dead shrubs, not debris laying on the ground) is recorded since it can serve as a LMMV host.

Prior to the 2013 census there had been considerable confusion about whether to measure dead plant material on living shrubs. Dead plant material (stems or branches still attached to a living plant, but where dieback has occurred) can serve as a host for LMMV and should be measured. Therefore, biologists will follow this protocol:

- The general rule for measuring plant cover is to include all stems on shrubs, whether leaves are present or not. Record whether the cover measurement is for living or dead stems. If a shrub has experienced dieback, record the amount of living and dead cover separately. To make cover measurements consistent/comparable with the Range and Training Land Assessment (RTLA) data, omit any gaps in a plant's canopy greater than 2 m (3 m for creosote bush [*Larrea tridentata*]) from the cover measurement (Note: this very rarely occurs).
- Stems without leaves are either dormant, senescing (dying), or dead. Dead stems turn a dark grey color. Spend time during the first two days of vegetation transects distinguishing plants with dormant or senescing stems from plants that have been dead for a long time.
- Woody tissue that supports living (green) plant parts is alive.
- Do not measure detached plant parts lying on the ground.
- If the entire shrub appears dead or inactive, but begins re-sprouting from the stump, consider the old stems dead. This happens often with spiny hopsage (*Grayia spinosa*).

Objective 6: Measure dust deposition.

Dust traps (4 per LMMV population, 16 total; Table 1) are maintained and monitored to assess levels of suspended particulates in the air which may inhibit both LMMV and desert cymopterus (*Cymopterus deserticola*, CYDE) growth, reproduction, and overall health. The traps consist of a marble dust collector (MDCO) suspended on a post ~2 m above the soil surface (Goossens and Rajot 2008). The dust is weighed prior to the beginning of the CYDE survey, and again at the end of the LMMV census. For each MDCO, the dust is extracted by bringing the sampler down off the post (wing nut attachment) and first removing any obvious debris (leaves, bugs, bird droppings, etc.) before rinsing the marble media and container walls with distilled water delivered through a spray bottle. The water/dust mixture at the bottom of each collector is then poured through a clean funnel into a plastic 500 mL bottle labeled with the dust trap ID. Before replacing the dust trap on the post, make sure it has at least 3 complete layers of marbles across the entire surface (carry extra marbles to each MDCO).

In the office, this dust-water mixture is poured into funnels containing pre-weighed filter paper and any unwanted material (e.g., bird feces, vegetation, insects, rodent bones, etc.) is removed using forceps. Before weighing each filter paper, label it with the name of the corresponding dust collector. A tote lid is used as a cover for the funnels to prevent any additional dust or particulates from being introduced to the samples from the building or cubicles. The filter papers are completely dried over the course of two workdays using a Fisherbrand™ Isotemp 60L Drying Oven set to 60°C (140°F) (Note: be sure to keep track of filter papers when moving them in and out of the drying oven). Once dry, the filter papers will be weighed again. The original weight of each is subtracted from the final weight to determine the mass of dust (in milligrams [mg]) collected at each trap.

Support Tasks for all Objectives

Additional tasks include plot and transect marking and maintenance. Study plots and transects are remote, and tags are occasionally lost. Numbered tags are sometimes removed by pack rats and need to be replaced. Replacing a tag requires carrying spare wire to attach tags to the nail, spare nails, or pin flags to insert into the ground, and numbered tags (if available) for the plots to be visited that day. If a numbered tag is unavailable, create a new one using a blank tag and metal number punch that should be part of the supplies carried to the field. If necessary, write-on aluminum tags should be replaced on each plot corner rebar with the plot ID and corner cardinal direction (e.g., BW1 SW). Field data need to be entered into electronic data files and checked for errors, and paper datasheets archived.

Resources

Human resource needs for the LMMV (and CYDE) surveys are based on the following practical considerations. Dust is collected first and processed. LMMV plot data and host cover transect data need to be collected by at least 2 people, and a team of 3 people is desirable. A single vehicle is required for field work and driving time can be an hour or more each way. The on-boarding process (e.g., orientation, Range Ops safety class, reading the Monitoring Plans, etc.) is required for all new personnel (~20 hours per employee). Multiple days of preparation (creating maps, data sheets, supply checks, etc.) and dust trap measurements precede collection of plot data. LMMV monitoring plot surveys are followed by host cover transect surveys. One week of season-ending dust collection and processing follows the collection of LMMV host cover data. Data shall be digitized and archived following the conclusion of LMMV surveys.

The 2024 CYDE and LMMV surveys will require ~1,064 hours of work time from two seasonal biological technicians (Table 2). Tables 2 – 4 show the schedule and human resources needed (Note: start and end dates may vary slightly from this schedule). One contractor biologist may be assigned to the LMMV survey daily during April – June (Table 4). Conversely, one or both seasonal technicians should be available to help other staff with surveys and data collection for other projects for one day of each week during April – June, if needed. See Table 5 for a list of required supplies.

Expected Results

Objective 1: Determine the number of live LMMV on study plots.

Current LMMV counts for each plot/population will be presented. Counts will be used to determine whether abundance is increasing or decreasing across all populations and within individual populations.

Objective 2: Find, map, and tag new recruits.

All new recruits will be listed in tabular format.

Objective 3: Measure mortality, re-sprouting, survivorship, and dormancy of tagged plants.

Mortality, re-sprouting, survivorship, and dormancy data will be presented. These parameters will be compared to previous years to examine changes over time.

Objective 4: Measure reproductive output of plants.

Flower production, fruit production, and seedling/recruit numbers will be presented. These parameters will be compared to previous years to examine changes over time.

Objective 5: Assess host plant cover at permanent transects.

The canopy cover of potential host plants within each population will be calculated and compared to past censuses. All 44 permanent cover transects will be measured in 2024, if possible. Transect 41 (located in CM) has not been surveyed since 2019 due to long-term squatters nearby. These squatters were first noted by surveyors in spring 2020 and subsequent attempts by law enforcement to remove them have been unsuccessful. The transect is missing all rebar stakes (possibly removed by the squatters) and will need to be re-established once the area has been designated safe for surveyors.

Objective 6: Measure dust deposition.

Two measurements of dust deposition (taken in March and June) for the three Fort Irwin populations and one CM population will be presented and compared to past years to examine changes in dust loading over time.

Literature Cited

Directorate of Public Works – Environmental (DPW-Env). 2005. Lane Mountain Milkvetch Long-term Monitoring Plan for the US Army National Training Center and Fort Irwin. Report available in the DPW-Env. Environmental Management System, Report # FI-NR-33.

Goossens D and Rajot JL. 2008. Techniques to measure the dry aeolian deposition of dust in arid and semi-arid landscapes: a comparative study in West Niger. Earth Surface Processes and Landforms 33:178-195.

Tables

Table 1. UTM coordinates for the 16 marble dust collectors (MDCO).

MDCO ID #	Easting	Northing
BW-1	515859	3893655
BW-4	514242	3894365
BW-5	516702	3893034
BW-6	514778	3893944
CM-4	502368	3883150
CM-5	504114	3884493
CM-9	497806	3883785
CM-10	497267	3882628
EP-6	506466	3892073
EP-7	508918	3892570
EP-9	506236	3893062
EP-10	505405	3895232
NG-1	520874	3898246
NG-4	519878	3899088
NG-7	518730	3898331
NG-8	519138	3899534

Table 2. Human resource needs for the 2024 CYDE and LMMV surveys. Numbers in parentheses are for permanent contractor staff (Teya).

Task	Number Personnel	Days per week	Weeks	Hrs. Seasonal Techs	Hrs. Teya Staff	Comments
In-Processing, Survey Prep	2 (1)	2.5 (2)	1	40	16	Orientation, range safety class, read Monitoring Plans, prep gear/maps
CYDE Plots	2 (1)	5 (2)	1	80	16	DC & Hinkley (10 plots)
Dust Collection, pre- and post-census	2 (1)	5 (2)	2	160	32	2 collections, 1 before and 1 after the census. Includes drying and weighing.
LMMV Monitoring Plots	2 (1)	5 (5)	5	400	200	40 plots, 2 plots/day if field crew = 2; 3 plots/day if crew = 3.
LMMV Host Cover Transects	2 (1)	5 (5)	4	304	152	44 transects, 2-4 per day. (minus 8 hours per crew & staff for Memorial Day)
Data Entry, Clean and Store Equipment	2	5	1	80	0	Enter plot and cover data. Data QA/QC. Clean and store equipment.
TOTAL	—	—	—	**1,064**	**424**	—

Table 3. Seasonal technician work hours by month for the CYDE and LMMV surveys. These may vary depending upon start date.

Month	Technician 1	Technician 2	Total	Comments
March	2×5×8 = 80	2×5×8 = 80	160	Onboarding, prep, dust collectors, CYDE survey, LMMV monitoring plots.
April	4×5×8 = 160	4×5×8 = 160	320	CYDE fruit count, LMMV monitoring plots. During April – June, techs may spend 1 day/week on other projects.
May	4×5×8 - 8 = 152	4×5×8 - 8 = 152	304	LMMV monitoring plots, LMMV host cover transects (-8 hrs. for Memorial Day).
June	4×5×8 = 160	4×5×8 = 160	320	LMMV host cover transects, dust collectors, post-season clean up.
Total	—	—	**1,104**	—

Table 4. Tentative schedule for the 2024 CYDE and LMMV surveys. Permanent contractor staff (Teya) may assist the seasonal crew when available. Seasonal crew members may assist contractor staff with other projects one day per week, or as needed.

Week Starting	Task	Seasonal crew	Teya staff
3/04/2024	Onboarding, prep, dust collectors	2	1
3/11/2024	CYDE survey	2	1 – 2
3/18/2024	CYDE survey	2	1 – 2
3/25/2024	LMMV monitoring plots	2	1 – 2
4/01/2024	LMMV monitoring plots	2	0
4/08/2024	LMMV monitoring plots	2	0
4/15/2024	CYDE fruit counts, LMMV monitoring plots	2	1
4/22/2024	LMMV monitoring plots	2	0
4/29/2024	LMMV monitoring plots	2	0
5/06/2024	LMMV host cover transects	2	1
5/13/2024	LMMV host cover transects	2	0
5/20/2024	LMMV host cover transects	2	0
5/27/2024*	LMMV host cover transects	2	0
6/03/2024	LMMV host cover transects, dust collectors	2	0
6/10/2024	Post-season clean up	2	0

* This week has only 4 work days due to the Memorial Day holiday.

Table 5. Supplies required for CYDE and LMMV surveys in 2024.

Item	Task	Amount/Notes
Aluminum tags (pre-numbered, 1 ½" round)	Marking new plants	New CYDE tags start @ 3188 New LMMV tags start @ 1295
Aluminum tags (blank, 1 ½" round)	Marking old plants whose tags are missing or illegible	200
Camera	Photographing plants	1
Collection bottles	Dust collection	16 (4 – 6 oz. capacity)
Coolers	Equipment storage, drinking water	1 for equipment, 1 for drinking water
Data sheets	Record field data	Data sheets for dust sampling, host cover vegetation transects, and monitoring plots
Distilled water	Dust collection	4 x 1-gallon jugs
Drainage rack	Dust collection	4 ammo racks
Drainage tub	Dust collection	1 (~29 in. x 18 in. x 6 in.)
Fiberglass tapes, 50 m & 100 m	Delineating plot boundaries	4 x 50 m tapes, 2 x 100 m tapes
Filter paper	Dust collection	1 box (11.0 cm diameter, 11μm)
Forceps	Remove twigs, insects, etc. from dust collectors before collection	1
Funnels	Dust collection	16 x 2.0 oz. capacity
Glass marbles	Dust collection	2000 marbles
GPS unit	Navigation	2 with plant/plot/MDCO locations
Metal number punch set (¼")	Label new ID tags	1 set (numeric)
Milligram scale	Dust collection	1 digital scale
Nails (5 ½")	Anchoring plant tags	200
Pin flags	Marking plant base & tag location	200
Spray bottle	Dust collection	2
Wire, 16-18 gauge	Attaching ID tags to anchor nails	1 spool
Wire, ultra-thin	Tying pin-flag and root-flag together where necessary	1 spool
Write-on aluminum tag with cardboard backing	Marking rebar (plot corners and transect start points)	250

Appendix I. Dust Sampling Form

Dust Sampling

Year: ____________ Sampling period: Pre-survey or Post-survey

Surveyors: ____

Dust sampler ID	Date collected from field	Marbles added? (Yes/No)	Filter paper pre-weight (mg)	Date filter paper started drying	Dried filter paper plus dust post-weight (mg)	Date post-weight measured	Dust weight (post-weight minus pre-weight) (mg)

Appendix II. Host Cover Survey Form

LMMV Host Cover Vegetation Transects

Date: ____________________ Surveyors: ____

Transect Number: ________________ Ground Disturbance: None Low Moderate High

Shrub species	Start distance (cm)	End distance (cm)

Shrub species	Start distance (cm)	End distance (cm)

Appendix III. Lane Mountain Milk-vetch Survey Form

Lane Mountain Milk-vetch Monitoring **Plot:** ____________

Date: ______________________ Surveyors: ____

Status: New / Alive / Dead / CNF Growth Stage: Seedling / Vegetative / Flowering / Fruiting / Flowering & Fruiting / NA

Plant ID #	Easting	Northing	Host Plant	Degree	Distance (cm)	Status	Growth Stage	# Flowers	# Fruits	Comments

APPENDIX G – NTC AND FORT IRWIN SPECIES LISTS[1]

[1] This list includes species that were cited from internal Army sources, as well as external documents. They may have been documented on post, or have the potential to occur on post but not been previously observed. NTC and Fort Irwin continue to update species as they are observed, so this list will continue to change over time.

FUNGI	
Scientific Name	**Common Name**
Battarrea spp.	Desert puffball
Podaxis pistillaris	False shaggy mane

BIRDS	
Scientific Name	**Common Name**
Accipiter cooperii	Cooper’s hawk
Accipiter striatus	sharp-shinned hawk
Actitis macularius	spotted sandpiper
Aechmophorus occidentalis	Western grebe
Aeronautes saxatalis	white-throated swift
Agelaius phoeniceus	red-winged blackbird
Aimophila ruficeps	rufous-crowned sparrow
Aix sponsa	wood duck
Alectoris chukar	chukar
Ammodramus savannarum	grasshopper sparrow
Amphispiza belli	sage sparrow
Amphispiza bilineata	black-throated sparrow
Anas acuta	northern pintail
Anas americana	American wigeon
Anas clypeata	northern shoveler
Anas crecca	green-winged teal
Anas cyanoptera	cinnamon teal
Anas discors	blue-winged teal
Anas platyrhynchos	mallard
Anas strepera	gadwall
Anser caerulescens	snow goose
Anser rossii	Ross's Goose
Anthus rubescens	American pipit
Antigone canadensis	sandhill crane
Aquila chrysaetos	golden eagle
Archilochus alexandri	black-chinned hummingbird
Ardea alba	great egret
Ardea herodias	great blue heron
Artemisiospiza belli	Bell's sparrow
Asio flammeus	short-eared owl
Asio otus	long-eared owl
Athene cunicularia	burrowing owl
Auriparus Claviceps	verdin

BIRDS (*continued*)	
Scientific Name	**Common Name**
Aythya affinis	lesser scaup
Aythya americana	redhead
Aythya collaris	ring-necked duck
Aythya valisineria	canvasback
Bombycilla cedrorum	cedar waxwing
Branta bernicla	Brant
Branta canadensis	Canada goose
Branta canadensis moffitti	Western Canada Goose
Bubo virginianus	great horned owl
Bubulcus ibis	cattle egret
Bucephala albeola	bufflehead
Bucephala clangula	common goldeneye
Buteo jamaicensis	red-tailed hawk
Buteo lineatus	red-shouldered hawk
Buteo regalis	ferruginous hawk
Buteo swainsoni	Swainson's hawk
Butorides striatus	green-backed heron
Calamospiza melanocorys	lark bunting
Calidris alpina	dunlin
Calidris mauri	western sandpiper
Calidris minutilla	least sandpiper
Callipepla californica	California quail
Callipepla gambelii	Gambel's quail
Calypte anna	Anna's hummingbird
Calypte costae	Costa's hummingbird
Campylorhynchus brunneicapillus	cactus wren
Cardellina pusilla	Wilson's warbler
Carduelis lawrencei	Lawrence's goldfinch
Carduelis psaltria	lesser goldfinch
Carpodacus mexicanus	house finch
Cathartes aura	turkey vulture
Catharus guttatus	hermit thrush
Catharus ustulatus	Swainson's thrush
Catherpes mexicanus	canyon wren
Ceryle alcyon	belted kingfisher
Chaetura vauxi	Vaux's swift
Charadrius semipalmatus	semipalmated plover
Charadrius vociferus	killdeer
Chlidonias niger	black tern
Chondestes grammacus	Lark sparrow
Chordeiles acutipennis	lesser nighthawk

BIRDS (*continued*)	
Scientific Name	**Common Name**
Circus cyaneus	northern harrier
Cistothorus palustris	marsh wren
Colaptes auratus	northern flicker
Columba livia	rock dove
Contopus borealis	olive-sided flycatcher
Contopus sordidulus	western wood-pewee
Corvus corax	common raven
Dendroica coronata	yellow-rumped warbler
Dendroica nigrescens	black-throated gray warbler
Dendroica occidentalis	hermit warbler
Dendroica petechia	yellow warbler
Dendroica townsendi	Townsend’s warbler
Dolichonyx oryzivorus	bobolink
Egretta thula	snowy egret
Elanus leucurus	White-tailed kite
Empidonax difficilis	pacific-slope flycatcher
Empidonax hammondii	Hammond's flycatcher
Empidonax oberholseri	ducky flycatcher
Empidonax traillii	willow flycatcher
Empidonax traillii extimus	southwestern willow flycatcher
Empidonax wrightii	gray flycatcher
Eremophilia alpestris	horned lark
Euphagus carolinus	rusty blackbird
Euphagus cyanocephalus	Brewer’s blackbird
Falco columbarius	Merlin
Falco mexicanus	prairie falcon
Falco peregrinus anatum	peregrine falcon
Falco sparverius	American kestrel
Fulica americana	American coot
Gallinago delicata	Wilson's Snipe
Gallinago gallinago	common snipe
Geococcyx californianus	greater roadrunner
Geothylpis trichas	common yellowthroat
Himantopus mexicanus	black-necked stilt
Hirundo pyrrhonata	cliff swallow
Hurundo rustica	barn swallow
Hydroprogne caspia	Caspian tern
Icteria virens	yellow-breasted chat
Icterus bullockii	Bullock’s oriole
Icterus cucullatus	hooded oriole
Icterus parisorum	Scott’s oriole

BIRDS (*continued*)	
Scientific Name	**Common Name**
Ixobrychus exilis	Least Bittern
Junco hyemalis	dark-eyed junco
Lanius ludovicianus	loggerhead shrike
Larus californicus	California gull
Larus delawarensis	ring-billed gull
Larus livens	yellow-footed gull
Larus philadelphia	Bonaparte’s gull
Larus pipixcan	Franklin’s gull
Laterallus jamaicensis	black rail
Leiothlypis virginiae	Virginia’s warbler
Limnodromus griseus	Short-billed dowitcher
Limnodromus scolopaceus	long-billed dowitcher
Melanerpes formicivorous	acorn woodpecker
Melospiza lincolnii	Lincoln's sparrow
Melospiza melodia	song sparrow
Melozone crissalis	California towhee
Mergus merganser	Common Merganser
Mergus serrator	red-breasted merganser
Mimus polyglottos	northern mockingbird
Mniotilta varia	black-and-white warbler
Molothrus ater	brown-headed cowbird
Myadestes townsendi	Townsend’s solitaire
Myiarchus cinerascens	ash-throated flycatcher
Nannopterum auritum	double-crested cormorant
Nycticorax nycticorax	black-crowned night heron
Oporornis tolmiei	MacGillivray’s warbler
Oreoscoptes montanus	sage thrasher
Oxyura jamaicensis	ruddy duck
Pandion haliaetus	osprey
Passer domesticus	house sparrow
Passerculus sandwichensis	savannah sparrow
Passerella iliaca	fox sparrow
Passerina amoena	Lazuli bunting
Passerina cyanea	indigo bunting
Pelecanus erythrorhynchos	American white pelican
Phainopepla nitens	phainopepla
Phalaenoptilus nuttalli	common poorwill
Phalaropus lobatus	red-necked phalarope
Phalaropus tricolor	Wilson's phalarope
Pheucticus melanocephalus	black-headed grosbeak
Picoides scalaris	ladder-backed woodpecker

BIRDS (*continued*)	
Scientific Name	**Common Name**
Pipilo chlorurus	green-tailed towhee
Pipilo maculatus	Spotted towhee
Piranga ludoviciana	western tanager
Plegadis chihi	white-faced ibis
Podiceps auritus	horned grebe
Podiceps nigricollis	eared grebe
Podilymbus podiceps	pied-billed grebe
Polioptila caerulea	blue-gray gnatcatcher
Polioptila melanura	black-tailed gnatcatcher
Pooecetes gramineus	Vesper sparrow
Porzana carolina	sora
Psaltriparus minimus	Bushtit
Pyrocephalus rubinus	vermilion flycatcher
Quiscalus mexicanus	great-tailed grackle
Rallus limicola	Virginia rail
Recurvirostra americana	American avocet
Regulus calendula	ruby-crowned kinglet
Riparia riparia	bank swallow
Salpinctes obsoletus	rock wren
Sayornis nigricans	black phoebe
Sayornis saya	Say's phoebe
Selasphorus platycercus	Broad-tailed hummingbird
Selasphorus rufus	rufous hummingbird
Setophaga ruticilla	American redstart
Sialia currucoides	mountain bluebird
Sialia mexicana	Western bluebird
Sitta canadensis	red-breasted nuthatch
Sphyrapicus nuchalis	Red-naped sapsucker
Spinus pinus	pine siskin
Spinus tristis	American Goldfinch
Spizella atrogularis	black-chinned sparrow
Spizella breweri	Brewer's sparrow
Spizella pallida	clay-colored sparrow
Spizella passerina	chipping sparrow
Spizelloides arborea	American tree sparrow
Stelgidopteryx serripennis	northern rough-winged swallow
Sterna forsteri	Forster's tern
Sterna hirundo	Common tern
Strepopelia decaocto	Eurasian collared-dove
Strepopelia risoria	ringed turtle-dove
Sturnella neglecta	western meadowlark

BIRDS (*continued*)	
Scientific Name	**Common Name**
Sturnus vulgaris	European starling
Tachycineta bicolor	tree swallow
Tachycineta thalassina	violet-green swallow
Thryomanes bewickii	Bewick’s wren
Toxostoma bendirei	Bendire’s thrasher
Toxostoma crissale	crissal thrasher
Toxostoma lecontei	LeConte’s thrasher
Toxostoma redivivum	California thrasher
Tringa flavipes	lesser yellowlegs
Tringa melanoleuca	greater yellowlegs
Tringa solitaria	solitary sandpiper
Troglogytes aedon	house wren
Turdus migratorius	American robin
Tyrannus verticalis	western kingbird
Tyrannus vocierans	Cassin’s kingbird
Tyto alba	common barn-owl
Vermivora celata	orange-crowned warbler
Vermivora ruficapilla	Nashville warbler
Vireo bellii pusillus	least Bell’s vireo
Vireo cassinii	Cassin's vireo
Vireo gilvus	warbling vireo
Vireo plumbeus	plumbeous vireo
Vireo solitarius	solitary vireo
Vireo vicinior	gray vireo
Wilsonia pusilla	Wilson’s warbler
Xanthocephalus xanthocephalus	yellow-headed blackbird
Zenaida asiatica	white-winged dove
Zenaida macroura	mourning dove
Zonotrichia atricapilla	golden-crowned sparrow
Zonotrichia leucophrys	white-crowned sparrow

REPTILES AND AMPHIBIANS	
Scientific Name	**Common Name(s)**
Arizona elegans	glossy snake
Aspidoscelis tigris	western whiptail
Aspidoscelis tigris tigris	whiptail lizard
Callisaurus draconoides	zebra-tailed lizard
Chionactis occipitalis	western shovel-nosed snake
Coleonyx variegatus	banded gecko

REPTILES AND AMPHIBIANS (*continued*)	
Scientific Name	**Common Name(s)**
Crotalus cerastes	sidewinder
Crotalus mitchellii	speckled rattlesnake
Crotalus scutulatus	Mojave rattlesnake
Crotaphytus bicinctores	Great Basin collared lizard
Crotaphytus collaris	collared lizard
Crotaphytus insularis	desert collared lizard
Dipsosaurus dorsalis	desert iguana
Eumeces gilberti	Gilbert's skink
Gambelia wislizenii	long-nosed leopard lizard
Gopherus agassizii	desert tortoise
Hypsiglena torquata	desert night snake
Lampropeltis getula	common kingsnake
Lampropeltis pyromelana	Sonoran Mountain kingsnake
Lichanura trivirgata	rosy boa
Masticophis flagellum	coachwhip
Masticophis flagellum piceus	Red coachwhip
Phrynosoma platyrhinos	desert horned lizard
Phyllorhynchus decurtatus	spotted leaf-nosed snake
Pituophis catenifer	gopher snake
Pituophis melanoleucus	pine snake
Rhinocheilus lecontei	long-nosed snake
Salvadora hexalepis	western patch-nosed snake
Sauromalus obesus	chuckwalla
Sceloporus magister	desert spiny lizard
Sceloporus occidentalis	western fence lizard
Sceloporus uniformis	Yellow-backed Spiny Lizard
Sonora semiannulata	ground snake
Trimorphodon biscutatus	lyre snake
Uma scoparia	Mojave fringe-toed lizard
Urosaurus graciosus	long-tailed brush lizard
Uta stansburiana	side-blotched lizard
Xantusia vigilis	common night lizard

MAMMALS	
Scientific Name	**Common Name(s)**
Ammospermophilus leucurus	whitetail antelope squirrel
Antrozous pallidus	pallid bat
Canis familiaris	domestic / feral dog
Canis latrans	coyote

MAMMALS (*continued*)	
Scientific Name	**Common Name(s)**
Chaetodipus formosus	long-tailed pocket mouse
Chaetodipus penicillatus	desert pocket mouse
Corynorhinus townsendii	Townsend's big-eared bat
Dipodomys deserti	desert kangaroo rat
Dipodomys merriami	Merriam's kangaroo rat
Dipodomys microps	Chisel-toothed kangaroo rat
Dipodomys panamintinus	Panamint kangaroo rat
Eptesicus fuscus	Big brown bat
Equus asinus	wild burro
Eumops perotis	Western mastiff bat
Felis catus	domestic cat
Lasiurus blossevillii	Red bat
Lasiurus cinereus	Hoary bat
Lepus californicus	blacktail jackrabbit
Lynx rufus	bobcat
Macrotus californicus	California Leaf-Nosed Bat
Mus musculus	House mouse
Myotis californicus	California myotis
Neotoma lepida	desert woodrat
Onychomys torridus	southern grasshopper mouse
Ovis canadensis nelsoni	Nelson's desert bighorn sheep
Parastrellus hesperus	Canyon bat
Perognathus longimembris	little pocket mouse
Perognathus parvus	Great Basin pocket mouse
Peromyscus crinitus	canyon mouse
Peromyscus eremicus	cactus mouse
Peromyscus maniculatus	deer mouse
Pipistrellus hesperus	western pipistrel
Puma concolor	mountain lion
Rattus rattus	roof rat
Reithrodontomys megalotis	western harvest mouse
Spilogale gracilis	Western spotted skunk
Sylvilagus audubonii	desert cottontail
Tadarida brasiliensis	Mexican free-tailed bat
Taxidea taxus	American badger
Thomomys bottae	Botta's pocket gopher
Urocyon cinereoargenteus	grey fox
Vulpes macrotis	kit fox
Xerospermophilus mohavensis	Mohave ground squirrel
Xerospermophilus tereticaudus	Round-tailed ground squirrel

FISH	
Scientific Name	**Common Name**
Gambusia affinis	Mosquitofish

INVERTEBRATES	
Scientific Name	**Common Name(s)**
Abaeis nicippe	Sleepy orange butterfly
Anisoptera (suborder)	Dragonfly
Anopheles sp.	Mosquito
Apinae (Genus)	Bee
Apis mellifera	Honeybee
Armadillium vulgare	Pillbug
Asbolus verrucosus	Desert ironclad beetle
Bembicinae (Subfamily)	Sand wasp
Bombus crotchii	Crotch bumble bee
Bootettix argentatus	Creosote bush grasshopper
Branchinecta mackini	Alkali fairy shrimp
Cahuillus sp.	Desertsnail species
Calopteryx sp.	Damsefly
Cerenopus concolor	Darkling beetle species
Ceuthophilus sp.	Camel cricket
Colias eurytheme	Orange sulfur
Corythucha morrilli	Desert lacebug
Cryptoglossa muricata	Darkling beetle species
Culiseta sp.	Mosquito
Danaus plexippus	Monarch butterfly
Edrotes ventricosus	Darkling beetle species
Eleodes armata	Armored darkling beetle
Euphilotes battoides	Western square-dotted blue
Euphilotes ellisii avawatz	Ellis' Blue
Geocoris pallens	Western big-eyed bug
Hetaerina sp.	Damsefly
Libellula sp.	Skimmer
Machilis sp.	Jumping bristletail
Macronychia sp.	Sarcophagid fly
Malacosoma sp.	Tent caterpiller
Messor pergandei	Black harvester ant
Multareis cornutus	Desert treehopper
Multareoides bifurcatus	Bifurcate treehopper
Nehalennia sp.	Damsefly

INVERTEBRATES (*continued*)	
Scientific Name	**Common Name(s)**
Nematocera (Suborder)	Gnat
Ochthebius sp.	Minute moss beetle
Oligochaeta (class)	Annelid worm
Ormenis saucia	Desert planthopper
Pachybrachis desertus	Creosote short horned beetle
Papilio polyxenes	Black swallowtail
Pepsis (Genus)	Tarantula hawk
Pieris sp.	Cabbage white butterfly
Pogonomyrmex badius	Smooth black harvester ant
Pogonomyrmex californicus	California harvester ant
Psilochorus sp.	Long legged spider
Rhyparochromus saturnius	European lygaeid
Sphaerius sp.	Minute bog beetle
Strymon melinus	Grey hairstreak
Taylorilgus pallidulus	Desert mirid
Tetragonoderus pallidus	Carabid beetle
Thamnocephalus platyurus	Beaver-tail fairy shrimp
Trimerotropis pallidipennis	Pallid-winged Grasshopper
Triops sp.	Tadpole shrimp
Vanessa cardui	Painted lady butterfly
Ctenizidae	Trapdoor spider
Order: Araneida	Funnel web spiders
Lycosidae	Wolf spider
Argyroneta aquatica	Water spider
Coccinellidae	Lady bug beetle
Dytiscidae	Predaceous diving beetle
Histeridae	Hister beetle
Hydrophilidae	Water scavenger beetle
Noteridae	Burrowing water beetle
Asilidae	Robber fly
Chaobordae	Phantom midge
Order: Diptera	Midge
Sciomyzidae	Marsh fly
Tabanidae	Horse fly
Tipuloidea	Crane fly
Order: Hemiptera (true bugs)	Desert leafhopper
Cicadoidea	Cicada
Order:Hemiptera (true bugs)	Water strider
Order: Hemiptera (true bugs)	Water Treader
Order: Coleoptera	Riffle beetle
Order: Hymeoptera	Sweat bee (Apoidea bee)
Order: Hymeoptera	Velvet ant

INVERTEBRATES (*continued*)	
Scientific Name	**Common Name(s)**
Ammophila procera	Thread-waisted wasp
Order: Hymeoptera	Wasp
Asellus aquaticus	Fresh water slater
Order: Lepidoptera	Unknown moth
Order: Odonata	Darner dragonfly
Order: Odonata	Narrow-winged damselfly
Sulifugae	Wind scorpion
Order: Trichoptera	Caddisfly
Order: Zygentoma	Desert silverfish
Diadasia diminuta	Globe Mallow Bee
Papilio polyxenes coloro	Desert Black Swallowtail

APPENDIX H – 2021 BIOLOGICAL OPINION

Biological Opinion for the Recovery and Sustainment Partnership Initiative, Use of Additional Maneuver Training Lands, and Operations and Activities at the National Training Center and Fort Irwin, San Bernardino County, California (FWS-SB-20F0163-21F1366), 2021

United States Department of the Interior

U.S. FISH AND WILDLIFE SERVICE
Ecological Services
Carlsbad Fish and Wildlife Office
2177 Salk Avenue, Suite 250
Carlsbad, California 92008

In Reply Refer to:
FWS-SB-20F0163-21F1366

December 13, 2021
Sent Electronically

Colonel Jason A. Clarke
Department of the Army
Headquarters, United States Army Garrison
Building 237, B Avenue, P.O. Box 105021
Fort Irwin, California 92310-5000

Subject: Biological Opinion for the Recovery and Sustainment Partnership Initiative, Use of Additional Maneuver Training Lands, and Operations and Activities at the National Training Center and Fort Irwin, San Bernardino County, California

Dear Colonel Clark:

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion based on our review of the Department of the Army's (Army) proposed actions. The proposed actions are the implementation of the Recovery and Sustainment Partnership Initiative, the use of additional maneuver training lands in the Western Training Area, and all remaining operations and activities at Fort Irwin. We will consider the effects of the proposed actions on the federally threatened desert tortoise (*Gopherus agassizii*) and its critical habitat and on the endangered Lane Mountain milk-vetch (*Astragalus jaegerianus*). This document was prepared in accordance with section 7 of the Endangered Species Act of 1973 (Act), as amended (16 U.S.C. 1531 *et seq.*).

We based this biological opinion on information in previous biological opinions and our files. We also coordinated closely with your staff during the development of the biological opinion.

CONSULTATION HISTORY

The Departments of Defense and the Interior (2018) signed a memorandum of understanding "to establish a mutually beneficial partnership among the Parties to develop and promote effective ecosystem and species conservation initiatives that will "provide for increased flexibility for military mission activities." One of the goals stated in the memorandum of understanding is to "develop innovative regulatory approaches and tools for achieving [Endangered Species Act] objectives in a manner consistent with military needs and objectives." The Army and Service initiated discussion of participation in the Recovery and Sustainment Partnership Initiative at a meeting in Sacramento on May 15 and 16, 2019. We have provided a more detailed description of the proposed action with regard to the Recovery and Sustainment Partnership Initiative, the desert tortoise, and Fort Irwin later in this biological opinion and in Appendix A.

The biological opinion (Service 2012) for the addition of maneuver training lands at Fort Irwin contains a detailed description of the consultation history regarding the expansion of Fort Irwin. We incorporate that discussion by reference.

In addition to consulting on the expansion and use of additional maneuver training lands at Fort Irwin, the Service and Army have consulted on numerous infrastructure actions. To address the Army's needs more efficiently, the Service (2014a) and Army consulted on operations and activities at Fort Irwin.

The Army and Service agreed that the proposed actions currently under consultation would not alter the effects on the Lane Mountain milk-vetch as described under previous biological opinions. The Service and Army also agreed that including the Lane Mountain milk-vetch in this document would be appropriate so that our agencies could rely on a single biological opinion. To that end, we have updated the species' status information and the analysis from our previous biological opinion regarding the use of additional maneuver training lands at Fort Irwin to address information that is new since that biological opinion (Service 2004).

The Service did not designate critical habitat for the Lane Mountain milk-vetch within the boundaries of Fort Irwin. The potential exists for dust to travel from disturbance on the base to critical habitat off-base. However, off-base critical habitat that is adjacent to Fort Irwin is bounded by a conservation area within the base where training would not occur; therefore, we expect that dust from Army activities would have a discountable, if any, effect on off-base critical habitat. Consequently, the Army and Service did not consult on critical habitat with regard to the proposed actions.

This biological opinion addresses the potential effects of recovery actions that will occur on lands outside of Fort Irwin because of the Recovery and Sustainment Partnership Initiative at a programmatic scale. The Service will consult on the specific potential effects of such activities as appropriate in the future.

The Service developed the description of the proposed actions for this biological opinion in close coordination with Army staff at Fort Irwin; we also referenced the draft environmental impact statement for military training and the extension of the public land withdrawal (Army 2021b). The Service (2020) provided a draft biological opinion to the Army and Bureau of Land Management (Bureau) for review and comment on April 24, 2020. The Army (2021a, 2021c) and Bureau (2020) provided comments on the draft biological opinion. We have incorporated the comments into this final biological opinion.

DESCRIPTION OF THE PROPOSED ACTION

Briefly stated, the proposed action comprises current and future training activities within the boundaries of Fort Irwin, including the development, operation, and maintenance of future infrastructure within the installation, and use and maintenance of the Manix Trail. The proposed action also includes measures implemented to protect desert tortoises within Fort Irwin, the translocation of desert tortoises, and the implementation of recovery actions for the desert tortoise within the Western Mojave Recovery Unit (Service 2011).

Current Activities

The U.S. Army (Army) bases its warfighting doctrine on the central idea that Army units seize, retain, and exploit the initiative to gain a position of relative advantage over the enemy. The National Training Center at Fort Irwin provides the opportunity for the Army to use various types of armament during maneuvers over large areas of differing types of terrain. Because of its size, design, and terrain, the National Training Center is one of the few places in the world where brigade-size units (i.e., more than 5,000 soldiers and 1,000 vehicles in a rotation) can test their combat readiness.

“Rotations” are brigade-level training events; during rotations, a visiting unit deploys to Fort Irwin and conducts various types of training. Rotations are highly realistic and stressful training events that incorporate force-on-force and live-fire scenarios to prepare units for combat and security missions. Fort Irwin hosts an average of ten rotations per year. The primary rotational unit is a Brigade Combat Team, which includes either wheeled (Stryker) or tracked armored combat vehicles and all of their support functions. When rotational training is not occurring, individual training areas can be scheduled for specific training events; these are called off-rotation (or non-rotational) training events.

Joint military branches (Marine Corps, Navy, and Air Force), Army Reserve, National Guard, Special Operations Forces, multinational partners, and regular and transitional law enforcement units also train at the National Training Center, along with units stationed at Fort Irwin (home station units). Fort Irwin also serves as a post-mobilization warfighting center for the National Guard.

Fort Irwin comprises a cantonment (or community area), the Range Complex, training areas, the Deep Space Communications Complex (Goldstone Complex), and the Leach Lake Tactical Range. The Goldstone Complex, which the Army leases to the National Aeronautics and Space Administration, is located in the western part of the installation. It consists of a series of deep space radio telescopes and serves as a deep space communication network. The Jet Propulsion Laboratory uses the Goldstone Complex’s telescopes to monitor deep space missions.

Rotations and other maneuver training occur primarily in the training areas. Approximately 75 percent of Fort Irwin is suitable for maneuver training. Terrain restricts training in some areas and other areas are off-limits to training (Figure 1). These areas include:

1. The Goldstone Complex, except for use of fixed main supply routes and the unmanned aerial vehicle facility and runway (32,411 acres);
2. Leach Lake Tactical Range, which the Air Force uses as an aerial bombing range. The Army also uses this range as an impact area for artillery training (91,330 acres);
3. The cantonment area (13,976 acres);
4. The Range Complex, which is the primary location for fixed firing ranges (19,608 acres); and
5. Natural and cultural resource conservation areas, including dry lakebeds, sensitive equipment areas, safety restriction areas, and utility corridor areas (41,640 acres).

We used multiple sources of information to prepare this biological opinion. The acreages of the same feature frequently varied among documents; consequently, some of acreages we use in this biological opinion will differ from those in the Army's (2021b) draft environmental impact statement and other documents. We consider these differences to be minor with regard to the analyses in this biological opinion.

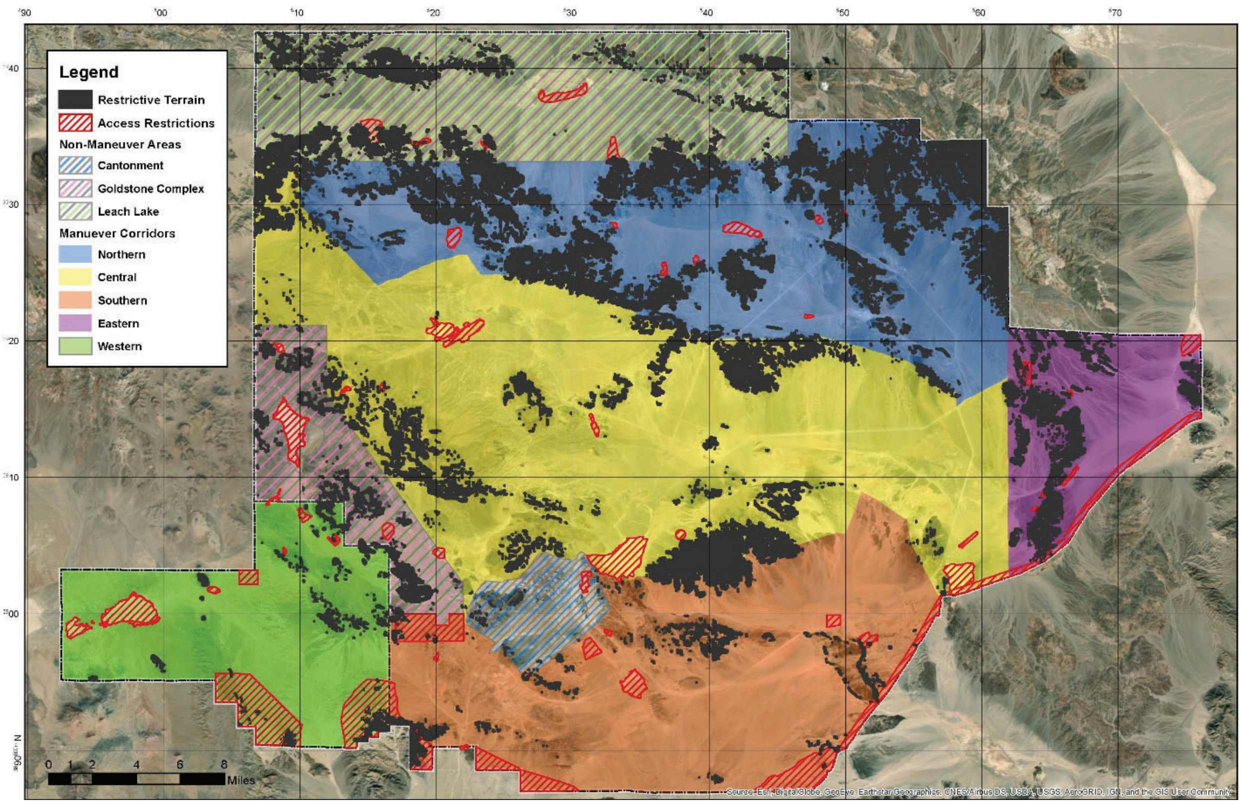


Figure 1. Restricted areas and terrain limitations within the National Training Center.

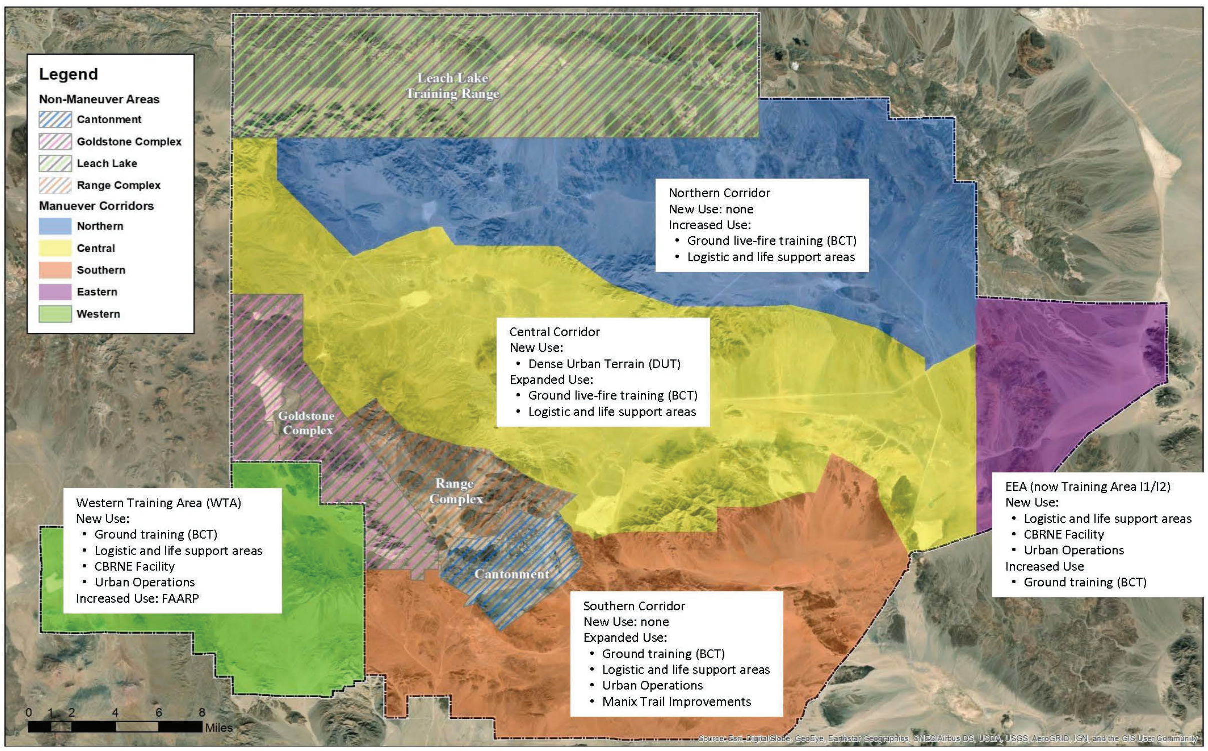
The Army manages a 67-acre off-highway vehicle area for recreation. Fencing to prevent desert tortoises from entering surrounds the area. The Army checks the fence quarterly and after heavy rainfall events for breaches. Walking and bike paths encircle the cantonment area. The Army occasionally hosts mud runs or obstacle challenges and offers tours that take small groups into the training areas via wheeled vehicles. The Army anticipates that it will continue these and similar activities.

The Army also manages 103,000 acres outside of Fort Irwin's boundaries for the conservation of the desert tortoise. These lands are intermixed with Bureau-managed lands where recovery actions would take place. The Army has provided funds for the Bureau to install post-and-cable fencing and route markers on these lands and to close and/or restore unauthorized routes (Housman 2021a).

Changes in Training Activity

The following paragraphs describe the necessary changes in military training projected at Fort Irwin. Given future changes in war-fighting doctrine and technology, the Army will likely need to modify its training and alter its infrastructure beyond what we have described in the following paragraphs. The Army and Service intend to use the guidance provided in this biological opinion to address the effects such future changes may have on the desert tortoise and its critical habitat.

Future changes expected on Fort Irwin within the installation's original footprint will support continued rotational training in existing maneuver corridors, but with greater capacity for live-fire training. The Army will also improve urban operation training around the existing urban area known as Tiefort City located in the Central Corridor. This expanded urban operation site will have a larger footprint and allow for dense urban terrain training. Figure 2 depicts the locations of the anticipated new training.



BCT- Brigade Combat Team; DUT- Dense Urban Terrain; EEA- Eastern Expansion Area; FAARP- Forward Area Arming and Refueling Point; CBRNE- Chemical, Biological, Radiological, Nuclear, Explosive materials

Figure 2. General locations of anticipated changes in training use.

Major changes within the former expansion areas include opening the Western Training Area to ground training (anticipated in 2025) and increasing maneuver training within Training Areas I1 and I2. The Army also anticipates using these training areas to support new urban operation sites, simulated chemical/biological/radioactive/nuclear facilities, forward area arming and refueling points, and various logistic and life support areas. The Army has not yet determined specific locations for these activities.

These projected changes will occur in both the highly and less-used areas of Fort Irwin as the Army expands its training capabilities. During the development/building phase, the Army would construct new infrastructure and prepare new training sites; these activities would likely involve heavy machinery, excavation or construction, and movement of construction materials to the sites.

Maneuver Training

The Army intends to reconfigure the maneuver space at the National Training Center to replicate the linear and lateral distance of the area that the Brigade Combat Teams would be responsible for when deployed. Reconfiguring the trainings areas would increase the available space and better facilitate realistic combined arms training. For example, new weapon systems typically have greater range and thus require the unit to be further away from the target to replicate real-world standoff distances.

Sustainment Training

Brigade Combat Teams at the National Training Center must train and exercise their support battalions in sustainment operations. The Army trains Brigade Combat Teams to handle the logistics of recovering damaged vehicles, maintenance, and fueling operations over long distances and to provide rear area security. Reconfiguring the training areas would increase the available space and better facilitate realistic sustainment training. The Army will likely use Eastern and Western Training Areas for logistic and life support operations to extend supply lines to replicate real-world distances.

Modification of Training Infrastructure

The Army intends to modify infrastructure at Fort Irwin to meet future training requirements.

Increased Live Weapons Training Capabilities

The National Training Center needs to increase its capability to use live ammunition in rear areas to replicate the security mission that Brigade Combat Teams would experience. The Army will require additional targets to replicate a realistic threat to these rear areas; the units defending these areas will likely establish additional obstacles, force protection berms and security checkpoints.

Until recently, rotational live fire training has occurred primarily in the Northern Corridor. Since 2013, Brigade Combat Teams have become larger; they are now composed of three maneuver battalions instead of two. A brigade combat team requires the space and terrain type to maneuver its three battalions to train properly for combat. To exercise all three battalions simultaneously in a doctrinally correct live-fire training scenario, units need to maneuver and engage targets within all maneuver corridors. This training will require the development of additional targets, obstacles, and objectives (small clusters of buildings).

Improve Urban Operations Sites

The Army intends to increase the number and complexity of areas where it can conduct urban operations. To accomplish this task, the Army would construct or expand urban areas within current training areas and in the Eastern and Western Training Areas.

Improve Communication Capabilities

The Army intends to improve the ability for training units to communicate during rotations and other training exercises. These improvements could include the construction and operation of cell towers and installation of communication lines.

Create New Facilities for Simulated Chemical, Biological, Radiological, and Nuclear Training

The Army intends to construct new facilities for simulated chemical, biological, radiological, and nuclear training in the Northern, Central, and Southern Corridors and the Eastern and Western Training Areas. The facilities may be under or above ground, in bunkers, or in constructed caves. The Army would site these facilities in secluded areas, so the Brigade Combat Teams have to find, secure, and mitigate the threats. The equipment used to simulate the chemical, biological, radiological, and nuclear threats is inert and not operational.

Forward Area Arming and Refueling Points and Ready Ammunition Storage Areas

The training rotations at the National Training Center require Brigade Combat Teams to train closely with combat aviation support. The Army needs locations throughout Fort Irwin to refuel and maintain helicopters and for the aircraft to obtain necessary supplies, food, and ammunition to resupply ground forces. To meet this training need, the Army will need to establish forward arming and refueling points, ready ammunition storage areas, and other aviation logistic sites throughout the length of the battlefield in the Central and Southern Corridors and Eastern and Western Training Areas. Terrain will dictate the location of these sites, which means that the Army will use certain areas repeatedly; however, the locations are not predetermined and may vary from rotation to rotation.

Land Management

The Army intends to improve existing vehicle trails to provide for safe and efficient movement of soldiers, equipment, and materiel while reducing the potential for erosion and damage to the physical environment. To comply with its environmental guidance, the Army will control erosion and repair maneuver damage, as needed, to maintain the physical conditions of the training areas and maintain realistic training scenarios.

Range Improvements

The Army intends to improve weapon ranges to meet current training requirements. At the current time, Range 1 requires upgrades for use by new weapon systems and to reduce conflicts in usage. The Army will likely require additional upgrades of other weapons ranges in the future as equipment and doctrine change.

Manix Tank Trail Improvements

The Manix Tank Trail is an unpaved 27-mile-long trail between Fort Irwin and Interstate 15; the Army transports rotational units and equipment to and from Fort Irwin via this trail. The Army needs to upgrade the trail to increase the safety and efficiency of logistics before and after rotational training.

Conservation Program

The Army's conservation program for desert tortoises at the National Training Center focuses on two primary goals: Protecting desert tortoises during its activities in a reasonable and prudent manner and providing long-term, consistent assistance to off-installation recovery efforts for the species. The Army and Service developed this strategy to enable the Army to use Fort Irwin for training in the most efficient manner while promoting the long-term survival and recovery of the desert tortoise.

Minimizing Impacts to Desert Tortoises during Activities on Fort Irwin

One of the goals of the Recovery and Sustainment Partnership Initiative is to provide the Department of Defense with greater mission flexibility with regard to on-base operations and activities while conserving listed species. To that end, the Service and Army reviewed the efficacy of the current protective measures for the desert tortoise at Fort Irwin. One aspect we reviewed was how the Army used surveys to protect desert tortoises. To provide clarity to this discussion, we will define the terms we use with regard to surveys.

"Protocol survey" refers to a standardized methodology of searching for desert tortoises in the area of a proposed activity. Federal agencies use the results from protocol surveys to support analyses in biological assessments and documents they prepare under the National Environmental Policy Act. In contrast to that, we refer to surveys intended to remove desert tortoises from an area immediately before its use during a ground-disturbing activity as "clearance surveys."

Because desert tortoises occur in low densities in most of Fort Irwin, the Army and Service have agreed that, in general, the Army would not conduct protocol surveys for desert tortoises when it undertakes construction or maintenance. In the fiscal years from 2017 through 2019, the Army detected 11 desert tortoises during 216 protocol surveys that covered 5,866 acres in preparation for construction or maintenance (Housman 2020a). These results indicate that desert tortoises are not abundant in many areas of Fort Irwin; the Service and Army agreed that adjusting the current procedures would be appropriate and compatible with the goals of the Recovery and Sustainment Partnership Initiative.

In some situations, the Army may conduct larger activities in areas where desert tortoises may be more abundant. Larger activities require the Army to conduct a review under the National Environmental Policy Act through development of an environmental assessment or environmental impact statement. Such reviews include field work to assess natural and cultural resources. If the biologists conducting the field visits determine that desert tortoises are likely abundant within the boundaries of such projects, the Army will conduct a clearance survey and translocate any desert tortoises it finds to suitable habitat within a conservation area. Alternately, the Army could move these desert tortoises from harm's way, if that is the more appropriate course of action; moving desert tortoises from harm's way involves relatively short-distance movement of the animal into an area where it would be safe from the current Army activity. The Army and Service will make such decisions on a case-by-case basis without re-initiating consultation. If the Army does not prepare an environmental assessment or environmental impact statement, it would not conduct any surveys but would translocate any desert tortoises it finds during its project activities.

Based on recent experience, the Army does not expect that it would prepare environmental assessments or environmental impact statements frequently. The Army and Service also agreed that the procedure described in the previous paragraph would apply in the Western Training Area after the initial translocation of desert tortoises from that area.

Because the Army has not conducted training exercises in the Western Training Area, it will translocate desert tortoises from that area prior to the onset of training. The Army is currently working with the U.S. Geological Survey and Bureau to assess the number of animals that will require translocation, determine one or more appropriate recipient sites, and develop a specific translocation plan for these desert tortoises. The Service will review the translocation plan prior to its implementation. The Army is also conducting an additional National Environmental Policy Act review before it begins using the Western Training Area.

In the fiscal years from 2017 through 2019, personnel conducting rotational and other activities reported 160 sightings of desert tortoises across all current training areas (Housman 2020a). We expect that these sightings do not necessarily represent unique desert tortoises; that is, we expect that personnel observe the same desert tortoise on more than one occasion.

In some circumstances, soldiers and workers may encounter a desert tortoise on a road or at a training or work site. To address this situation, wildlife staff will brief training units and workers, as appropriate, in how to move desert tortoises from harm's way. Alternatively, the soldier or worker will call wildlife staff to obtain directions over the phone. Depending on the situation, the personnel in the field and wildlife staff may elect to leave the desert tortoise in place if the activity is not likely to kill or injure it. The soldier or worker moving the desert tortoise must report the encounter to wildlife staff and include the following information: The location, date, and time of the encounter; where the desert tortoise was released; and whether the desert tortoise voided its bladder. If possible, the soldier or worker should provide pictures of the capture and release sites and of the desert tortoise. The Army will include information regarding these encounters to the Service in its annual report.

The Army will follow the general guidance contained in the Service's (2009, 2019c or updated versions) field manual and translocation protocol, as appropriate, for all handling of desert tortoises, including survey protocols and disease management. When translocation is the most appropriate course of action, the Army will coordinate with the Service regarding the location of the recipient site, follow-up monitoring, timing, and other issues. The Army will also coordinate closely with affected land managers on the location of recipient and potential dispersal sites if they are proposed on lands that are not managed by the Department of Defense. On a case-by-case basis, the Army and Service may decide to deviate from the guidance in the field manual and translocation protocol, if the specific circumstances warrant. The Army and Service may determine that it is appropriate to hold any desert tortoise in captivity temporarily; the agencies may also decide that head-starting of small desert tortoises is appropriate prior to their translocation.

Off-Installation Recovery Efforts for the Desert Tortoise

The Army will assist the Service and other partners in working towards the recovery of the desert tortoise by contributing to implementation of recovery actions under the Department of Defense's Recovery and Sustainment Partnership Initiative. The Service and the Department of Defense, in coordination with the Bureau and the Desert Tortoise Management Oversight Group, will fully develop a 5-year plan that will identify and prioritize the Department of Defense's recovery activities under this initiative. This plan will contribute to recovery goals outlined in the Service's (2011) recovery plan, fit within the broader interagency recovery effort, and outline the Department of Defense's recovery contributions under the Recovery and Sustainment Partnership Initiative.

Appendix A provides a preliminary framework and budget for the initial 5-year plan, which the Department of Defense and Service, in consultation with the Bureau, will fully develop during the first year of this biological opinion's implementation. Funding or implementation of the plan will primarily require coordination among the Department of Defense, Service, Bureau, California Department of Fish and Wildlife, National Fish and Wildlife Foundation, and local land trusts and non-governmental partners. The Army has provided initial funding of $530,000 to an account that the Marine Corps has established for transferring funds to the National Fish and Wildlife Foundation (Housman 2021b). Additionally, the Department of Defense has provided $1,500,000 for the Recovery and Sustainment Partnership Initiative for the desert tortoise in California. Finally, the National Fish and Wildlife Foundation has begun to draft a request for proposals for the initial on-the-ground recovery actions.

Appendix A also describes "focal areas" for recovery actions. Focal areas comprise regions with higher desert tortoise densities, higher habitat potential values, ecological intactness, and a location that supports landscape-scale connectivity; they would be located within the Superior-Cronese, Fremont-Kramer, or Ord-Rodman Areas of Critical Environmental Concern. The

Service and other parties working on this effort will define the final boundaries of these focal areas during development of the initial 5-year plan.

Although this plan would have a 5-year time horizon, the Service and Department of Defense, in consultation with the Bureau could modify it at any time to adjust implementation priorities in response to changing recovery needs. This shift could then affect what actions and recovery priorities the Army focuses on under the plan. The time-frame for the 5-year plan represents a planning horizon and does not represent the term for the Army's recovery contributions under the Recovery and Sustainment Partnership Initiative. The Department of Defense and Service would work together to update the 5-year plan in coordination with the Bureau and the Desert Tortoise Management Oversight Group when necessary and work with the Army to determine where and how it can best contribute to plan implementation.

The Army will implement or fund various activities under this plan, with a focus on activities to benefit desert tortoise populations in desert tortoise conservation areas defined by the recovery plan (Service 2011). Activities would include, but are not limited to:

1. Permanent habitat conservation (land acquisition, conservation easements, *etc.*),
2. Habitat restoration (including assisting the Bureau in developing seed sources that will be able to provide the necessary native plant materials for future restoration efforts),
3. Fencing of conservation areas, as appropriate,
4. Closing/restoration of unauthorized roads or routes,
5. Funding of visitor-contact patrols,
6. Fencing to exclude desert tortoises from roads,
7. Augmentation of populations of desert tortoises, and
8. Range-wide monitoring.

As stated above, the 5-year plan may change during implementation depending on recovery priorities (*e.g.*, focal areas may shift, priority recovery action categories may change). However, Appendix A provides an approximation of the initial recovery needs that Department of Defense resources would address under the section 7(a)(1) program and provides a means of characterizing the magnitude of the program under the Recovery and Sustainment Partnership Initiative. The development of future 5-year plans, beyond the current plan's time horizon, may address different geographic areas or recovery priorities, but we do not anticipate, and the Army is not committing to, annual funding levels (adjusted for inflation) above that identified for the initial plan. In addition, the Service and Bureau understand that the Army's funding commitments to support plan implementation are subject to the requirements of the Antideficiency Act (31 U.S.C. 1341). The Antideficiency Act prohibits federal agencies from obligating or expending funds in excess of amounts available in appropriations or funds.

None of the recovery activities that the Army would fund as part of the Recovery and Sustainment Partnership Initiative would occur within the boundaries of Fort Irwin, except for possibly within existing conservation areas for the desert tortoise along the southern boundary of the base. (See Figure 1.) These activities would occur in conservation areas for the desert tortoise within the Western Mojave Recovery Unit. We anticipate that other Department of Defense installations are likely to participate in the Recovery and Sustainment Partnership Initiative and fund recovery actions in the Western Mojave Recovery Unit.

Minimizing Impacts to the Lane Mountain Milk-vetch during Activities on Fort Irwin

We have also included here the following conservation measures for the Lane Mountain milk-vetch that the Army and Service developed during the consultation on operations and activities at Fort Irwin (Service 2004). The Army will ensure the long-term survival of the Lane Mountain milk-vetch by:

1. Maintaining the National Training Center-Gemini Conservation Area adjacent to the southern boundary of the Goldstone Deep Space Communications Complex. This 2,471-acre off-limits area was fenced in 2003, restricting most vehicle traffic. Most of this occurrence of the Lane Mountain milk-vetch is contained within this conservation area.

2. Maintaining the 4,300-acre East Paradise Conservation Area. This conservation area contains 80 percent of the Paradise Valley occurrence of the Lane Mountain milk-vetch.

3. Maintaining the 3,700-acre Brinkman Wash Restricted Access Area that contains 1,872 acres of Lane Mountain milk-vetch habitat.

4. Erecting and maintaining signs along the perimeter of the Restricted Access Area at approximately 100-meter intervals and by erecting restricted access signs along all routes that access the Brinkman Wash Restricted Access Area.

5. Incorporating information regarding the off-limits areas into environmental awareness briefings.

6. Delineating all Lane Mountain milk-vetch conservation areas on all training maps.

7. Prohibiting and eliminating all vehicular travel in Lane Mountain milk-vetch conservation areas within Fort Irwin with the following exceptions: (1) access for yearly monitoring and research approved by the Fort Irwin Natural Resources Program Manager; (2) emergency vehicles, particularly those needed for wildfire control; and (3) exceptional natural resource activities, such as roundups of feral burros (*Equus africanus asinus*) or cultural surveys, approved by the Fort Irwin Natural Resources Program Manager.

8. Using observer/controller teams to prevent unnecessary habitat destruction by rotational units unfamiliar with the terrain and travel routes.

9. Identifying and conserving potential habitat for the Lane Mountain milk-vetch within the region. The Army will identify and survey for small pockets of potential habitat, defined by soil, bedrock geology, and elevation, found within the boundaries of Fort Irwin. If potential habitat for the Lane Mountain milk-vetch is found, the Army will attempt to reduce training in the area by reclassifying the area as “No Dig.” If reclassification is possible and does not limit the Army’s mission, the Army will erect signs and siebert stakes around the periphery of the area and notify Integrated Training Area Management GIS so that the reclassification will appear on the next update of the range map.

10. Conserving host plants and using the viability of host plants as an indicator of ecosystem health in Lane Mountain milk-vetch habitat.

11. Erecting passive dust monitoring stations so that dust deposition can be monitored for impacts to the Lane Mountain milk-vetch from fugitive dust.

12. Appling soil binders to main supply routes and battalion staging areas to reduce dust production.

13. Monitoring and controlling invasive plants and weeds and monitoring and mapping the spread of exotic species in Lane Mountain milk-vetch habitat.

Re-initiation Threshold

As part of its proposed action, the Army will re-initiate formal consultation if it finds 10 desert tortoises that are 180 millimeters or larger that have died because of its use of the Western Training Area and operations and activities in any calendar year within Fort Irwin, along the Manix Trail, or during translocation. The Army cannot monitor the training activities in a practical or reasonable manner that would allow it to find most desert tortoises that die because they are struck by vehicles or ordnance, crushed or entrapped in burrows, or because of some other aspect of training. Large-scale training activities occur over wide areas and at great intensity; on-site monitoring during training could not cover such large areas and would be dangerous to monitors. Post-training monitoring is impractical because of the large areas involved; additionally, scavengers remove the carcasses of any animal soon after death. We recognize that the Army would not find every desert tortoise that dies because of its activities.

At Fort Irwin, all personnel conducting support activities within desert tortoise habitat and undergoing training receive detailed instruction on the environment in which they will be working or training. This instruction includes direction on the appropriate procedures to follow when they encounter a dead or live desert tortoise. The Army will use this reporting system with regard to desert tortoises that may die because of its activities to assess whether it is approaching or has reached the threshold discussed in the previous paragraph.

“During translocation” refers to desert tortoises that die directly because of the translocation process; it does not refer to animals that may die while in the wild after their release. For example, we would consider a desert tortoise to have died during translocation if a biologist left it in a container and it overheated during its processing. The public regularly uses the Manix

Trail outside of Fort Irwin. For that reason, the Army, Service, and Bureau will use the best available information to determine the cause of mortality of any dead desert tortoises found on the portion of the trail outside of Fort Irwin. We have based this re-initiation criterion on desert tortoises of this size because the best available information indicates that surveyors do not see desert tortoises that are smaller than 180 millimeters with the same frequency that they see the large animals (Service 2018).

When it finds a dead desert tortoise, the Army will endeavor to determine the cause and time of death. The Service and Army will consider only desert tortoises that likely died because of Army activities within approximately a year of the time of their finding to apply to the re-initiation criterion.

We have not established a re-initiation criterion for moving desert tortoises from harm's way because we expect those desert tortoises will survive.

Based on past monitoring, we also expect that survival rates will not differ significantly among translocated, resident, and control desert tortoises. Resident desert tortoises are those animals within their home ranges with translocated individuals nearby; control desert tortoises are animals within their home ranges with no translocated individuals nearby. The Army and Service have agreed to develop a monitoring program for desert tortoises from the Western Training Area that will provide additional information on how desert tortoises react to translocation in the long term. To this end, the Army, Service, and U.S. Geological Survey will base a monitoring program on the metrics described in Table 2 of the Service's (2019c) draft translocation protocol. These metrics include comparing the survival and growth rates and evidence of reproduction of translocated and resident individuals. The Service will review this translocation plan; the Army will not translocate desert tortoises until receiving the Service's approval. Translocation onto Bureau-managed lands requires the review and approval by the Bureau. On a case-by-case basis, the Army and Service, in consultation with Bureau, if Bureau-managed lands are involved, may agree to incorporate desert tortoises translocated from other areas of Fort Irwin into other monitoring efforts that may be in progress at the time.

The translocation plan will contain detailed criteria for determining when re-initiation of consultation is appropriate, based on the metrics of success that it will include. If translocation activities directly kill desert tortoises (*e.g.*, if a desert tortoise is crushed by a vehicle that is moving desert tortoises), that mortality would apply to the annual threshold of 10.

Methodology and Reporting

The Army and Service based the methodology on the procedures described in the "Minimizing Impacts to Desert Tortoises during Activities on Fort Irwin" section of this biological opinion.

Activities in Previously Disturbed Areas: In such cases, the Army will move the desert tortoise from harm's way. The soldier or worker moving the desert tortoise will provide the date, time, location, and approximate size of the desert tortoise to the appropriate contact in Fort Irwin's Natural Resources Office. Staff in the Natural Resources Office will compile these data for the annual report.

Intermittent or Occasional Training in Areas with Suitable Habitat: In these situations, the Army will follow the procedures described in the previous paragraph. We consider suitable habitat for desert tortoises to occur in those areas that support its forage species, suitable substrates for burrowing or caliche caves, and shrub cover. The Service and Army recognize that no clear line exists between Previously Disturbed Areas and suitable habitat. The Army's Natural Resources Manager will be responsible for reaching this determination with regard to its activities; the Army may request our technical assistance if it so desires.

Routine Training with Vehicles or Infrastructure Projects in Areas with Suitable Habitat: The Army will work with the Service early in its planning processes to determine the appropriate protective measures to implement. Once the agencies have discussed the situation and determined a course of action, the Army will implement the guidance described in the "Minimizing Impacts to Desert Tortoises during Activities on Fort Irwin" section of this biological opinion for this class of activity. The Service and Army intend that they will resolve these situations as much as reasonably possible without re-initiating formal consultation. If the resolution requires the Army to translocate desert tortoises to other locations, the Army will provide the same information as above, plus the location of the release site(s), tag number(s), and the results of health assessments of the individuals to the Service and Bureau. Staff in the Natural Resources Office will compile these data for the annual report.

The Army will provide the Service and the Bureau with an annual report of the activities that it conducts under the auspices of this consultation by January 31 of each year this biological opinion is in effect. The annual report will include information on any activity in which anyone contacts a desert tortoise when training or working on Army activities associated with Fort Irwin. For example, if someone contacts a desert tortoise on the Manix Trail outside the boundaries of Fort Irwin, they will report that information.

ACTION AREA

The "action area" refers to "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 Code of Federal Regulations (CFR) 402.02). The action area for the proposed action comprises Fort Irwin, the Manix Trail, lands outside of Fort Irwin to which the Army may translocate desert tortoises from Fort Irwin, and the areas in which recovery actions are likely to occur.

ANALYTICAL FRAMEWORK FOR THE JEOPARDY AND ADVERSE MODIFICATION DETERMINATIONS

Jeopardy Determination

Section 7(a)(2) of the Endangered Species Act requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of listed species. "Jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02).

The jeopardy analysis in this biological opinion relies on four components:

1. The Status of the Species, which describes the range-wide condition of the species, the factors responsible for that condition, and its survival and recovery needs;

2. The Environmental Baseline, which analyzes the condition of the species in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the species;

3. The Effects of the Action, which are all consequences to the species caused by the proposed action that are reasonably certain to occur; and

4. The Cumulative Effects, which evaluates the effects of future, non-Federal activities in the action area on the species.

For the section 7(a)(2) determination regarding jeopardizing the continued existence of the species, the Service begins by evaluating the effects of the proposed Federal action and the cumulative effects. The Service then examines those effects against the current status of the species to determine if implementation of the proposed action is likely to reduce appreciably the likelihood of both the survival and recovery of the species in the wild.

Adverse Modification Determination

Section 7(a)(2) of the Endangered Species Act requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to destroy or to adversely modify designated critical habitat. "Destruction or adverse modification" of critical habitat means a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species (50 CFR 402.02).

The analysis regarding the destruction or adverse modification of critical habitat determination in this biological opinion relies on four elements:

1. The Status of Critical Habitat, which describes the range-wide condition of critical habitat in terms of the physical and biological features that provide for the conservation of the listed species, the factors responsible for that condition, and the intended recovery function of the critical habitat overall;

2. The Environmental Baseline, which analyzes the condition of the critical habitat in the action area, the factors responsible for that condition, and the value of the critical habitat in the action area for the conservation of the listed species;

3. The Effects of the Action, which are all consequences to critical habitat caused by the proposed action that are reasonably certain to occur; and

4. The Cumulative Effects, which evaluate the effects on critical habitat of future non-Federal activities that are reasonably certain to occur in the action area.

For the section 7(a)(2) determination regarding the destruction or adverse modification of critical habitat, the Service begins by evaluating the effects of the proposed Federal action and the cumulative effects. The Service then examines those effects against current status of the critical habitat to determine if implementation of the proposed action appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species.

STATUS OF THE SPECIES AND CRITICAL HABITAT

Desert Tortoise

Listing History

The Service listed the Mojave population of desert tortoise (all desert tortoises north and west of the Colorado River in Arizona, Utah, Nevada, and California) as threatened on April 2, 1990 [55 Federal Register (FR) 12178].

Recovery Plan

In the revised recovery plan for the desert tortoise, the Service (2011) identified the need for "conservation areas" to protect existing desert tortoise populations and habitat. Box 2 and Figure 2 in the recovery plan (Service 2011) describe and depict these areas in a generalized manner, respectively.

The revised recovery plan lists three objectives and associated criteria to achieve delisting. The first objective is to maintain self-sustaining populations of desert tortoises within each recovery unit into the future. The criterion is that the rates of population change for desert tortoises are increasing over at least 25 years (i.e., a single generation), as measured by extensive, range-wide monitoring across conservation areas within each recovery unit and by direct monitoring and estimation of vital rates (recruitment, survival) from demographic study areas within each recovery unit.

The second objective addresses the distribution of desert tortoises. The goal is to maintain well-distributed populations of desert tortoises throughout each recovery unit; the criterion is that the distribution of desert tortoises throughout each conservation area increase over at least 25 years.

The final objective is to ensure that habitat within each recovery unit is protected and managed to support long-term viability of desert tortoise populations. The criterion is that the quantity of desert tortoise habitat within each conservation area be maintained with no net loss until population viability is ensured.

The revised recovery plan (Service 2011) also recommends connecting blocks of desert tortoise habitat, such as critical habitat units and other important areas, to maintain gene flow between populations. Linkages defined using least-cost path analysis (Averill-Murray *et al*. 2013) illustrate a minimum connection of habitat for desert tortoises between blocks of habitat and represent priority areas for conservation of population connectivity.

Threats

The threats described in the listing rule and both recovery plans (Service 1994, 2011) continue to affect the species. The most apparent threats to the desert tortoise are those that result in mortality and permanent habitat loss across large areas, such as urbanization and large-scale renewable energy projects and those that fragment and degrade habitats, such as proliferation of roads and highways, off-highway vehicle activity, wildfire, and habitat invasion by non-native invasive plant species.

We remain unable to precisely quantify how particular threats affect desert tortoise populations relative to other threats. The assessment of the original recovery plan emphasized the need for a better understanding of the implications of multiple, simultaneous threats facing desert tortoise populations and of the relative contribution of multiple threats on demographic factors (i.e., birth rate, survivorship, fecundity, and death rate; Tracy *et al*. 2004).

For example, we have long known that the construction of a transmission line can result in the death of desert tortoises and loss of habitat. We have also known that common ravens (*Corvus corax*), known predators of desert tortoises, use transmission line pylons for nesting, roosting, and perching and that the access routes associated with transmission lines provide a vector for the introduction and spread of invasive weeds and facilitate increased human access into an area. Increased human access can accelerate illegal collection and release of desert tortoises and their deliberate maiming and killing, as well as facilitate the spread of other threats associated with human presence, such as vehicle use, garbage and dumping, and invasive plants (Service 2011). Changes in the abundance of native plants, because of invasive weeds, can compromise the physiological health of desert tortoises, making them more vulnerable to drought, disease, and predation.

Five-Year Review

Section 4(c)(2) of the Endangered Species Act requires the Service to conduct a status review of each listed species once every 5 years. The purpose of a 5-year review is to evaluate whether the species' status has changed since listing (or since the most recent 5-year review); these reviews, at the time of their completion, provide the most up-to-date information on the range-wide status of the species. For this reason, we are incorporating the 5-year review of the status of the desert tortoise (Service 2010) by reference to provide most of the information needed for this section of the biological opinion. The following paragraphs provide a summary of the relevant information in the 5-year review, updated as appropriate with the best available information.

In the 5-year review, the Service discusses the status of the desert tortoise as a single distinct population segment and provides information on the Federal Register notices that resulted in its listing and the designation of critical habitat. The Service also describes the desert tortoise's ecology, life history, spatial distribution, abundance, habitats, and the threats that led to its listing (i.e., the five-factor analysis required by section 4(a)(1) of the Endangered Species Act). In the 5-year review, the Service concluded by recommending that the status of the desert tortoise as a threatened species be maintained.

With regard to the status of the desert tortoise as a distinct population segment, the Service concluded in the 5-year review that the recovery units recognized in the original and revised recovery plans (Service 1994 and 2011, respectively) do not qualify as distinct population segments under the Service's distinct population segment policy (61 FR 4722; February 7, 1996). We reached this conclusion because individuals of the listed taxon occupy habitat that is relatively continuously distributed, exhibit genetic differentiation that is consistent with isolation-by-distance in a continuous-distribution model of gene flow, and likely vary in behavioral and physiological characteristics across the area they occupy as a result of the transitional nature of, or environmental gradations between, the described subdivisions of the Mojave and Colorado deserts.

The Service summarizes information in the 5-year review with regard to the desert tortoise's ecology and life history. Of key importance to assessing threats to the species and to developing and implementing a strategy for recovery is that desert tortoises are long lived, require up to 20 years to reach sexual maturity, and have low reproductive rates during a long period of reproductive potential. The number of eggs that a female desert tortoise can produce in a season is dependent on a variety of factors including environment, habitat, availability of forage and drinking water, and physiological condition. Predation seems to play an important role in clutch failure. Predation and environmental factors also affect the survival of hatchlings. The Service notes in the 5-year review that the combination of the desert tortoise's late breeding age and a low reproductive rate challenges our ability to recover the species.

The 5-year review also notes that desert tortoises increase their reproduction in high rainfall years; more rain provides desert tortoises with more high quality food (i.e., plants that are higher in water and protein), which, in turn, allows them to lay more eggs. Conversely, the physiological stress associated with foraging on food plants with insufficient water and nitrogen may leave desert tortoises vulnerable to disease, and the reproductive rate of diseased desert tortoises is likely lower than that of healthy animals. Young desert tortoises also rely upon high-quality, low-fiber plants (e.g., native annual plants) with nutrient levels not found in the invasive weeds that have increased in abundance across its range (Oftedal *et al*. 2002; Tracy *et al*. 2004). Compromised nutrition of young desert tortoises likely represents an effective reduction in reproduction by reducing the number of animals that reaches adulthood. Consequently, although we do not have quantitative data that show a direct relationship, the abundance of weedy species within the range of the desert tortoise has the potential to affect the reproduction of desert tortoises and recruitment into the adult population in a negative manner.

"Adult" desert tortoise connotes reproductive maturity. Desert tortoises may become reproductive at various sizes. We have used the term "adult" in this biological opinion to indicate reproductive status. In range-wide monitoring and for pre-project surveys, the Service uses 180 millimeters as its cut-off length for counting desert tortoises, because the best available information indicates that surveyors do not see desert tortoises that are smaller than 180 millimeters with the same frequency that they see larger desert tortoises (Service 2019c).

The vast majority of threats to the desert tortoise or its habitat are associated with human land uses. Using captive neonate and yearling desert tortoises, Drake *et al*. (2016) found that individuals "eating native forbs had better body condition and immune functions, grew more, and had higher survival rates (>95%) than [desert] tortoises consuming any other diet"; health and body condition declined in individuals fed only grasses (native or non-native). Current information indicates that invasive species likely affect a large portion of the desert tortoise's range. Furthermore, high densities of weedy species increase the likelihood of wildfires; wildfires, in turn, destroy native species and further the spread of invasive weeds.

Drake *et al*. (2015) "compared movement patterns, home-range size, behavior, microhabitat use, reproduction, and survival for adult desert tortoises located in, and adjacent to, burned habitat" in Nevada. They noted that the fires killed many desert tortoises but found that, in the first 5 years post-fire, individuals moved deeper into burned habitat on a seasonal basis and foraged more frequently in burned areas (corresponding with greater production of annual plants and herbaceous perennials in these areas). Production of annual plants upon which desert tortoises feed was 10 times greater in burned versus unburned areas but was dominated by non-native species (e.g., red brome [*Bromus rubens*]) that frequently have lower digestibility than native vegetation. During years six and seven, the movements of desert tortoises into burned areas contracted with a decline in the live cover of a perennial forage plant that rapidly colonizes burned areas. Drake *et al*. (2015) did not find any differences in health or survivorship for desert tortoises occupying either habitat (burned or unburned) during this study or in reproduction during the seventh year after the fire.

Since the completion of the 5-year review, the Service has issued several biological opinions that affect large areas of desert tortoise habitat because of numerous proposals to develop renewable energy within its range. These biological opinions concluded that proposed solar plants were not likely to jeopardize the continued existence of the desert tortoise primarily because they were located outside of critical habitat and areas of critical environmental concern designated by the Bureau that contain most of the land base required for the recovery of the species. The proposed actions also included numerous measures intended to protect desert tortoise during the construction of the projects, such as translocation of affected individuals. In aggregate, these projects would result in an overall loss of approximately 73,644 acres of habitat of the desert tortoise. We also predicted that the project areas supported up to 19,896 desert tortoises; we concluded that most of these individuals were small desert tortoises, that most large desert tortoises would likely be translocated from project sites, and that most mortalities would be small desert tortoises (< 180 millimeters) that were not detected during clearance surveys. To date, 661 desert tortoises have been observed during construction of solar projects (see Appendix B); most of these individuals were translocated from work areas, although some desert tortoises have been killed. The mitigation required by the Bureau and California Energy Commission (the agencies permitting some of these facilities) resulted in the acquisition of private land and funding for the implementation of various actions that are intended to promote the recovery of the desert tortoise. These mitigation measures are consistent with recommendations in the recovery plans for the desert tortoise; many of the measures have been derived directly from the recovery plans and the Service supports their implementation. We expect that, based on the best available scientific information, they will result in conservation benefits to the desert tortoise; however, it is difficult to assess how desert tortoise populations will respond because of the long generation time of the species.

In August 2016, the Service (2016) issued a biological opinion to the Bureau for a land use plan amendment under the Desert Renewable Energy Conservation Plan. The land use plan amendment addressed all aspects of the Bureau's management of the California Desert Conservation Area; however, the Service and Bureau agreed that only those aspects related to the construction, operation, maintenance, and decommissioning of renewable energy facilities were likely to adversely affect the desert tortoise. The land use plan amendment resulted in the designation of approximately 388,000 acres of development focus areas where the Bureau would apply a streamlined review process to applications for projects that generate renewable energy; the Bureau estimated that approximately 11,290 acres of modeled desert tortoise habitat within the development focus areas would eventually be developed for renewable energy. The Bureau also adopted numerous conservation and management actions as part of the land use plan amendment to further reduce the adverse effects of renewable energy development on the desert tortoise.

The land use plan amendment also increased the amount of land that the Bureau manages for conservation in California (e.g., areas of critical environmental concern, California Desert National Conservation Lands, etc.) from 6,118,135 to 8,689,669 acres (Bureau 2015); not all of the areas subject to increased protection are within desert tortoise habitat. The Bureau will also manage lands outside of development focus areas according to numerous conservation and management actions; these conservation and management actions are more protective of desert tortoises than direction contained in the previous land use plan. The Service (2016) concluded that the land use plan amendment was not likely to jeopardize the continued existence of the desert tortoise and would benefit its recovery; the Service also concluded that the proposed action was not likely to result in the destruction or adverse modification of critical habitat.

In addition to the biological opinions issued for solar development within the range of the desert tortoise, the Service (2012) also issued a biological opinion to the Department of the Army (Army) for the use of additional training lands at Fort Irwin. As part of this proposed action, the Army translocated approximately 650 adult desert tortoises from 18,197 acres of the southern area of Fort Irwin, which had been off-limits to training, to lands south of the base that are managed by the Bureau and the Army. The Army would also use an additional 48,629 acres that lie east of the former boundaries of Fort Irwin; much of this parcel is either too mountainous or too rocky and low in elevation to support numerous desert tortoises. As part of the proposed action, the Army also acquired approximately 100,000 acres of non-federal land within the Superior-Cronese Critical Habitat Unit for management for conservation of desert tortoises. It also purchased the base property of three cattle allotments; the Bureau subsequently re-allotted the forage on those allotments to wildlife. The Army also funded several other activities aimed at conserving desert tortoises in the Western Mojave Recovery Unit.

The Service also issued a biological opinion to the Department of the Navy (Navy) that considered the effects of the expansion of the Marine Corps Air Ground Combat Center at Twentynine Palms (Service 2017). We concluded that the Navy's proposed action, the use of approximately 167,982 acres of public and private land for training, was not likely to jeopardize the continued existence of the desert tortoise. Most of the expansion area lies within the Johnson Valley Off-highway Vehicle Recreation Area. As part of this proposed action, the Navy translocated 998 adult desert tortoises from the expansion area to 4 recipient sites to the north and east of the expansion area (Henen 2019). The Lucerne-Ord and Siberia sites are entirely within Bureau-managed lands, and the Rodman-Sunshine Peak North and Cleghorn sites overlap Bureau-managed lands and lands managed by the Navy. The Lucerne-Ord site lies within the Ord-Rodman Area of Critical Environmental Concern. The Navy translocated desert tortoises from the Johnson Valley Off-highway Vehicle Recreation Area into populations that were below the Service's established minimum viable density, to attempt to augment these populations and make them more viable in the long-term.

The Service also issued a biological opinion to the Navy that considered the effects of the expansion of the Naval Air Weapons Station at China Lake (Service 2019a). We concluded that the Navy's proposed action, the use of approximately 2,777 acres of the 26,509-acre Cuddeback Range expansion area, was not likely to jeopardize the continued existence of the desert tortoise. The Cuddeback Range lies within the Superior-Cronese Critical Habitat Unit. However, all of the disturbance would occur in a previously disturbed area that the U.S. Air Force historically used as a target zone. The Navy will include the entire Cuddeback Range in its Integrated Natural Resource Management Plan and construct a perimeter fence around the range to prevent trespass by the public. These actions will provide conservation benefits for plants, fish, and wildlife within the area, including the desert tortoise. Because the Navy will not disturb most of the area, it did not translocate any desert tortoises as part of this action.

The incremental effect of the larger actions (i.e., solar development, the expansions of Fort Irwin and the Marine Corps Air Ground Combat Center) on the desert tortoise is unlikely to be positive, despite the numerous conservation measures that have been (or will be) implemented as part of the actions. The acquisition of private lands as mitigation for most of these actions increases the level of protection afforded these lands; however, these acquisitions do not create new habitat and federal, state, and privately managed lands remain subject to most of the threats and stresses we discussed previously in this section. Land managers have been implementing measures to manage these threats and we expect, based on the best available scientific information, that such measures provide conservation benefits to the desert tortoise. We have been unable, to date, to determine whether desert tortoise populations have benefited from the measures. This is partly because of the low reproductive capacity of the desert tortoise. Therefore, the conversion of habitat into areas that are unsuitable for this species continues the trend of constricting the desert tortoise into a smaller portion of its range.

As the Service notes in the 5-year review (Service 2010), "[t]he threats identified in the original listing rule continue to affect the [desert tortoise] today, with invasive species, wildfire, and renewable energy development coming to the forefront as important factors in habitat loss and conversion," and "[t]he vast majority of threats to the desert tortoise or its habitat are associated with human land uses."

Recently, illegal marijuana-growing operations have disturbed thousands of acres of desert scrub habitat in the desert portions of Kern, Los Angeles, and San Bernardino counties. Typically, the growers seek out private land, cultivate a single crop, and then abandon the facility. Given the scale and location of these operations, they have almost certainly killed desert tortoises while preparing sites and while travelling to and from the facilities. The California Department of Fish and Wildlife and local law enforcement are attempting to control these illegal activities.

Climate change is likely to affect the prospects for the long-term conservation of the desert tortoise. Climate change is likely to influence the amount of precipitation within the range of the desert tortoise. Models suggest that temperatures are likely to increase (Christensen *et al*. 2007; Seager *et al*. 2007 and Archer and Predick 2008 in Mitchell *et al*. 2021). Models also suggest changes in precipitation; Guida *et al*. (2019 in Mitchell *et al*. 2021) noted a 20 percent reduction in precipitation in the last 100 years. Other "climate projections disagree about whether precipitation will increase or decrease for this region" (Bachelet *et al*. 2016 in Mitchell *et al*. 2021).

We do not know the effect of increased temperatures on hatchling sex ratios and about the effect of decreased precipitation or increased drought frequency on the egg production and survival of all age classes of desert tortoises (Service 2010, 2011). Research suggests that desert tortoises will produce and lay eggs earlier in a warming climate (Lovich et al. 2012), which could lead to increased annual egg production by providing more time for females to lay additional clutches in a year (Wallis et al. 1999). Shifts in egg production and nesting might not compensate for changes in the environment, depending on factors such as the time nests spend above the critical thermal maximum temperature for eggs and whether the availability of forage necessary to provide the nutrients for egg production synchronizes with shifts in the activity patterns of desert tortoises (Lovich et al. 2017). In addition, declining reproductive output across much of the desert tortoise's range, as estimated between 1990 and 2018, could have a negative population-level effect, especially if precipitation is significantly reduced across the species' range as predicted under some climate models (Mitchell *et al*. 2021). Human-subsidized predation pressure on juvenile desert tortoises, especially by common ravens, will compound the effects of any reduction in reproductive output.

Local-level models projected substantial reductions in and movement upslope of suitable desert tortoise habitat under the anticipated effects of climate change. For example, at moderate predictions of climate change (+2°C maximum July temperature, –50 millimeters annual precipitation), modeled desert tortoise habitat shrank by nearly 66 percent in the Mojave Desert portion of Joshua Tree National Park and nearly 88 percent in its Sonoran Desert portion (Barrows 2011). Similarly, projections of 1 to 3°C warmer maximum July temperatures resulted in modeled habitat reductions of 24 and 55 percent, respectively, in the vicinity of the Marine Corps Air Ground Combat Center at Twentynine Palms (Barrows *et al*. 2016). Models of the region surrounding Lake Mead National Recreation Area using a similar range of climate projections as those above predicted habitat reductions of up to 77 percent (Barrows and Murphy 2011). Much of the predicted habitat east of the Colorado River shifted upslope away from Lake Mead National Recreation Area onto adjacent BLM lands under the warmer and drier scenarios (Barrows and Murphy 2011).

Currently, two research projects are investigating implications of climate change across the desert tortoise's range. One is investigating how both land use and climate change will affect gene flow and corridor functionality using present and future habitat models (Heaton 2020). The other began with the premise that reliance on standard habitat models for performing climate vulnerability assessments may overestimate the risk from climate change because such assessments place more focus on the nature and magnitude of exposure to change than species' adaptive capacity to change. This project is using data collected across the broadest possible range of environmental conditions to estimate population growth rates of desert tortoises as a function of inter-correlated vital rates, body condition, and spatiotemporally varying environmental conditions; the researchers then plan to assess metapopulation viability under multiple plausible future scenarios (Shoemaker 2020). Both projects are scheduled for completion in mid-2022.

Core Criteria for the Jeopardy Determination

When determining whether a proposed action is likely to jeopardize the continued existence of a species, we are required to consider whether the action "reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). We have used the best available information to summarize the status of the desert tortoise with respect to its reproduction, numbers, and distribution.

Reproduction

In the 5-year review, the Service notes that desert tortoises increase their reproduction in high rainfall years; more rain provides desert tortoises with more high quality food (i.e., plants that are higher in water and protein), which, in turn, allows them to lay more eggs. Conversely, the physiological stress associated with foraging on food plants with insufficient water and nitrogen may leave desert tortoises vulnerable to disease (Oftedal *et al*. 2002), and the reproductive rate of diseased desert tortoises is likely lower than that of healthy animals. Young desert tortoises also rely upon high-quality, low-fiber plants (e.g., native annual plants) with nutrient levels not found in the invasive weeds that have increased in abundance across its range (Oftedal *et al*. 2002; Tracy *et al*. 2004). Compromised nutrition of young desert tortoises likely represents an effective reduction in reproduction by reducing the number of animals that reaches adulthood; see previous information from Drake *et al*. (2016). Consequently, although we do not have quantitative data that show a direct relationship, the abundance of weedy species within the range of the desert tortoise has the potential to affect the reproduction of desert tortoises and recruitment into the adult population in a negative manner.

Various human activities have introduced numerous species of non-native invasive plants into the California desert. Routes that humans use to travel through the desert (paved and unpaved roads, railroads, motorcycle trails, etc.) serve as pathways for new species to enter habitat of the desert tortoise and for species that currently occur there to spread. Other disturbances of the desert substrate also provide invasive species with entry points into the desert. The abundance and distribution of invasive weeds may compromise, at least to some degree in localized areas across its range, the reproductive capacity of the desert tortoise; the continued increase in human access across the desert likely continues to facilitate the spread of weeds and further affect the reproductive capacity of the species.

Numbers

In the 5-year review, the Service discusses various means by which researchers have attempted to determine the abundance of desert tortoises and the strengths and weaknesses of those methods. Due to differences in area covered and especially to the non-representative nature of earlier study sites, data gathered by the Service's current range-wide monitoring program cannot be reliably compared to information gathered through other means at this time.

Data from small-scale study plots (e.g., one square mile) established as early as 1976 and surveyed primarily through the mid-1990s indicate that localized population declines occurred at many sites across the desert tortoise's range, especially in the western Mojave Desert. Spatial analyses of more widespread surveys also found evidence of relatively high mortality in some parts of the range (Tracy *et al*. 2004). Although we cannot extrapolate population densities from the local study plots to provide an estimate of the number of desert tortoises on a range-wide basis, historical densities in some parts of the desert exceeded 38 per square kilometer; Tracy *et al*. 2004). The Service (2010) concluded that "appreciable declines at the local level in many areas, which coupled with other survey results, suggest that declines may have occurred more broadly."

The range-wide monitoring that the Service initiated in 2001 is the first comprehensive attempt to determine the densities of desert tortoises in conservation areas across their range. Allison and McLuckie (2018) used annual density estimates obtained from this monitoring effort to evaluate range-wide trends in the density of desert tortoises over time. (All references to the density of desert tortoises within each monitoring area are averages. Some local areas within each monitoring area support higher densities and some lower; desert tortoises do not occur in uniform densities across large areas.) This analysis indicates that densities in the Northeastern Mojave Recovery Unit have increased since 2004, with the increase apparently resulting from increased survival of adults and sub-adults moving into the adult size class. The analysis also indicates that the populations in the other four recovery units are declining; Table 1 depicts the estimated abundance of desert tortoises within the recovery units and the change in abundance. Surveys did not include the steepest slopes in these desert tortoise conservation areas; however, the model developed by Nussear *et al*. (2009) generally rates steep slopes as less likely to support desert tortoises.

Table 1. Change in desert tortoise abundance in recovery units (Allison and McLuckie 2018)*.

Recovery Units	Modeled Habitat (km^2)	2004 Abundance	2014 Abundance	Change in Abundance
Western Mojave	23,139	131,540	64,871	-66,668
Colorado Desert	18,024	103,675	66,097	-37,578
Northeastern Mojave	10,664	12,610	46,701	+34,091

Eastern Mojave	16,061	75,342	24,664	-50,679
Upper Virgin River	613	13,226	10,010	-3,216
Total	68,501	336,393	212,343	-124,050

* Allison and McLuckie (2018) used modeled habitat within the entire range of the desert tortoise for this estimate. In other discussions in this biological opinion, we used information only from the area of monitored habitat within desert tortoise conservation areas to estimate the number of desert tortoises in the recovery unit.

To further assess the status of the desert tortoise, the Desert Tortoise Recovery Office (Service 2015a) used multi-year trends from the best-fitting model describing log-transformed density of adult animals per square kilometer. In 2014, three of the five recovery units supported densities below 3.9 adult animals per square kilometer [Western Mojave (2.8), Eastern Mojave (1.5), and Colorado Desert (3.7); see Table 10 in Service 2015b], which is the minimum density recommended to avoid extinction in the 1994 recovery plan. The Northeastern Mojave Recovery Unit supported 4.4 adult desert tortoises per square kilometer and the Upper Virgin River Recovery Unit, which is by far the smallest recovery unit, supported 15.3 adults per square kilometer.

Allison and McLuckie (2018) considered the declines of adult desert tortoises in the Western Mojave and Eastern Mojave recovery units and concluded that these “steep declines” in density are sustainable only if reproduction and the growth and survival of juveniles improved greatly. (Allison and McLuckie used 180 millimeters as the separation point between large and small desert tortoises.) However, they note, “the proportion of juveniles has not increased anywhere since 2007, and in these two recovery units the proportion of juveniles in 2014 has declined to 91% and 77% of their representation in 2004, respectively.” In short, as of 2014, small desert tortoises were not moving into the large cohort at a rate that was sufficient to reverse declines.

Distribution

The Service (2010) concluded in its 5-year review that the distribution of the desert tortoise has not changed substantially since the publication of the original recovery plan in 1994 in terms of the overall extent of its range. Prior to 1994, urban and agricultural development, military training, and off-road vehicle use extirpated desert tortoises from large areas within their distributional limits. For example, the cities of Barstow, Lancaster, Las Vegas, and St. George, agricultural areas south of Edwards Air Force Base, the National Training Center at Fort Irwin, and portions of off-road recreation areas managed by the Bureau are located within the range of the desert tortoise. Unauthorized off-highway vehicle use in areas such as east of California City has also affected the distribution of the desert tortoise.

Urban development around Las Vegas has likely been the largest contributor to habitat loss throughout the range since 1994. Desert tortoises have essentially been removed from the 18,197-acre southern expansion area at Fort Irwin (Service 2012). The development of large solar facilities has also reduced the amount of habitat available to desert tortoises. No solar facilities have been developed within areas of critical environmental concern that the Bureau has designated for the desert tortoise in California, although such projects have occurred in areas that the Service considers important linkages between conservation areas (e.g., Silver State South Project in Nevada).

In recognition of the absence of specific and recent information on the location of habitable areas within the Mojave Desert, especially at the outer edges, Nussear *et al*. (2009) developed a quantitative, spatial habitat model for the desert tortoise north and west of the Colorado River. The model incorporates environmental variables such as precipitation, geology, vegetation, and slope and uses occurrence data of desert tortoises from sources spanning more than 80 years, including data from the 2001 to 2008 range-wide monitoring surveys. The model predicts the relative potential for desert tortoises to be present in any given location, given the combination of habitat variables at that location in relation to areas of known occupancy throughout the range. Calculations of the amount of desert tortoise habitat in the 5-year review (Service 2010) and in this biological opinion use a threshold of 0.5 or greater predicted value for potential desert tortoise habitat. The model does not account for anthropogenic effects to habitat and represents the potential for occupancy by desert tortoises absent these effects.

Table 2 depicts acreages of habitat (as modeled by Nussear *et al*. 2009, using only areas with a probability of occupancy by desert tortoises greater than 0.5 as potential habitat) within the recovery units of the desert tortoise and of impervious surfaces as of 2006 (Fry *et al*. 2011); calculations are by Darst (2014). Impervious surfaces include paved and developed areas and other disturbed areas that have zero probability of supporting desert tortoises. All units are in acres.

Table 2. Modeled habitat of the desert tortoise; all units are in acres.

Recovery Units	Modeled Habitat	Impervious Surfaces (percentage)	Remaining Modeled Habitat
Western Mojave	7,585,312	1,989,843 (26)	5,595,469
Colorado Desert	4,950,225	510,862 (10)	4,439,363
Northeastern Mojave	3,012,293	386,182 (13)	2,626,111
Eastern Mojave	4,763,123	825,274 (17)	3,937,849
Upper Virgin River	231,460	84,404 (36)	147,056
Total	20,542,413	3,796,565 (18)	16,745,848

Since 2010, we again conclude that the species’ distribution has not changed substantially in terms of the overall extent of its range. However, solar facilities, military activities, and other developments have removed desert tortoises from several thousand acres within their range.

Summary of the Status of the Desert Tortoise

As noted in the 5-year review and revised recovery plan for the desert tortoise (Service 2010, 2011), the desert tortoise is subject to landscape-level impacts in addition to the site-specific effects of individual human activities. Land managers have undertaken actions to improve the status of the desert tortoise. For example, as part of its efforts to offset the effects of the use of additional training maneuver lands at Fort Irwin (Service 2004), the Department of the Army acquired the private interests in the Harper Lake and Cronese Lakes allotments, which are located within critical habitat in the Western Mojave Recovery Unit; as a result, cattle have been removed from these allotments. The retirement of allotments assists in the recovery of the desert tortoise by eliminating sources of mortality (e.g., trampling by livestock, mortality from maintaining range improvements, reduction in subsidies to common ravens, etc.).

Federal and state agencies and non-governmental organizations have implemented numerous other activities to conserve desert tortoises. For example, they have acquired thousands of acres of habitat, installed fences to prevent desert tortoises from entering highways, begun to control common ravens, and implemented other actions recommended in the recovery plan (Service 2011). However, desert tortoise numbers continue to decline. We expect that drought and mortality from human activities and common ravens are the primary causes.

Critical Habitat of the Desert Tortoise

The Service designated critical habitat for the desert tortoise in portions of California, Nevada, Arizona, and Utah in a final rule published February 8, 1994 (59 FR 5820). The Service designates critical habitat to identify the key biological and physical needs of the species and key areas for recovery and to focus conservation actions on those areas. Within the geographical area occupied by the species at the time of listing, critical habitat is composed of specific geographic areas that contain the biological and physical features essential to the species' conservation and that may require special management considerations or protection. These features, which include space, food, water, nutrition, cover, shelter, reproductive sites, and special habitats, are called the physical and biological features of critical habitat. The specific physical and biological features of critical habitat of the desert tortoise are: sufficient space to support viable populations within each of the recovery units and to provide for movement, dispersal, and gene flow; sufficient quality and quantity of forage species and the proper soil conditions to provide for the growth of these species; suitable substrates for burrowing, nesting, and overwintering; burrows, caliche caves, and other shelter sites; sufficient vegetation for shelter from temperature extremes and predators; and habitat protected from disturbance and human-caused mortality.

Critical habitat of the desert tortoise would not be able to fulfill its intended recovery function without each of the physical and biological features being functional. For example, critical habitat would not function properly if a sufficient amount of forage species were present but human-caused mortality was excessive. A second example is that critical habitat could not fulfill its intended function for recovery if an area with sufficient space to support viable populations and to provide for movement, dispersal, and gene flow did not support adequate forage species.

The final rule for designation of critical habitat did not explicitly ascribe specific conservation roles or functions to the various critical habitat units. Rather, it refers to the strategy of establishing recovery units and “desert wildlife management areas” recommended by the recovery plan for the desert tortoise, which had been published as a draft at the time of the designation of critical habitat, to capture the “biotic and abiotic variability found in desert tortoise habitat” (59 FR 5823). Specifically, we designated the critical habitat units to follow the direction provided by the draft recovery plan for the establishment of desert wildlife management areas. The critical habitat units in aggregate are intended to protect the variability that occurs across the large range of the desert tortoise; the loss of any specific unit may compromise the ability of critical habitat as a whole to serve its intended function for recovery.

Since the designation of critical habitat, Congress increased the size of Joshua Tree National Park and created the Mojave National Preserve. A portion of the expanded boundary of Joshua Tree National Park lies within critical habitat of the desert tortoise; portions of other critical habitat units lie within the boundaries of the Mojave National Preserve. Critical habitat within Joshua Tree National Park would no longer be potentially available for multiple use, such as mineral development. Recreational use of the new portions of the park likely changed; we expect that activities associated with hiking likely increased to some degree, while dispersed camping and vehicle-based activity likely decreased. Recreational use of the critical habitat likely increased with the creation of Mojave National Preserve. Conversely, multiple use within critical habitat in the preserve decreased because some activities, such as mineral development, no longer occur. Utilities continue to operate with existing rights-of-way within the Mojave National Preserve; these operations generally have minor effects on critical habitat.

Congress also increased the size of the Johnson Valley Off-highway Vehicle Recreation Area through the passage of the Dingell Act in 2019. This act included 3,471 acres of the Ord-Rodman Critical Habitat Unit in the Johnson Valley Off-highway Vehicle Recreation Area, which represents approximately 1.37 percent of the 253,200-acre critical habitat unit. This action increased the likelihood that more intense vehicular recreation would occur within critical habitat; such recreation would degrade the physical and biological features of critical habitat. We do not know if the level of use has increased since the change in boundaries.

Within each critical habitat unit, both natural and anthropogenic factors affect the function of the physical and biological features of critical habitat. As an example of a natural factor, in some specific areas within the boundaries of critical habitat, such as within and adjacent to dry lakes, some of the physical and biological features are naturally absent because the substrate is extremely silty; desert tortoises do not normally reside in such areas. Comparing the acreage of desert tortoise habitat as depicted by Nussear *et al.*’s (2009) model to the gross acreage of the critical habitat units demonstrates quantitatively that the entire area within the boundaries of critical habitat likely does not support the physical and biological features. In Table 3, the acreage for modeled habitat is for the area in which the probability that desert tortoises are present is greater than 0.5. (We used the 0.5 probability here, rather than the 0.6 value we used to define conservation areas, to depict the broader area that most desert tortoises likely occupy, instead of the slightly more restricted area we consider important for conservation.) The acreages of modeled habitat do not include loss of habitat due to human-caused impacts. The difference between gross acreage and modeled habitat is 653,214 acres; that is, approximately 10 percent of the gross acreage of the designated critical habitat is unlikely to support the features of habitat that are conducive to the presence of desert tortoises.

Table 3. Acreage of gross and modeled habitat within critical habitat units for the desert tortoise. We have not adjusted the acreage for the Ord-Rodman Critical Habitat Unit in response to the Dingell Act. All units are in acres.

Critical Habitat Unit	Gross Acreage	Modeled Habitat
Superior-Cronese	766,900	724,967
Fremont-Kramer	518,000	501,095
Ord-Rodman	253,200	184,155
Pinto Mountain	171,700	144,056
Piute-Eldorado	970,600	930,008
Ivanpah Valley	632,400	510,711
Chuckwalla	1,020,600	809,319
Chemehuevi	937,400	914,505
Gold Butte-Pakoon	488,300	418,189
Mormon Mesa	427,900	407,041
Beaver Dam Slope	204,600	202,499
Upper Virgin River	54,600	46,441
Total	6,446,200	5,792,986

Human activities can have obvious or more subtle effects on the physical and biological features of critical habitat. The grading of an area and subsequent construction of a building removes physical and biological features; this action has an obvious effect on critical habitat. The revised recovery plan identifies human activities such as urbanization and the proliferation of roads and highways as threats to the desert tortoise and its habitat; these threats are examples of activities that have a clear effect on the physical and biological features of critical habitat.

Condition of the Physical and Biological Features of Critical Habitat

The revised recovery plan (Service 2011) discusses the importance of understanding the combined and synergistic effects of human activities on habitat of the desert tortoise. For example, surface disturbance causes increased rates of erosion and generation of dust. Increased erosion alters additional habitat outside of the area directly affected by altering the nature of the substrate, removing shrubs, and possibly destroying burrows and other shelter sites. Increased dust affects photosynthesis in the plants that provide cover and forage to desert tortoises.

Disturbed substrates and increased atmospheric nitrogen enhance the likelihood that invasive weeds will out-compete native species; the proliferation of weedy species increases the risk of large-scale fires, which further move habitat conditions away from those that are favorable to desert tortoises.

The following paragraphs generally describe how the threats described in the revised recovery plan affect the physical and biological features of critical habitat of the desert tortoise.

Sufficient space to support viable populations within each of the recovery units and to provide for movement, dispersal, and gene flow

Urban and agricultural development, concentrated use by off-road vehicles, illegal marijuana facilities, and other activities such as development of transmission lines and pipelines completely remove habitat. Although we are aware of local areas within the boundaries of critical habitat that have been heavily disturbed, we do not know of any areas that have been disturbed to the intensity and extent that compromise the function of this physical and biological feature. To date, the largest single loss of critical habitat is the use of 18,197 acres of additional training land in the southern portion of Fort Irwin. The congressional transfer of 3,471 acres of the Ord-Rodman Critical Habitat Unit to the Johnson Valley Off-highway Vehicle Recreation Area may reduce the space available to support viable populations within the Western Mojave Recovery Unit and to provide for movement, dispersal, and gene flow. The extent to which recreationists use the transferred area will determine the extent of the effect on this and the other physical and biological features.

The widening of existing freeways likely caused the second largest loss of critical habitat. Despite these losses of critical habitat, which occur in a linear manner, the critical habitat units continue to support sufficient space to support viable populations within each of the five recovery units.

In some cases, major roads likely disrupt the movement, dispersal, and gene flow of desert tortoises. State Route 58 and Highway 395 in the Fremont-Kramer Critical Habitat Unit, Fort Irwin Road in the Superior-Cronese Critical Habitat Unit, and Interstate 10 in the Chuckwalla Critical Habitat Unit are examples of large and heavily travelled roads that likely disrupt movement, dispersal, and gene flow. Roads that have been fenced and provided with underpasses may alleviate this fragmentation to some degree; however, such facilities have not been in place for sufficient time to determine whether they will eliminate fragmentation.

The threats of invasive plant species described in the revised recovery plan generally do not result in the removal of this physical and biological feature because they do not convert habitat into impervious surfaces, as would urban development.

Sufficient quality and quantity of forage species and the proper soil conditions to provide for the growth of these species

This physical and biological feature addresses the ability of critical habitat to provide adequate nutrition to desert tortoises. As described in the revised recovery plan and 5-year review, grazing, historical fire, invasive plants, altered hydrology, drought, wildfire potential, fugitive dust, and climate change/temperature extremes contribute to the stress of "nutritional compromise." Paved and unpaved roads through critical habitat of the desert tortoise provide avenues by which invasive native species disperse; these legal routes also provide the means by which unauthorized use occurs over large areas of critical habitat. Nitrogen deposition from atmospheric pollution likely occurs throughout all the critical habitat units and exacerbates the effects of the disturbance of substrates. Because paved and unpaved roads are widespread through critical habitat, this threat has adversely affected the value of critical habitat for conservation of the desert tortoise throughout its range, to some degree. Since the Service issued its recovery plans and 5-year review, illegal marijuana-growing facilities have removed this physical and biological feature from areas of critical habitat in the western Mojave Desert. These facilities remove the third through fifth physical and biological features from areas also; we will not repeat this information for those physical and biological features.

Suitable substrates for burrowing, nesting, and overwintering

Surface disturbance, motor vehicles traveling off route, use of off-highway vehicle management areas, off-highway vehicle events, unpaved roads, grazing, historical fire, wildfire potential, altered hydrology, and climate change leading to shifts in habitat composition and location, storms, and flooding can alter substrates to the extent that they are no longer suitable for burrowing, nesting, and overwintering. Erosion caused by these activities can alter washes to the extent that desert tortoise burrows placed along the edge of a wash, which is a preferred location for burrows, could be destroyed. We expect that the area within critical habitat that is affected by off-road vehicle use to the extent that substrates are no longer suitable is relatively small in relation to the area that desert tortoises have available for burrowing, nesting, and overwintering; consequently, off-road vehicle use has not had a substantial effect on this physical and biological feature.

Most livestock allotments have been eliminated from within the boundaries of critical habitat. Of those that remain, livestock would compact substrates to the extent that they would become unsuitable for burrowing, nesting, and overwintering only in areas of concentrated use, such as around watering areas and corrals. Because livestock grazing occurs over a relatively small portion of critical habitat and the substrates in most areas within livestock allotments would not be substantially affected, suitable substrates for burrowing, nesting, and overwintering remain throughout the critical habitat units.

Burrows, caliche caves, and other shelter sites

Human-caused effects to burrows, caliche caves, and other shelter sites likely occur at a similar rate as effects to substrates for burrowing, nesting, and overwintering for the same general reasons. Consequently, sufficient burrows, caliche caves, and other shelter sites remain in the critical habitat units.

Sufficient vegetation for shelter from temperature extremes and predators

In general, sufficient vegetation for shelter from temperature extremes and predators remains throughout critical habitat. In areas where large fires have occurred in critical habitat, many of the shrubs that provide shelter from temperature extremes and predators have been destroyed; in such areas, cover sites may be a limiting factor. The proliferation of invasive plants poses a threat to shrub cover throughout critical habitat as the potential for larger and more frequent wildfires increases.

In 2005, wildfires in Nevada, Utah, and Arizona burned extensive areas of critical habitat (Service 2010). Although different agencies report slightly different acreages, Table 4 provides an indication of the scale of the fires. The Service is aware that fires in August 2020 also occurred in critical habitat of the desert tortoise. Table 5 includes the approximate acreages of those fires (Luciani 2021).

Table 4. Summary of total burned area within desert tortoise critical habitat for 2005.

Critical Habitat Unit	Total Area Burned (acres)	Percent of the Critical Habitat Unit Burned
Beaver Dam Slope	53,528	26
Gold-Butte Pakoon	65,339	13
Mormon Mesa	12,952	3
Upper Virgin River	10,557	19

Table 5. Summary of total burned area within desert tortoise critical habitat for 2020.

Critical Habitat Unit	Total Area Burned (acres)	Percent of the Critical Habitat Unit Burned
Beaver Dam Slope	51	0.02
Gold-Butte Pakoon	23,684	5
Mormon Mesa	12	<0.01
Upper Virgin River	9,029	17
Ivanpah Valley	42,142	7
Piute-Eldorado	0.1	<0.01

The revised recovery plan notes that the fires caused statistically significant losses of perennial plant cover, although patches of unburned shrubs remained. The percentages of burned habitat do not mean that the fire removed all habitat value for desert tortoises. Drake *et al*. (2015) noted that the production of annual plants was 10 times greater in burned areas compared to unburned areas; however, non-native plants, such as red brome (*Bromus madritensis* ssp. rubens), dominated the burned areas. Desert tortoises continued to use the dead branches of shrubs, such as creosote (*Larrea tridentata*) and burro bush (*Ambrosia dumosa*). Their use of burrows was similar in burned and unburned areas (Drake *et al*. 2015). We cannot quantify precisely the extent to which these fires disrupted the value of the critical habitat, given the patchiness with which the physical and biological features of critical habitat are distributed across the critical habitat units and the varying intensity of the wildfires. The work by Drake *et al*. (2015) demonstrates that the physical and biological features within burned areas retain at least some of their value for the conservation of desert tortoises but conclude "burned habitat may take years to recover sufficiently to fully support [desert] tortoise populations."

Habitat protected from disturbance and human-caused mortality

In general, the Federal agencies that manage lands within the boundaries of critical habitat have adopted land management plans that include implementation of some or all of the recommendations contained in the original recovery plan for the desert tortoise (see pages 70 to 72 of Service 2010). The Bureau's (Service 2016) land use plan amendment for the Desert Renewable Energy Conservation Plan increased the amount of land under protective status and adopted conservation and management actions that furthered the Bureau's goals for these areas. Areas of critical environmental concern and California Desert National Conservation Lands are the units by which the Bureau manages its lands; for the most part, these management units overlap critical habitat of the desert tortoise.

To at least some degree, the adoption of these plans has resulted in the implementation of management actions that are likely to reduce the disturbance and human-caused mortality of desert tortoises. For example, these plans resulted in the designation of open routes of travel and the closure (and, in some cases, physical closure) of unauthorized routes. Numerous livestock allotments have been relinquished by the permittees and cattle no longer graze these allotments. Because of actions on the part of various agencies, many miles of highways and other paved roads have been fenced to prevent desert tortoises from wandering into traffic and being killed. The Service and other agencies of the Desert Managers Group in California are implementing a plan to remove common ravens that prey on desert tortoises and to undertake other actions that would reduce subsidies (i.e., food, water, sites for nesting, roosting, and perching, etc.) that facilitate common raven abundance in the California desert (Service 2008a).

Despite the implementation of these actions, disturbance and human-caused mortality continue to occur in many areas of critical habitat to the extent that they adversely affect the value of critical habitat for the conservation of the desert tortoise, to some degree. For example, many highways and other paved roads in California remain unfenced. Hughson and Darby (2011) noted that as many as 10 desert tortoises are reported killed annually on paved roads within Mojave National Preserve. Because scavengers quickly remove carcasses from roads, we expect that vehicle use kills more desert tortoises than are reported.

Unauthorized off-road vehicle use continues to disturb habitat and result in loss of vegetation within the boundaries of critical habitat; although we have not documented the death of desert tortoises as a direct result of this activity, it likely occurs. Additionally, the habitat disturbance caused by this unauthorized activity exacerbates the spread of invasive plants, which displace native plants that are important forage for the desert tortoise, thereby increasing the physiological stress faced by desert tortoises.

Illegal marijuana-growing facilities have introduced additional disturbance and sources of human-caused mortality into areas of critical habitat in the western Mojave Desert. The removal of habitat from areas where cultivation occurs causes disturbance and mortality; vehicles travelling to and from cultivation site on existing routes or on routes they create cause additional disturbance and mortality.

Finally, in California, the Bureau will not allow the development of renewable energy facilities on public lands within the boundaries of areas of critical environmental concern and California Desert National Conservation Lands. Counties have not specifically restricted the development of renewable energy facilities on private lands within the boundaries of areas of critical environmental concern. However, the checkerboard pattern of land ownership would likely necessitate that the Bureau consider issuance of a right-of-way for such a facility, which likely decreases the potential for such proposals in the future.

Summary of the Status of Critical Habitat of the Desert Tortoise

As noted in the 5-year review and revised recovery plan for the desert tortoise (Service 2010, 2011), critical habitat of the desert tortoise is subject to landscape-level impacts in addition to the site-specific effects of individual human activities. Land managers have undertaken actions to improve the status of critical habitat. For example, as part of its efforts to offset the effects of the use of additional training maneuver lands at Fort Irwin (Service 2004), the Department of the Army acquired the private interests in the Harper Lake and Cronese Lakes allotments, which are located within critical habitat in the Western Mojave Recovery Unit; as a result, cattle have been removed from these allotments. The retirement of allotments assists in the recovery of the species by eliminating disturbance to the physical and biological features of critical habitat by cattle and range improvements.

Although human activities have affected the remaining physical and biological features to some degree, these impacts have not, to date, appreciably diminished the value of the critical habitat units for the conservation of the desert tortoise. We have reached this conclusion primarily because the effects are localized and thus do not affect the value of large areas of critical habitat for the conservation of the desert tortoise.

Lane Mountain Milk-vetch

Unless otherwise noted, the following information is from the 5-year review (Service 2008b) and the species report (2014b). The Service prepared the species report in 2014 to collect the best available information regarding the status of the Lane Mountain milk-vetch. We are incorporating the 5-year review and species report by reference to provide much of the information needed in this section of the biological opinion.

Listing History

The Service listed Lane Mountain milk-vetch as endangered on October 6, 1998 (63 FR 53596). The primary threats to Lane Mountain milk-vetch were surface mining, off-highway vehicle recreation, non-native species, and military training activities.

Species Biology and Life History

Lane Mountain milk-vetch is a perennial plant in the pea family. It typically twines up through a host shrub that it uses for structural support. Although the taproot is perennial, the above-ground portion of the plant is herbaceous; it re-sprouts from the taproot or old stems with the first winter rains and dies back during the drier summer months. Plants may remain dormant during years of low rainfall.

The Service's (2014b) review of the status of the Lane Mountain milk-vetch contains substantial information regarding the biology of the species and its life history.

Recovery Plan

The Service has not completed a recovery plan for this species.

Five-Year Review

At the time of listing, we were aware of few individuals within four occurrences. The Service's 5-year review included the following new information that it had gathered since the listing of the Lane Mountain milk-vetch as endangered:

1. Intensive surveys by the U.S. Army in 2001 revealed that two of those four occurrences were actually a single larger occurrence. The surveys also detected a fourth occurrence and more than 5,700 individuals.

2. Monitoring indicated the numbers of adult and newly recruited individuals have been decreasing since 1999;

3. The U.S. Army had proposed training on approximately 23 percent of the occurrences but most of the rest of the known occupied habitat was in conservation management; and

4. Its life history includes episodic germination events that seem to be tied to medium- and large-scale weather patterns; we have observed die-offs of the Lane Mountain milk-vetch in small areas. Therefore, a high level of uncertainty exists regarding the ability of Lane Mountain milk-vetch to persist through local extirpations and recolonization of suitable habitat.

We concluded that the new information regarding the more widespread distribution of the species, greater numbers of individuals, and the placement of approximately 77 percent of the areal extent of the occurrences into conservation management met the definition of a threatened species.

Species Report

In this report, the Service (2014b) reviewed information that we had received since the completion of the 5-year review. This information included the results of research on the life history of the Lane Mountain milk-vetch and ongoing population monitoring by the Army. The Service also reviewed the legal protections afforded the species and the Army's and Bureau's land management activities and policies.

As a result of this review, the Service (2014b) concluded that the existing laws, regulations, and policies "… mandate[d] consideration, management, and protection of resources that benefit Lane Mountain milk-vetch." Biologically, the Service concluded that climate change and small population size posed "substantial threats" to the Lane Mountain milk-vetch that are not addressed by existing regulatory mechanisms.

Petition Finding

In December 2011, the Pacific Legal Foundation petitioned the Service to reclassify the Lane Mountain milk-vetch to threatened status, based on our finding in the 5-year review. The Service issued a 12-month finding with regard to the petition on May 2, 2014 (79 FR 25084), which summarized information that we had gathered in the species report (Service 2014b).

In the 12-month finding, we noted two long-term studies that indicated that the number of Lane Mountain milk-vetch plants had decreased substantially since 1999, probably in response to a decrease in the amount and frequency of rain over this period. Decreases in rainfall may have the greatest negative effect on the survival of seedlings and their recruitment into the reproducing population. We also noted that military training, off-highway vehicle activities, mining, climate change, and other threats continued as stressors on this species. For these reasons, we concluded that reclassification of the Lane Mountain milk-vetch to threatened status was not warranted.

Core Criteria for the Jeopardy Determination

Reproduction

In the wild, seed production is low, even in years of abundant rainfall. Seed production was much greater under favorable greenhouse conditions; consequently, harsh weather and predation on seeds may limit reproduction in the wild.

Six insect taxa were observed on Lane Mountain milk-vetch during two studies on its pollination ecology; some were likely robbing nectar and were uninvolved with pollination. Leaf-cutter and metal leaf-cutter bees (*Anthidium dammersi, A. emarginatum*, and *Osmia latisculata*) were the most abundant visitors and likely effective pollinators.

Numbers

The Army conducted an intensive survey from 1999 to 2001 to determine the distribution and number of Lane Mountain milk-vetch plants (Service 2014b). The Army counted 5,723 plants during this study. Some potential exists that the surveys missed a few plants and counted other plants more than once. Despite those limitations, the Army's intensive effort located most of the plants present during this time and represents a valuable data point in understanding the status of the species.

To attempt to track population trends, the Army and others established sampling plots and began tagging individual plants among the four occurrences of the Lane Mountain milk-vetch. Since 2005, botanists have tagged 557 plants (Redhorse Corporation 2021). In 2021, Redhorse (2021) detected 13 live Lane Mountain milk-vetches; one of the observations was of an individual that had not been previously tagged.

The paucity of observed live individuals in 2021 does not necessarily indicate that plants that did not sprout are dead. The Lane Mountain milk-vetch sprouts from a taproot in years of sufficient precipitation. The average precipitation at weather stations within the range of the species during the 2021 growing season was 8.6 millimeters, which is well below the level of rainfall that typically results in the observation of young plants (Redhorse 2021, Figure 9). However, long-term drought is likely to result in an overall decline in the number of individuals.

Distribution

Four occurrences of the Lane Mountain milk-vetch occur in the western Mojave Desert, north of the city of Barstow. The four occurrences cover approximately 21,400 acres. We generally refer to these occurrences as the Goldstone, Brinkman Wash/Montana Mine, Paradise Valley, and Coolgardie Mesa units. Table 6 summarizes the distribution of habitat of the Lane Mountain milk-vetch.

Table 6. Distribution of the Lane Mountain Milk-vetch.

Occurrence	Area of the Occurrence (acres) [1]	Percentage of the Species' Habitat[2]	Land Management Status
Goldstone	1,283	6	Entirely within an Army conservation area
Brinkman Wash / Montana Mine	5,497	28	Entirely on Fort Irwin Approximately 1,872 acres within a "no-dig" zone Approximately 3,625 acres within areas available for training
Paradise Valley	4,794	22	Most of the occurrence is on Fort Irwin; some is on Bureau land Approximately 3,634 acres within an Army conservation area

			Approximately 971 acres within Fort Irwin area available for training Approximately 200 acres managed by the Bureau within an area of critical environmental concern
Coolgardie Mesa	9,775	46	Approximately 9,888 acres managed by the Bureau within an area of critical environmental concern[3] Approximately 1,282 acres of Army conservation lands Approximately 2,899 acres of private lands
Total	21,349	100	

[1] We used the acreages from the Service's (2004) biological opinion. The sizes of the occurrences vary to some degree among documents because authors used slightly different ways of defining the boundaries.
[2] We rounded percentages to the nearest whole number.
[3] We used the acreage of critical habitat of the Lane Mountain milk-vetch in this cell because we do not have recent data on land ownership for the Coolgardie Mesa occurrence. The total acreage in this cell exceeds the overall amount of habitat for the Lane Mountain milk-vetch at Coolgardie Mesa because critical habitat extends beyond the occurrence's boundaries to some degree to account for ecosystem processes (76 FR 29108). We expect that the actual acreage of habitat is proportional to that of critical habitat.

Figure 3 depicts the locations of the four occurrences of the Lane Mountain milk-vetch.

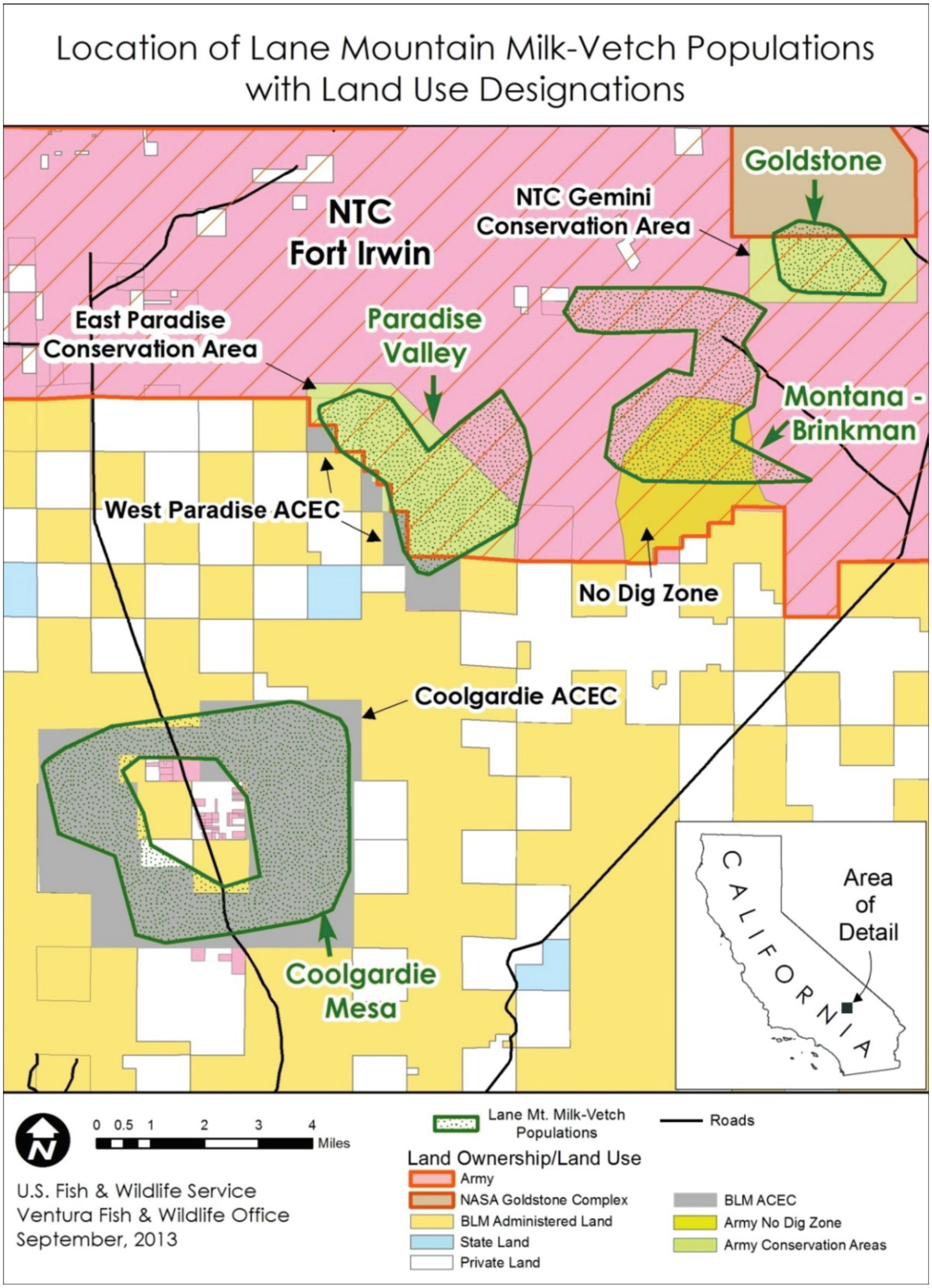


Figure 3. Location of Lane Mountain milk-vetch occurrences with land use designations (from Service 2014b). The words "occurrence" and "population" have the same meaning with regard to the locations where the Lane Mountain milk-vetch occurs.

Summary of the Status of the Lane Mountain Milk-vetch

As noted in the species report (Service 2014b) and the 12-month finding (79 FR 25084), as of 2014, two long-term studies indicated that the number of Lane Mountain milk-vetch plants had decreased substantially since 1999, probably in response to a decrease in the amount and frequency of rain over this period. Ongoing monitoring by the Army since 2015 has generally shown that the number of plants visible in any year is closely related to the amount of rainfall (Redhorse 2021); overall, drought continues to threaten this species. Military training, off-highway vehicle activity, mining, and climate change (e.g., drought) continue as stressors on this species.

ENVIRONMENTAL BASELINE

We have focused the discussion of the environmental baseline in the action area on areas within the boundaries of Fort Irwin. The conditions within other portions of the action area along the Manix Trail and in the areas where translocation and recovery actions would occur are located in the Western Mojave Recovery Unit. We described those conditions in the status section of this biological opinion.

Previous Consultations in the Action Area

The Service and Army have an extensive consultation history regarding the expansion of the National Training Center. The Consultation History section of the Service's (2012) biological opinion regarding the use of additional training lands at Fort Irwin describes those consultations in some detail. The Service's (2012) biological opinion addressed the Army's use of the Eastern and Southern Training Areas; the Status of the Desert Tortoise section of this biological opinion provides additional detail with regard to that consultation. We are incorporating that consultation history into this biological opinion by reference. During that consultation, the Army (2011) informed the Service that it had decided not to pursue training in the Western Training Area at that time but that it would review its training needs and reconsider training there in the future.

The Service (2014a) and Army also consulted on ongoing operations and activities at Fort Irwin. That biological opinion addressed training, management, and safety activities in the training areas. It also addressed activities regarding infrastructure in the cantonment area, alternative energy, recreation, research, and education. The Service concluded that the proposed activities were not likely to jeopardize the continued existence of the desert tortoise or result in the destruction or adverse modification of its critical habitat. Since the Service issued that biological opinion, the Army has reported few deaths of desert tortoises.

The Service and Army have also consulted on numerous small activities within Fort Irwin. The Service concluded in the biological opinions that resulted from these consultations that the proposed actions were not likely to jeopardize the continued existence of the desert tortoise or result in the destruction or adverse modification of its critical habitat. To the best of our knowledge, no desert tortoises died because of these activities. The Previous Consultations in the Action Area section of the Service's (2014a) biological opinion provides additional detail on some of these consultations; we are incorporating that information into this biological opinion by reference.

Status of the Desert Tortoise in the Action Area

Training activities at Fort Irwin prior to the listing of the desert tortoise altered its distribution within the original boundaries of the installation. Subsequent to the consultation regarding use of the Southern Training Area (Service 2012), the Army removed most desert tortoises from that area. Desert tortoises remain in designated conservation areas on base; these areas are located along the southern edge of the installation and in restricted use zones that the Army has established for the Lane Mountain milk-vetch (Figure 3). A desert tortoise exclusion fence separates the southern boundary of Fort Irwin from habitat to the south; the exclusion fence lies to the north of the Army's conservation areas.

Desert tortoises also remain in small numbers throughout the installation. Of these animals, most reside higher on alluvial fans that are less accessible to most vehicles.

The Army has not undertaken any systematic surveys of the entire area within its boundaries. With a few exceptions, however, the Army and Service have a reasonable understanding of the status of desert tortoises at Fort Irwin. In the following paragraphs, we will provide this information for each general area of the installation.

Leach Lake Gunnery Range

The Army has not conducted surveys for desert tortoises within the Leach Lake Gunnery Range because unexploded ordnance renders the area unsafe. Based on the elevation within the gunnery range and its location within the central Mojave Desert, we expect that some desert tortoises occur in the area. Given its long-time use as a target area, desert tortoises likely exist only in unused areas. The potential exists for desert tortoises to occur on the upper slopes of alluvial fans in this area, away from targets.

Goldstone Deep Space Communications Complex

Information regarding the status of desert tortoises within the Goldstone Deep Space Communications Complex comes from surveys conducted in 1983 and 1989. We have summarized the following description of the status of the desert tortoise in this area from the biological opinion for the complex's routine operation (Service 1998).

Within suitable habitats, desert tortoises are probably more common in less rocky, alluvial areas and less common on rocky hillsides and mountainous areas. Most desert tortoises likely occur in areas that are between 1,600 to 3,600 feet in elevation. Goldstone Deep Space Communications Complex personnel regularly see desert tortoises crossing NASA Road.

Cantonment Area

Most of the cantonment area is developed with infrastructure and is heavily used by Fort Irwin personnel. Consequently, the remaining areas of desert tortoise habitat exist in smaller patches. Desert tortoises occasionally wander into this area but it does not support a viable population.

Downrange Operations Area

Within the boundary of Fort Irwin prior to its expansion, desert tortoises occurred in extremely low numbers in areas that the Army had used for force-on-force training. More desert tortoises occur on the upper slopes of the alluvial fans than on surrounding training areas, probably because the more rugged terrain in these areas is not conducive to the large-scale movement of military vehicles.

The Southern Training Area comprises the southernmost portion of the downrange area. Because of the consultation on the use of additional maneuver training lands, the Army translocated most of the desert tortoises in this area onto Army lands south of the training areas. We expect that the surveys to remove desert tortoises missed a few individuals and that others may have moved into this area from surrounding habitat on Fort Irwin; the Army also left desert tortoises in place that it deemed were not suitable for translocation (*i.e.*, those that had evidence of disease but were not so debilitated that they were euthanized). A mesh fence to exclude desert tortoises separates the Southern Training Area from the conservation areas and other desert tortoise habitat to the south.

The Western Training Area is the westernmost portion of Fort Irwin. Previous survey and research efforts indicated that approximately 450 to 600 "adult" desert tortoises reside in this area (Karl 2002, Esque et al. 2009, Esque et al. unpublished data, and Walde et al. unpublished data in Housman 2021c). The use of the term "adult" in this context does not necessarily mean desert tortoises larger than 180 millimeters; however, it conveys information that numerous large desert tortoises occur within Fort Irwin and that additional smaller individuals and eggs are also present. Desert tortoises generally occur in a patchy distribution in this area. The Army initially separated the Western Training Area from adjacent habitat with a mesh fence to prepare to translocate desert tortoises. In 2014, the Army created approximately 16 3-meter-long openings in the fence to allow passage by desert tortoises. After informally consulting with the Service, the Army closed the openings in 2019. We do not know the extent to which desert tortoises used the openings.

Desert tortoises within the Eastern Training Area generally reside in the area where the alluvial fan joins the mountainous areas to the west of the alluvial fan. The alluvial fan downslope from this area is extremely rocky. The alluvial fan is also somewhat below elevations at which desert tortoises most frequently occur and thus may be hotter and receive less rainfall than areas to the east. These factors may be responsible for desert tortoises being largely restricted to the upper alluvial fan where, presumably, temperatures are cooler and rainfall more abundant. In 2004, the Army estimated that approximately 288 desert tortoises resided in this parcel (Service 2004); if trends in other portions of the western Mojave Desert also occurred here, the number of desert tortoises has likely decreased since that time.

Conservation Areas

These areas to the south of the Southern Training Area generally contain high quality habitat for desert tortoises; surveys completed in preparation for the translocation of desert tortoises from the Southern Training Area indicated that these areas generally supported numerous desert tortoises. Since that time, the Army has translocated additional desert tortoises into these areas.

The Service surveys these areas as part of its range-wide monitoring. We have not attempted to determine densities for these areas. Please refer to the Status of the desert tortoise section of this biological opinion for information on densities in this area of the desert (*i.e.*, the Superior-Cronese Area of Critical Environmental Concern).

Status of Critical Habitat of the Desert Tortoise in the Action Area

The Service (2012) analyzed the effects of use of the Southern Training Area on critical habitat of the desert tortoise and concluded that it would "essentially eliminate the primary constituent elements" (now referred to as physical and biological features) in this area of the Superior-Cronese Critical Habitat Unit. Because of this consultation, we will not discuss the Southern Training Area in this biological opinion.

The condition of the physical and biological features of critical habitat within the remainder of the action area (*i.e.*, the Manix Trail, Western Training Area, translocation sites, and areas of recovery actions) generally reflects that of critical habitat as a whole; we will not repeat that discussion here. Because of the fence that the Army installed around the Western Training Area, it has not received recreational use in recent years.

Status of the Lane Mountain Milk-vetch in the Action Area

Three of the four occurrences of the Lane Mountain milk-vetch occur within Fort Irwin. Table 7 summarizes the environmental baseline with regard to the occurrences of the Lane Mountain milk-vetch within Fort Irwin.

Table 7. Distribution of the Lane Mountain Milk-vetch on Fort Irwin.

Occurrence	Area of the Occurrence on Fort Irwin (acres)	Management Status of the Occurrence
Goldstone	1,283	Located entirely within a conservation area
Brinkman Wash / Montana Mine	5,497	Approximately 1,872 acres within a no-dig area. Training on foot allowed; vehicles prohibited except in some specified areas. Approximately 3,625 acres available for training
Paradise Valley	4,596	Approximately 3,634 acres within a conservation area Approximately 971 acres available for training
Total	11,376	

EFFECTS OF THE ACTION

The implementing regulations for section 7(a)(2) define the effects of the action as "all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action" (50 CFR 402.02).

The implementing regulations also note that "a conclusion of reasonably certain to occur must be based on clear and substantial information, using the best scientific and commercial data available" (50 CFR 402.17(a)). When considering whether activities caused by the proposed action (but not part of the proposed action) or activities reviewed under cumulative effects are reasonably certain to occur, we consider factors such as:

1. Past experiences with activities that have resulted from actions that are similar in scope, nature, and magnitude to the proposed action;

2. Existing plans for the activity; and

3. Any remaining economic, administrative, and legal requirements necessary for the activity to go forward.

In general, the various activities that the Army may undertake at Fort Irwin, as described in the Description of the Proposed Action section of this biological opinion, would have the same effect on the desert tortoise and its habitat, including critical habitat, and the Lane Mountain milk-vetch and its habitat. For example, heavy equipment, whether used in training exercises or in the development of infrastructure would affect listed species in the same general manner. Therefore, we will not discuss how the various types of activities that the Army will conduct (*e.g.*, sustainment training, maneuver training, upgrading of infrastructure, *etc.*) may affect the desert tortoise and its habitat, including critical habitat, and Lane Mountain milk-vetch and its habitat. Instead, we will present an analysis of the overall effects of these activities, based on the Army's strategy for reducing impacts to these species. We will then discuss the Army's off-installation recovery efforts for the desert tortoise. Finally, we will summarize and quantify (where possible) these effects in relation to the appropriate metrics for our determinations with regard to the likelihood of jeopardizing the continued existence of the species and, for the desert tortoise, of resulting in the destruction or adverse modification of its critical habitat.

We do not know the exact location or timing of all of the Army's operations and activities within the entirety of Fort Irwin, including the Western Training Area. However, we are familiar with the nature of training and infrastructure work that the Army is reasonably certain to undertake within the defined boundary of Fort Irwin and the Manix Trail. Therefore, we have analyzed the adverse effects of these activities and operations and addressed them in the incidental take statement of this biological opinion. At this time, we do not know the exact timing, location, or nature of the off-installation recovery activities that are likely to occur during implementation of the Recovery and Sustainment Partnership Initiative. For this reason, although we will provide a general analysis of the types of activities that we expect will occur, we will not address them in the incidental take statement.

Effects of the Action on the Desert Tortoise

We will analyze the Army's activities within the boundaries of Fort Irwin (i.e., use of the Western Training Area and ongoing activities and operations) separately from the off-installation recovery activities that would occur later in time under the Recovery and Sustainment Partnership Initiative.

Effects of the Army's Use of the Western Training Area and Operations and Activities on the Desert Tortoise

Activities conducted by the Army can kill or injure desert tortoises in various ways, regardless of whether the animals are in previously disturbed or undisturbed habitat. Training vehicles or construction equipment would crush desert tortoises of all sizes. Foot traffic may kill smaller animals. Desert tortoises may fall into trenches or other holes in the ground and die of exposure. Army activities are also likely to crush burrows, which can either trap desert tortoises inside or leave them exposed to predation or extreme weather. Ordnance may occasionally strike desert tortoises. Although these are the most likely threats to desert tortoises from the Army's activities, we do not intend this discussion as presentation of a complete list. Our intent with this biological opinion is to consider all mortalities of desert tortoises that occur because of lawful Army activities as effects of the proposed action.

Activities in Previously Disturbed Areas

The Army is likely to intensify and conduct additional types of training in areas that it has disturbed previously; it may also construct additional infrastructure in these areas. The Army and Service have agreed that the Army will not conduct pre-activity surveys in areas that it has disturbed previously because desert tortoises are usually absent because of the Army's previous activities. If the Army encounters a desert tortoise during these activities, it will either move the individual from harm's way or translocate it to another area, either on- or off-installation. (If circumstances warrant, as described in the Minimizing Impacts to Desert Tortoises during Activities on Fort Irwin section of this biological opinion, the Army may leave the desert tortoise in place.) Whether the Army moves the desert tortoise from harm's way or translocates it will depend on the circumstances. The proximity of suitable, undisturbed habitat nearby and the nature of the Army activity will influence the decision regarding the disposition of the desert tortoise. We will discuss the effects of moving desert tortoises from harm's way and translocation later in this biological opinion.

If the Army does not find a desert tortoise that is present, its activities are likely to kill or injure it. Because small desert tortoises (*i.e.*, those under 180 millimeters) and eggs are harder to see than large desert tortoises, they are more likely to be killed or injured during activities. Few desert tortoises are likely to die in previously disturbed areas, in large part because of previous activities. Also, the Army translocated most desert tortoises from the Southern Training Area in 2013.

Intermittent or Occasional Training in Areas with Suitable Habitat

If the Army encounters a desert tortoise in an area that supports suitable habitat during intermittent or occasional training, it will either move the desert tortoise from harm's way or leave it in place, depending upon the circumstances, as described in the Minimizing Impacts to Desert Tortoises during Activities on Fort Irwin section of this biological opinion.

Areas with suitable habitat are more likely to support desert tortoises than previously disturbed sites. Consequently, the Army is more likely to encounter desert tortoises in these areas than under the previous scenario. However, given the less intense nature of the Army's activities, we expect that few desert tortoises are likely to die or be injured. As we discussed previously, small desert tortoises are more vulnerable than large ones.

Routine Training with Vehicles or Infrastructure Projects in Areas with Suitable Habitat

Large areas within Fort Irwin no longer support suitable habitat because of previous training and infrastructure projects. In contrast, the Army has not conducted much training in other areas, particularly in the Western Training Area; these areas continue to support undisturbed habitat and desert tortoises. Absent protective measures, routine training with vehicles or infrastructure projects in these areas would kill or injure numerous desert tortoises.

As we described in the Description of the Proposed Action section of this biological opinion, the Army and Service will determine, on a case-by-case basis, whether to move desert tortoises from harm's way, remove desert tortoises from the work area during the activity, or translocate them to secure habitat either on or off installation. Regardless of the option the Army and Service choose, the Army will implement the latest Service protocols for handling, translocation, and disease management to protect desert tortoises.

Because desert tortoises spend most of their lives underground and can be difficult to detect even when they are above ground, the potential exists that the Army may not detect some individuals when translocating them from an area. In some cases, the Army may find and translocate these animals later on. Some desert tortoises, either individually or in small groups, are likely to persist within or near some training areas for decades because they reside in areas that are not conducive to training; because these animals are isolated from the desert tortoises outside of Fort Irwin, they cannot contribute to the overall conservation of the species. Some desert tortoises are likely to be killed because of future Army activities; the loss of these animals would not affect the overall conservation of the desert tortoise because of the relatively small number of individuals involved and their isolation from populations outside of Fort Irwin.

Common Ravens, Coyotes, and Other Predators

The Army's activities have the potential to attract common ravens, coyotes, and other mammalian predators, provide subsidies in the form of food, water, and shelter, and allow for an increase in their abundance. These species prey on desert tortoises; increases in their numbers would increase the threat of predation on desert tortoises.

When the Army is constructing or maintaining infrastructure, it will require workers to implement measures to reduce subsidies to predators. These measures would vary on a project-specific basis but would include control of attractants (food, water, and shelter) and implementing adaptive management techniques such as installing devices to discourage predators from using project-related structures.

During training activities, the Army requires soldiers to contain waste materials. That requirement and post-training remediation would reduce the amount of food available to predators. Training likely results in the death of small animals, which predators will scavenge. Given the nature of training, the Army is not capable of reducing that effect.

We cannot reasonably predict how activities at Fort Irwin are likely to alter current levels of predation of desert tortoises within the action area because of the numerous variables involved. For example, the abundance of predators varies with environmental conditions; their numbers will increase after years of abundant rainfall. Some predators, such as common ravens, migrate in and out of the action area. The Service's efforts to control common ravens in the desert may alter their abundance. Best management practices are effective in eliminating some, but not all, use by predators. However, because many predators travel widely and subsidies throughout the action area support these species, we conclude that subsidies provided by the Army's activities do not have a measurable effect on the regional population of predators and, subsequently, on the level of predation on desert tortoises.

Moving Desert Tortoises from Harm's Way

Moving desert tortoises from harm's way involves transporting individuals from the immediate area of an activity that is likely to injure or kill the animals. Depending on the nature of the activity, desert tortoises may be moved up to several hundred feet from the activity.

No one has studied the effects of moving desert tortoises from harm's way. We expect that the placement of the desert tortoise up to several hundred feet from its original location is not likely to adversely affect individuals because they are likely still within their home ranges. (That is, they remain where they are familiar with local resources, such as areas to forage and seek shelter.)

Handling desert tortoises can cause them to void their bladders, which they use to store water. Averill-Murray (2002) found that desert tortoises that voided their bladders during handling had lower survival rates than those that did not. Careful handling while moving desert tortoises from harm's way can reduce the likelihood of their voiding their bladders. Because moving desert tortoises from harm's way does not involve excessive handling and anyone who does so will receive instruction beforehand, we expect that desert tortoises voiding their bladders is likely to occur infrequently.

Translocation of Desert Tortoises

We anticipate that the Army is likely to translocate large numbers of desert tortoises from Fort Irwin to augmentation sites off-installation in preparation of using undisturbed habitat for training and infrastructure, particularly in the Western Training Area. In recent years, agencies and project proponents have translocated numerous desert tortoises from military training areas and construction sites. Many of these translocations involved various studies to evaluate how the movement affected resident and translocated desert tortoises in relation to control animals. A recent biological opinion discussed the effects of translocation on desert tortoises in detail (Service 2017) and Dickson *et al*. (2019) evaluated the results of a multi-year study of translocation on desert tortoises from the site of a solar project. We have incorporated those analyses into this biological opinion and will not repeat that information here.

In general, studies demonstrate that translocated, resident, and control desert tortoises do not differ significantly in survival rates, levels of stress hormones, movements, susceptibility to predation, and other aspects of behavior. With regard to some aspects that researchers have studied (*e.g.*, movement patterns), the behavior pattern of translocated desert tortoises resembled those of controls and residents after 2 to 3 years. We acknowledge that desert tortoises that spend more time above ground are more vulnerable to predators. Drought likely causes some predators to switch from their normal prey to desert tortoises; desert tortoises near human development seem to be more vulnerable to predation, possibly because coyotes may be more abundant in those areas.

In general, we conclude that translocation is an effective tool for protecting desert tortoises, if those conducting the translocation follow specific protocols designed to increase the chance of success. These protocols include translocating desert tortoises only during appropriate times of the year (*i.e.*, when they are active), only into suitable habitat, and with appropriate consideration of disease issues. Specific circumstances with regard to numerous variables influence the ultimate outcomes of translocation.

The Service and Army will consider disease when translocating desert tortoises. To the best of our knowledge, no wild desert tortoise population is free of disease; Rideout (2015) notes that no wildlife populations are completely free of disease. Consequently, the Army and Service’s goal is to ensure that translocated desert tortoises do not affect the prevalence of disease in a negative manner among recipient populations. To achieve this goal, the Army will follow the Service’s most recent protocol with regard to management of disease, including the use of an algorithm (Figure 4) to determine whether translocation of any individual is appropriate and an evaluation of the recipient sites to ensure that the sites do not show evidence of an active outbreak of disease (Service 2019b).

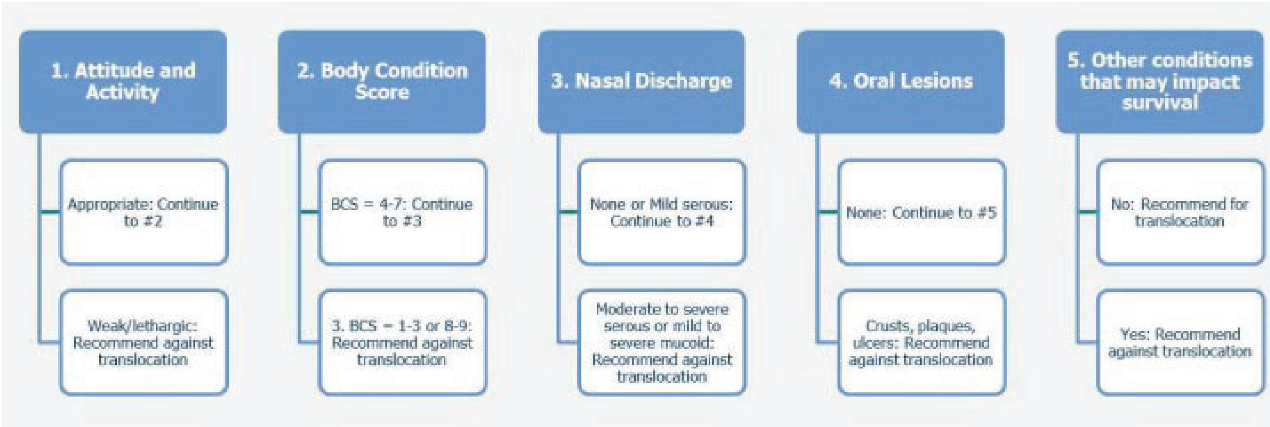


Figure 4. Translocation algorithm from Service (2019b).

The Army and Service expect that new information regarding the management of diseases will emerge over time. We will modify the management of disease when new information is available, in coordination with the Service's Desert Tortoise Recovery Office.

U.S. Geological Survey is currently evaluating habitat conditions and the current density of desert tortoises in potential recipient areas in the Western Mojave Recovery Unit. The purpose of this evaluation is to ensure that the Army can translocate desert tortoises to the most appropriate habitat that currently supports densities that are suitable for receiving additional animals. U.S. Geological Survey's experience with desert tortoises in general and translocation in particular will ensure that the Army and Service are using the most current and best available information to translocate desert tortoises to areas where they are most likely to prosper.

Core Criteria for the Jeopardy Determination regarding the Use of the Western Training Area and Ongoing Activities and Operations

As we stated previously in this biological opinion, "jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02). This regulatory definition focuses on how the proposed action would affect the reproduction, numbers, and distribution of the species under consideration in the biological opinion. For that reason, we have used those aspects of the desert tortoise's status as the basis to assess the overall effect of the proposed action on the species.

Additionally, we determine whether a proposed action is likely "to jeopardize the continued existence of the species" through an analysis of how a proposed action affects the listed taxon within the action area in relation to the range of the entire listed taxon. For the desert tortoise, this process involves considering the effects at the level of the action area, then at the level of the recovery unit, and then finally for the range of the listed taxon. Logically, if a proposed action is unlikely to cause a measurable effect on the listed taxon within the action area, it is unlikely to affect the species throughout the recovery unit or the remainder of its range. Conversely, an action with appreciable effects on the listed entity in the action area may degrade the status of the species to the extent that it affects the recovery unit or the entire range.

In this section, we will synthesize the analyses contained in the previous paragraphs to determine how the proposed use of the Western Training Area and ongoing operations and activities at Fort Irwin are likely to affect the reproduction, number, and distribution of the desert tortoise. We will then assess the effects of these aspects of the proposed action on the recovery of the species and whether they are likely to appreciably reduce the likelihood of both the survival and recovery of the desert tortoise in the wild.

Reproduction

The proposed action will not affect the reproduction of desert tortoises. We consider effects on reproduction to be those that would alter the reproductive capacity of the species. For example, the use of a pesticide that would disrupt the endocrine system of a species would alter its reproductive capacity.

We acknowledge that repeated training in an area would decrease the abundance of the native annual plants upon which desert tortoises feed and that the loss of forage would likely reduce the ability of females to produce eggs. However, because the Army and Service intend to translocate most individuals from areas of current or future heavy training, the decrease in the amount of forage on base will not affect the reproduction of desert tortoises. Additionally, absent their translocation, the Army's future activities in locations of repeated training would kill most of the desert tortoises, which is a more direct and immediate effect than decreasing the available forage.

Translocation of desert tortoises from the Western Training Area (and in much smaller numbers, from elsewhere on Fort Irwin) would increase their density in recipient areas in the Western Mojave Recovery Unit. Desert tortoises currently occur at densities that are much lower than historic levels. At extremely low densities, individuals become isolated and reproduction becomes less frequent.

As we discussed previously in this biological opinion, female desert tortoises lay eggs after being translocated. Research has also shown that translocated male desert tortoises had, in the short term, not been contributing to local reproduction, although we expect that trend to reverse itself over time. We are unlikely to observe a rapid and appreciable increase in the rate of reproduction after translocation. Desert tortoises have a slow reproductive rate. Weather will also affect their reproduction; reproductive success will likely be higher in years with average and above-average rainfall. In summary, because of translocation, the density of desert tortoises in the recipient areas would increase to some degree, which would reduce the isolation of individuals and facilitate reproduction.

Numbers

The Army has proposed to re-initiate formal consultation if it finds 10 desert tortoises that are 180 millimeters or larger that have died because of its activities within the boundaries of Fort Irwin or along the Manix Trail in any calendar year. We recognize the Army will not detect all desert tortoises killed by its activities. We do not have any information by which we can predict how many desert tortoises actually die because of an activity based on the number of carcasses that are found, either randomly or during systematic surveys. We also recognize that the degree to which observed annual mortalities represent the actual number of mortalities likely varies over time due to factors unrelated to the detectability of desert tortoises (*e.g.*, scavenger prevalence, the nature of the Army's activities, *etc.*).

From 1994 through 2019, the Army (Service 2014a, Housman 2020b) found 61 desert tortoises that died within the boundaries of Fort Irwin because of its activities. Forty-four of these mortalities occurred between 1994 and 2003. In most years, the Army finds no or one desert tortoise that died because of its activities; in 2015 and 2016, it found six and four desert tortoises, respectively, that died as a result of its activities (Housman 2020b). From 2004 through 2012, the Army encountered 190 live desert tortoises, between 6 and 37 per year (see Table 5 in Service 2014a); we are aware that some of these encounters are with the same individuals. This information indicates that desert tortoises persist in low numbers in areas of Fort Irwin; also, as we mentioned previously, the Army detected 11 desert tortoises during 216 protocol surveys of 5,866 acres in the fiscal years from 2017 through 2019 (Housman 2020a). It also indicates that soldiers and workers are able to detect and avoid killing or injuring them at least some of the time.

To summarize this information, desert tortoises remain within Fort Irwin at low densities; if the Army proceeds with the translocation of desert tortoises from the Western Training Area, the same would likely be true of that portion of the installation. Soldiers and workers occasionally encounter desert tortoises. The Army infrequently finds desert tortoises that died because of its activities.

The Service has no information to estimate the number of desert tortoises that are likely to have died because of Army activities, based on the number of carcasses found where we can attribute the death to training, operations, or maintenance. For the purpose of this analysis, we consider it reasonable and conservative to assume that five large desert tortoises die for each individual that the Army finds. Therefore, if the Army finds 10 large desert tortoises that likely died because of its activities in a year, we assume 50 individuals have died. Again, we note that we are basing this discussion only on large desert tortoises to enable a comparison with data collected during range-wide monitoring. Also, small desert tortoises are difficult to find and methods of estimating their abundance contain more assumptions and therefore more potential for variation than does our method for predicting the number of large desert tortoises.

Finally, we assumed that the current trend of decline of desert tortoises would continue until 2025 and used the data from the Service's (2015a) trend analysis to project the number of large individuals within the Western Mojave Recovery Unit. The results of this extrapolation are in Table 3.

Table 3. Numbers of large desert tortoises in conservation areas of the Western Mojave Recovery Unit in 2014 and extrapolated for 2025[1].

Year	Number of Large Desert Tortoises[1]	Lower 95 Percent Confidence Interval	Upper 95 Percent Confidence Interval
2014	17,645	11,155	27,912
2025	8,108	5,426	12,116

[1] Allison (2020). "Conservation areas" refers only to critical habitat units and other areas where the Service conducts range-wide monitoring.

The numbers in the previous table do not include large desert tortoises that reside outside of conservation areas. Therefore, we emphasize that the following calculations upon which we based this analysis are not precise; however, they allow for a reasonable approach to the analysis based on the best available information and our professional judgment.

This extrapolation allows us to evaluate the loss of 50 large desert tortoises per year compared to the population estimate in 2025. We considered the extrapolation to 2025 to be reasonable to acknowledge that the loss of desert tortoises may be ongoing. The number of desert tortoises killed is likely to decline over time because fewer desert tortoises will remain on base as a result of translocation and mortalities.

The loss of 250 large desert tortoises (50 per year) from 2020 (when we extrapolated the loss over time) to 2025 represents approximately 3.1 percent of the estimated number of large desert tortoises within conservation areas in Western Mojave Recovery Unit at that time (250 / 8,108 x 100 = 3.08).

The loss of 50 large desert tortoises annually and 250 by 2025 through the Army's activities is not likely to appreciably reduce the number of desert tortoises in the Western Mojave Recovery Unit. For this reason, we will not extend our analysis to the entire range of the listed taxon.

Over the previous 25 years, the Army found 61 desert tortoises that died because of its activities. The average number of desert tortoises per year found is 2.44; this number included animals smaller than 180 millimeters. Consequently, the annual loss of 50 desert tortoises larger than 180 millimeters is most likely an overestimate.

Our experience is that approximately one-third of the desert tortoises captured for translocations are smaller than 180 millimeters, with most of those being smaller than 120 millimeters. Mortality rates of smaller desert tortoises are higher than those of larger individuals; therefore, the number present varies more. Consequently, because of this variation and the fact that larger individuals are more important to the overall population, we do not attempt to quantify the number of smaller animals that may be present.

The Army and Service have agreed to re-initiate formal consultation if the Army finds that 10 large desert tortoises died because of its activities in any calendar year. We recognize that the Army will not detect every desert tortoise that dies because of its activities. For that reason, based on the best available information and our professional judgment, finding 10 desert tortoises that die in any calendar year because of the Army's activities represents a conservative, reasonable, and prudent means of ensuring that the proposed action does not appreciably reduce the number of desert tortoises in the Western Mojave Recovery Unit.

We have not established a re-initiation threshold with regard to translocation at this time. The Service will consider such a threshold after completion of the translocation plan and refinement of the metrics for determining whether translocation is meeting the goals established by the Army, Service, and U.S. Geological Survey. The agencies will base the goals in the translocation plan on the metrics contained in the Service's (2019c) translocation protocol.

Distribution

Although desert tortoises remain at low densities in portions of Fort Irwin within its original boundaries, these animals are generally isolated from the off-installation population, particularly by the exclusion fence along the southern boundary of the base. After the translocation of desert tortoises from the Western Training Area, conditions there will be similar to those throughout the rest of the installation. Consequently, the translocation of desert tortoises from the Western Training Area will reduce the distribution of the desert tortoise in the Western Mojave Recovery Unit.

The translocation of desert tortoises from Western Training Area would essentially reduce the distribution of the desert tortoise in the Western Mojave Recovery Unit by approximately 62,045 acres. We arrived at that conclusion because the Western Training Area covers approximately 70,045 acres (Service 2012). The Army established the 4,300-acre East Paradise Conservation Area and a 3,700-acre "no-dig" area for the Lane Mountain milk-vetch within the Western Training Area. (*I.e.*, 70,045 – (4,300 + 3,700) = 62,045.) The Army has placed exclusion fencing on the northern boundary of the East Paradise Conservation Area so that desert tortoises cannot enter training areas to the north but are able to move onto public lands to the south. The northern boundary of the no-dig area has only barbed wire fencing to exclude vehicles. We expect that few desert tortoises reside in this area because of the terrain. The Army will not translocate desert tortoises from this area; as discussed previously in the biological opinion, the Army will not use this area for training that involves vehicular maneuvers. Consequently, we expect that desert tortoises will continue to reside in this area at low densities. (We expect that the Army would remove desert tortoises from the Desert Cymopterus Conservation Area; this small area is separated from the rest of the Western Training Area only by a barbed wire fence.) See Figure 5 for a map of the fenced areas at Fort Irwin.

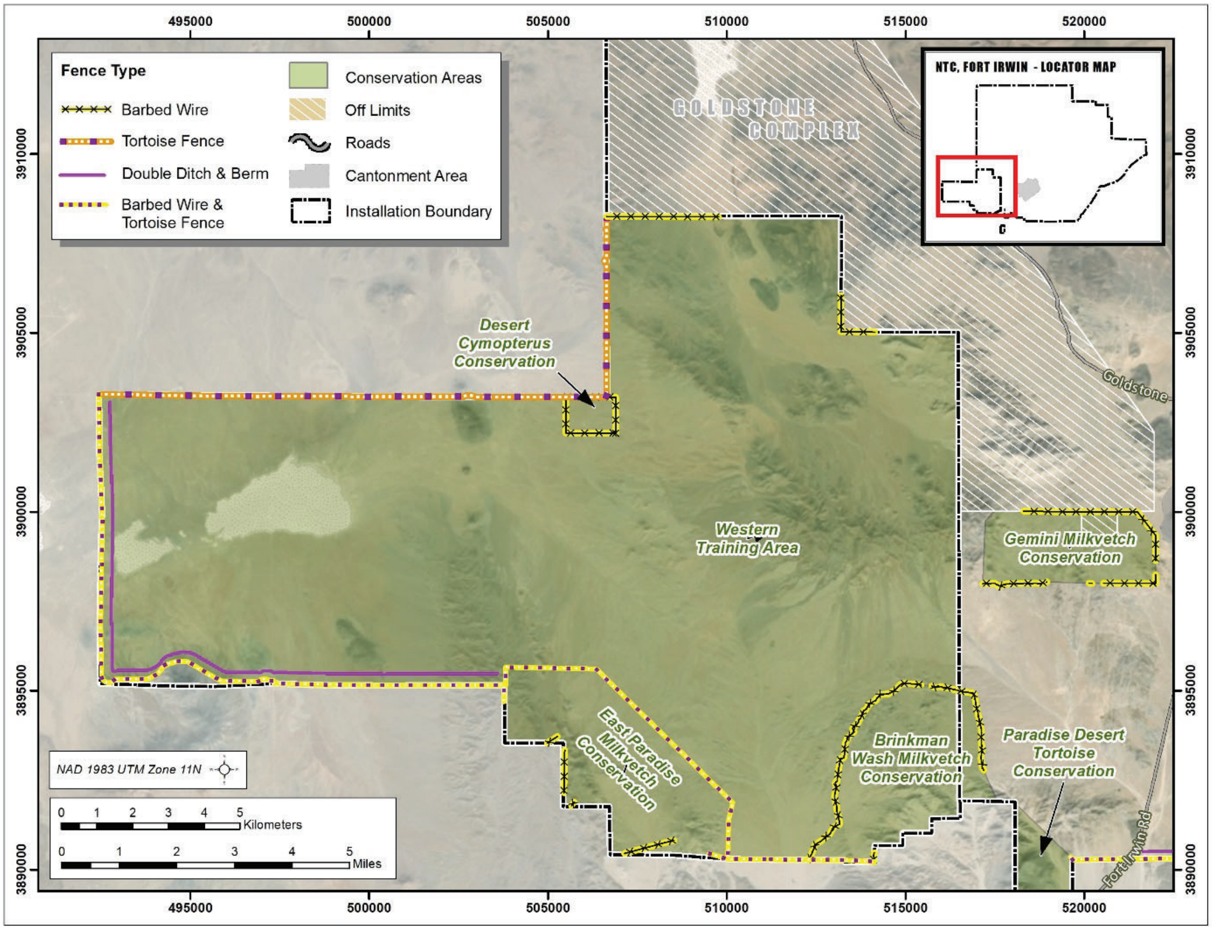


Figure 5. Fencing of the Western Training Area and nearby conservation areas at Fort Irwin.

To assess this effect on desert tortoises, we compared this change in distribution to the acreage of modeled habitat in the Western Mojave Recovery Unit. As we discussed previously in this biological opinion, modeled habitat of the desert tortoise covers approximately 5,595,469 acres in the western Mojave region (*i.e.*, 7,585,312 acres of modeled habitat minus 1,989,843 acres of impervious surfaces). Consequently, the proposed action would reduce the distribution of the desert tortoise in the western Mojave region by approximately 1.11 percent (*i.e.*, 62,045 / 5,717,878 x 100 = 1.109). For the entire range of the listed taxon, the proposed action would reduce the distribution of the desert tortoise by approximately 0.37 percent (*i.e.*, 62,045 / 16,745,848 x 100 = 0.351). In conclusion, the proposed action will not appreciably reduce the distribution of the desert tortoise in the Western Mojave Recovery Unit or range-wide.

Recovery

The translocation and other movement of desert tortoises from Fort Irwin to conservation areas would implement a task in the recovery plan (Service 2011). Specifically, the recovery plan calls for the augmentation of depleted populations through a strategic program. The U.S. Geological Survey is currently identifying depleted areas in the Western Mojave Recovery Unit that would meet the recovery plan's objectives. The best available information indicates that translocation does not injure desert tortoises, if experienced personnel following appropriate protocols conducted the work. The Service and Army will ensure that translocation occurs in this manner.

As noted previously, the exclusion of desert tortoises from the Western Training Area would reduce the area that the species is able to occupy. Habitat loss remains a threat to the species. The Western Training Area does not harbor any habitat attributes that would render it unique with regard to the recovery of the desert tortoise.

In summary, the translocation of desert tortoises into areas where these animals would likely increase breeding and population growth would promote recovery to some extent. To some extent, the loss of habitat within the Western Training Area would impede recovery. Overall, we conclude that the use of additional maneuver training lands within the Western Training Area and operations and activities at Fort Irwin is not likely to appreciably alter the recovery status of the desert tortoise.

Effects of Off-installation Recovery Efforts on the Desert Tortoise

The recovery plan (Service 2011) describes threats that have "multiple and synergistic effects" on desert tortoises and notes that "few data [are] available to evaluate or quantify the effects of these threats on desert tortoise populations." The recovery plan also states that the "desert tortoise requires 13 to 20 years to reach sexual maturity, has low reproductive rates during a long period of reproductive potential, and individuals experience relatively high mortality early in life. These factors make recovery of the species difficult."

For these reasons, the Army is contributing to an aggressive, multi-pronged approach to conserving desert tortoises through off-base recovery efforts. The Army and Service would implement the recovery efforts through partnerships with the Bureau, the California Department of Transportation, California Department of Fish and Wildlife, and conservation groups. Because desert tortoises endure multiple and synergistic effects of various threats, conservation must occur in a manner that addresses this issue.

Additionally, because desert tortoises occur over large areas, the Service and Army will direct many of their conservation efforts to the focal areas we discussed previously in this biological opinion. The Service selected these focal areas, based on the best available information and after discussion with partners, with regard to occupation by desert tortoises, habitat quality, and land ownership. Specifically, we chose these areas because:

1. They supported high concentrations of observations of desert tortoises (as assessed during range-wide monitoring);

2. They contain habitat with a high potential to support desert tortoises (to provide for habitat that would likely be productive for desert tortoises); and

3. Land ownership was favorable (to allow for access to implement recovery actions).

As we discussed previously in this biological opinion, the Army would fund numerous conservation activities within these focal areas. The Army will also address targeted, high-priority recovery needs outside of the focal areas. The Army's contributions to the Recovery and Sustainment Partnership Initiative recovery program outside of the focal areas would target installation of highway exclusion fencing and population augmentation. We will discuss the conservation activities in focal areas and non-focal areas in the following section and identify the recovery actions from the recovery plan (Service 2011) that they would implement.

In the recovery plan, the Service (2011) defined priorities to each recovery action. A priority 1 action is one that would be necessary "to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future." The Service did not assign this priority to any of the recovery actions discussed in the recovery plan. A priority 2 action is one "that must be taken to prevent a significant decline in species population numbers or habitat quality or some other significant negative impact short of extinction." The Service considers "[a]ll other actions necessary to provide for full recovery of the species" to be priority 3.

Permanent Habitat Conservation

This recovery activity would implement recovery action 2.9, which is to "secure lands/habitat for conservation" through acquisition of real property and easements. The Service (2011) ranked this action as priority 2 in the Western Mojave Recovery Unit because of the greater amount of private land in this region.

The acquisition of lands and their subsequent management for conservation would be protective of desert tortoises because it would preclude future development on those sites; the direct and indirect effects of development within conservation areas for the desert tortoise would hinder overall recovery efforts. The conservation land manager would also be able to close and restore unauthorized vehicle routes on the property; the Bureau may also be able to remove open routes on public lands that provided access to the former private lands. Finally, the Service and other partners could implement additional conservation activities on such lands, if needed.

Habitat Restoration

This recovery activity would implement recovery action 2.6, which is "restore desert tortoise habitat." The Service (2011) ranked this action as priority 2 in all recovery units. Habitat restoration would include, but not be limited to, control of non-native plants and restoration of disturbed areas.

Currently, the control of non-native plants would focus on management or removal of infestations of species that are not widely distributed in the desert. The goal of this work is to keep them from becoming more widely established. The Service and partners may also experiment with management of non-native species that are already wide-ranging, such as Mediterranean grass (*Schismus* spp.); however, the technology does not currently exist to undertake this effort on a large scale.

The restoration of disturbed areas would increase the area where desert tortoises could find shelter under shrubs and forage on native annual plants. Because desert tortoise habitat covers such a large area, the restoration of disturbed areas would not appreciably increase the area where desert tortoises could find shelter and food. Restoration activities would focus in large part on unauthorized routes (*i.e.*, routes that are not part of the land managers' designated route network). This restoration would reduce human use of these areas and thereby reduce the adverse effects of this use, such as killing of desert tortoises and attraction of common ravens to areas because of human use.

Assisting the Bureau with developing seed sources would enable use of the necessary native plant materials for future restoration efforts. Desert tortoises depend on a wide variety of native plants for nutrition. Use of those native forage plants in restoration is likely to increase productivity of these work areas. Consequently, increasing the Bureau's capacity for providing seed sources would promote the restoration goals in the recovery plan.

Fencing to Exclude Desert Tortoises from Roads

This recovery activity would partially implement recovery action 2.5, which is "restrict, designate, close, and fence roads." The Service (2011) ranked this action as priority 2 in all recovery units.

The Service and Army do not have the legal authority to restrict, designate, and close roads on lands managed or owned by other agencies or parties. The Army manages approximately 100,000 acres of lands for the conservation of desert tortoises in the Western Mojave Recovery Unit; it has been working cooperatively with the Bureau in management of the overall route network on these lands.

The Service and Army can work with other agencies to install fencing along roads. Specifically, the recovery plan (Service 2011) states that "[(desert]) [(t])ortoise-barrier fencing should be installed …and maintained along highways in desert tortoise habitat. In particular, all highways and paved roads within or adjacent to [(desert]) tortoise conservation areas should be fenced with appropriate modification to avoid population fragmentation. Fencing projects need to be completely implemented and maintained to ensure effectiveness." This action is of moderate priority in all recovery units.

Nafus *et al*. (2013) found greater proportions of juvenile desert tortoises along a road with 320 to 1,100 vehicles per day than along roads with lower traffic volumes. They concluded that "roads may decrease [(desert]) tortoise populations via several possible mechanisms, including cumulative mortality from vehicle collisions and reduced population growth rates from the loss of larger reproductive animals."

Reducing the number of desert tortoises that die from human activities overall is a key component of recovering the species. Excluding desert tortoises from roads is an important component of that objective particularly since we expect that most road-killed desert tortoises are adults. Adult desert tortoises wander more and are thus more likely to encounter roads. These individuals are also reproductive; consequently, their protection is a key component of recovery of the species.

Fencing roads has the potential to reduce connectivity and isolate populations. However, exclusion fencing can lead desert tortoises to washes that pass under roads through culverts and bridges. These crossings ensure that populations are not completely isolated. Also, roads alone, absent fencing, can alter gene flow; gene flow is one measure of evaluating whether an activity is fragmenting and isolating populations. Latch *et al*. (2011) evaluated 859 desert tortoises at 16 microsatellite loci in relation to geographic location, sex, elevation, slope, soil type, and spatial relationship to potential anthropogenic barriers south of Fort Irwin. They found two genetically differentiated sub-populations within the area bounded roughly by Interstate 15 to the south and Fort Irwin to the north. The researchers determined that slope, a paved road, and one unpaved route influenced gene flow.

Fort Irwin Road and the Manix Trail influenced gene flow. Fort Irwin Road is paved and is used by large numbers of vehicles, traveling at high speeds. The road was built long ago but heavy use recommenced when Fort Irwin resumed training in the 1970s. In 2002 or 2003, the County of San Bernardino and U.S. Army installed fencing to keep desert tortoises off the road because of the high incidence of mortalities. Manix Trail lies to the east of Fort Irwin Road. It is far wider than most unpaved routes in the desert. The Army maintains it and uses it to move troop rotations to and from the base. The public also uses the trail.

Latch *et al*. (2011) detected that "[d]esert tortoise pairs from the same side of a road exhibited significantly less genetic differentiation than [desert] tortoise pairs from opposite sides" of both Manix Trail and Fort Irwin Road. They note that, given the long generation time for desert tortoises, these slight genetic differences happened relatively recently, perhaps within "dozens" of years ago.

The authors also note "gene flow sufficient to maintain a low level of differentiation among subpopulations could be much less than one migrant per year or even one migrant every few decades in this species." Consequently, culverts and washes under fenced roads should be able to maintain sufficient connectivity.

Closing/Restoration of Unauthorized Roads or Routes

This recovery activity would partially implement recovery actions 2.5 and 2.6, which call for restricting, designating, closing, and fencing roads and restoring habitat, respectively. The Service (2011) ranked these actions as priority 2 in all recovery units.

We discussed the legal aspects of closing roads and routes in the previous section. The Army cooperates with the Bureau with regard to management of the route network on its lands; this recovery action would extend this management more intensively across lands managed by the Bureau and conservation partners. That is, the Army would provide funding to agencies and organizations to restore unauthorized roads and routes, which would allow for the restoration of habitat and decrease mortality of desert tortoises, as we discussed in the "Habitat Restoration" section of this analysis.

Augmentation of Populations of Desert Tortoises

This recovery activity would implement recovery action 3, which is to "augment depleted populations through a strategic program. The Service (2011) ranked the actions associated with augmentation as priority 2 in all recovery units.

As the recovery plan notes (Service 2011), the number of desert tortoises has declined substantially; because of the desert tortoise's reproductive ecology, their recovery will not be rapid. Augmentation, backed by a strategic program of research designed to investigate its effectiveness and that of other recovery actions, will enable the Service to determine the most effective means of managing desert tortoises and possibly providing an initial boost to increasing density so that individuals are not as reproductively isolated.

The Army and Service would use desert tortoises from within the boundaries of Fort Irwin, primarily from the Western Training Area, for this program. The Army may also use desert tortoises from other areas of the installation for other experimental augmentation sites. Because of the translocation of desert tortoises from the Southern Training Area and decades of previous training, the remainder of Fort Irwin will likely not supply numerous desert tortoises to use to augment off-installation populations.

Funding of Visitor-contact Patrols

These recovery activities would implement recovery action 2.3, which is "establish/continue environmental education programs." This recovery action is priority 2 (Service 2011).

The recovery plan notes that people continue to collect desert tortoises illegally, although we cannot quantify this effect. Unauthorized use of the desert (*e.g.*, dumping trash, unauthorized sheep grazing, use of closed roads, driving cross-country, *etc.*) also causes the loss of desert tortoises. Visitor-contact patrols would educate some users of the desert with regard to the sensitivity of habitat and species; ranger patrols may assist in reducing intentionally illegal activity. These activities would decrease the number of desert tortoises that die or are removed from the desert because of human activity and would assist in slowing the current decline in density.

Range-wide Monitoring

This recovery activity would implement recovery action 4.1, which is "monitor desert tortoise population growth." The Service (2011) ranked this task as priority 3. Range-wide monitoring allows the Service and others to track trends in desert tortoise populations, which provide information regarding whether other recovery activities are achieving their intended results. The Service considers this monitoring to be a key component of a recovery strategy for the desert tortoise.

Core Criteria for the Jeopardy Determination regarding the Recovery and Sustainment Partnership Initiative

We have discussed the purpose of this section previously in this biological opinion. Consequently, we will not repeat that discussion here.

In this section, we will synthesize the analyses contained in the previous paragraphs to determine how the proposed Recovery and Sustainment Partnership Initiative is likely to affect the reproduction, number, and distribution of the desert tortoise. We will then assess the effects of this aspect of the proposed action on the recovery of the species and whether it is likely to appreciably reduce the likelihood of both the survival and recovery of the desert tortoise in the wild.

Reproduction

The off-installation recovery efforts that the Army would fund would likely result in an increase in the reproductive capacity of desert tortoises. For example, controlling non-native plants and restoring disturbed habitat with plants that desert tortoises eat would increase available forage. This increase in forage and, as a consequence, reproductive capacity, may result in observable benefits to resident desert tortoises in local areas. The overall increase in reproductive capacity would likely be too minor to measure, at least in the short term, considering the relatively small areas where restoration would occur in relation to the size of the focal areas. Again, average and above-average annual rainfall would likely accelerate restoration to some degree and provide desert tortoises with additional nutrition, which would lead to animals being in generally better condition. Numerous drought years would have the opposite effect. Although climate change is likely to alter "normal" cycles of annual rainfall, we cannot predict with any specificity how climate change is likely to alter weather patterns over the next few decades.

Numbers

The implementation of off-base recovery activities through the Recovery and Sustainment Partnership Initiative is likely to increase the number of desert tortoises; that is the goal of the program. We cannot quantify the amount of the increase because of the numerous variables involved, such as the amount of funding available annually, the nature and location of the implemented recovery activities, and weather conditions.

Implementation of the recovery activities would necessitate vehicular travel on authorized routes within desert tortoise habitat and some work that involve ground disturbance; the amount of ground disturbance involved with restoration or fencing work would be minor. However, any activity that involves vehicular travel and ground disturbance has the potential to kill or injure desert tortoises. These activities are likely to kill or injure few desert tortoises because the recovery workers would be trained to recognize and avoid desert tortoises and the on-the-ground work would involve a relatively small amount of ground disturbance, mostly in previously disturbed areas.

In summary, we expect that the recovery activities associated with the Recovery and Sustainment Partnership Initiative would increase the number of desert tortoises in the Western Mojave Recovery Unit, although these activities could kill or injure a small number of individuals.

Distribution

Recovery activities will be focused on reducing sources of mortality and improving habitat conditions within the existing distribution of the desert tortoise in the Western Mojave Recovery Unit. Therefore, this aspect of the proposed action will not alter the distribution of the desert tortoise.

Recovery

The goal of the Recovery and Sustainment Partnership Initiative is to further the recovery of the desert tortoise. We cannot quantify to what degree that the recovery activities will increase the density of desert tortoises or improve habitat conditions because of the numerous variables involved. However, we expect this aspect of the proposed action to improve the overall condition of the desert tortoise.

Effects of Army Activities on Critical Habitat of the Desert Tortoise

Effects of the Army's Use of the Western Training Area and Operations and Activities on Critical Habitat of the Desert Tortoise

Critical habitat of the desert tortoise occurs in two main areas of Fort Irwin. Approximately 23,214 acres of critical habitat occur along the original southern boundary of Fort Irwin. The Service and Army have previously consulted on the effects of training on these lands (Service 2012). Approximately 19,643 acres now comprise the Southern Training Area; the Army manages approximately 3,571 acres along the southern boundary of Fort Irwin as conservation lands for the desert tortoise. Lands managed by the Bureau lie to the south of these conservation lands. Because previous consultations fully addressed the effects on critical habitat of Army use of these lands, we will not repeat that discussion here. (*I.e.*, Service [2012] addressed future training in the Southern Training Area and Service [2014a] addressed future infrastructure and other activities in the Southern Training Area.)

The second area of critical habitat occurs in the Western Training Area. The Western Training Area includes approximately 70,045 acres of critical habitat of the desert tortoise (Service 2012). Because of the East Paradise Conservation Area, the no-dig area, and Desert Cymopterus Conservation Area, approximately 61,697 acres of the Western Training Area would be available for training and support facilities (Housman 2020c).

The Army would not conduct training with vehicles in the East Paradise Conservation Area and the no-dig area. It may locate communications sites and other necessary tracking or monitoring equipment, including environmental monitoring equipment, and the roads to these facilities in these areas. The Army may also conduct orienteering and other training that does not involved ground disturbance in the no-dig area. The Army established the Desert Cymopterus

Conservation Area to protect an occurrence of the sensitive plant species, *Cymopterus deserticola*. The Army prohibits all uses in the 347.8-acre area, except for monitoring of desert cymopterus (Housman 2020c). Although the Army would not disturb the physical and biological features related to substrates and plants in this area, its isolation from larger areas of critical habitat decreases its value for the conservation of the desert tortoise. Consequently, the proposed action would diminish the value of approximately 62,045 acres of critical habitat in the Western Training Area.

Because the Army will use most of the Western Training Area differently than it will use the East Paradise Conservation Area and the no-dig area, we will note how the proposed action would affect the physical and biological features of critical habitat in each sub-area. We will then summarize the overall effects of the proposed action on critical habitat as a whole.

The Manix Trail crosses critical habitat of the desert tortoise. The Army would use this route when rotations enter and leave Fort Irwin; to allow for that use, the Army would maintain the trail. The Army will restrict its maintenance and operational use of the Manix Trail to previously disturbed areas. Because the Army would restrict its activities to the previously disturbed area of the Manix Trail and the physical and biological features of critical habitat are no longer present there, the proposed actions are not likely to adversely affect critical habitat of the desert tortoise in this area.

Western Training Area

Sufficient Space to Support Viable Populations within Each of the Recovery Units and to Provide for Movement, Dispersal, and Gene Flow

Within this training area, the proposed action would essentially eliminate space to support viable populations. It would also prevent the movement, dispersal, and gene flow of desert tortoises within this portion of the critical habitat unit. Within the context of the entire critical habitat unit, critical habitat to the north of the training area would allow for movement, dispersal, and gene flow to the west and then throughout the remainder of the critical habitat unit.

Sufficient Quality and Quantity of Forage Species and the Proper Soil Conditions to Provide for the Growth of these Species; Suitable Substrates for Burrowing, Nesting, and Overwintering; Burrows, Caliche Caves, and other Shelter Sites; and Sufficient Vegetation for Shelter from Temperature Extremes and Predators

We have grouped the second through fifth physical and biological features because they are closely interrelated ecologically and the proposed action would affect them in the same general manner.

Training with vehicles and development of infrastructure would immediately affect these physical and biological features. The physical disturbances associated with these activities would cause the loss of forage plants, disturbance of substrates, crushing of burrows and other shelter sites, and crushing and eventual removal of shrubs that provide cover.

Disturbance of substrates has the potential to allow invasive non-native plant species to spread. An additional concern is that vehicles traveling to Fort Irwin from other areas may introduce novel species.

Training within the original boundaries of Fort Irwin has not caused large infestations of weeds. (Housman 2020d). Based on this observation, we expect that the Army's activities in the Western Training Area are unlikely to cause a substantial increase in the abundance of weeds.

Additionally, the Army washes all rotational vehicles brought on to Fort Irwin for training (Housman 2020d). This precaution greatly reduces the likelihood that rotational vehicles will introduce seeds from outside of the region.

The integrated natural resources management plan (Army 2006-2011) calls for the Army to participate in regional weed management efforts and to control weeds within the conservation areas for the Lane Mountain milk-vetch. The integrated natural resources management plan notes that the Army's control efforts are contingent on funding.

As in other areas of Fort Irwin, these physical and biological features would persist in areas where training does not occur or occurs infrequently. We expect such areas to remain in isolated sites, such as in areas adjacent to the boundaries of the base and in steep, rugged terrain. We do not expect the Army's activities to have a measurable effect on these physical and biological features outside of the Western Training Area (*i.e.*, in the adjacent conservation areas).

Habitat Protected from Disturbance and Human-caused Mortality

The proposed action would disturb habitat and introduce various sources of human-caused mortality throughout most of this training area. As we have discussed previously in this section, the Army may not use areas along the boundary of Fort Irwin and rugged areas that are not as suitable for training. These isolated areas would likely continue to support this physical and biological feature.

East Paradise Conservation Area

Sufficient Space to Support Viable Populations within Each of the Recovery Units and to Provide for Movement, Dispersal, and Gene Flow

Within the East Paradise Conservation Area, the Army may locate communications sites and other tracking equipment; the Army would develop roads to reach these sites. In general, communication and tracking sites are small in area (*e.g.*, hundreds of square feet). Consequently, they would have a discountable effect on the amount of space needed to support a viable population of desert tortoises within the Superior-Cronese Critical Habitat Unit and would not impede movement, dispersal, or gene flow.

Roads to the communication and tracking sites would likely occupy a few acres along several miles of the routes. Development of the roads would involve the loss of a negligible amount of critical habitat; therefore, it would have a discountable effect on the amount of space needed to support a viable population of desert tortoises within the Superior-Cronese Critical Habitat Unit. Use of the roads would be relatively infrequent and would therefore not impede movement, dispersal, or gene flow.

Sufficient Quality and Quantity of Forage Species and the Proper Soil Conditions to Provide for the Growth of these Species; Suitable Substrates for Burrowing, Nesting, and Overwintering; Burrows, Caliche Caves, and other Shelter Sites; and Sufficient Vegetation for Shelter from Temperature Extremes and Predators

Within the East Paradise Conservation Area, the development of communication and tracking sites and the roads to these sites would remove these physical and biological features from small sites. That is, the disturbance would likely amount to hundreds of square feet for the sites themselves and several acres for the roads. The vast majority of the critical habitat within the East Paradise Conservation Area would continue to support these physical and biological features, which would retain their value for the conservation of the desert tortoise.

The roads to the sites could serve as corridors for the movement of non-native, invasive species. Such species can displace the native annual species included in the second physical and biological feature. Because the Army would use these roads infrequently, we expect that this risk will be less than it is for roads that numerous parties use frequently. To date, the Army has not observed weed infestations in these areas (Housman 2020d).

Habitat Protected from Disturbance and Human-caused Mortality

The location of communications sites, other tracking equipment, and the roads to these sites within the East Paradise Conservation Area would introduce some disturbance and human-caused mortality. Because the tracking sites are small and use of the roads would be infrequent, these activities would have a negligible effect on the value of critical habitat for the conservation of the desert tortoise.

No-dig Area

Sufficient Space to Support Viable Populations within Each of the Recovery Units and to Provide for Movement, Dispersal, and Gene Flow

The Army may locate communications sites and other tracking equipment and develop roads to reach these sites within the no-dig area. The effects of these activities would be the same as for the East Paradise Conservation Area.

The Army would conduct orienteering and other training that does not involve ground disturbance in this area. Such training would not affect this physical and biological feature because it would not involve ground disturbance, other than foot traffic; that is, it would not result in the loss of any critical habitat.

Sufficient Quality and Quantity of Forage Species and the Proper Soil Conditions to Provide for the Growth of these Species; Suitable Substrates for Burrowing, Nesting, and Overwintering; Burrows, Caliche Caves, and other Shelter Sites; and Sufficient Vegetation for Shelter from Temperature Extremes and Predators

The effects of the location of communications sites and other tracking equipment within the no-dig and the development and use of roads to reach these sites would be the same as for the East Paradise Conservation Area.

The orienteering and other training would not involve ground disturbance. Such training would have negligible effects on these physical and biological features because it would involve only foot traffic. Given the rugged nature of the terrain in this area, we expect that at least some portions of the no-dig area would not experience any disturbance.

Habitat Protected from Disturbance and Human-caused Mortality

The effects of the location of communications sites and other tracking equipment within the no-dig and the development and use of roads to reach these sites would be the same as for the East Paradise Conservation Area.

The orienteering and other training would not involve ground disturbance; it would involve a limited amount of disturbance and a low potential of human-caused mortality. (For example, a soldier could step on a small desert tortoise or on a burrow that could collapse and entrap the desert tortoise.) Such training would have a minor effect on this physical and biological feature because it would involve only foot traffic. Given the rugged nature of the terrain in this area, we expect that at least some portions of the no-dig area would not experience any disturbance.

Effects of Off-installation Recovery Efforts on Critical Habitat of the Desert Tortoise

We discussed how the off-installation recovery efforts would promote the conservation of desert tortoises in the Effects of Off-installation Recovery Efforts on the Desert Tortoise section of this biological opinion. Many of these efforts would also assist with the management of critical habitat. We will summarize those effects in the following section; because the beneficial effects to critical habitat overlap to a large degree with those to the desert tortoise, we have not included extensive detail in this section.

Sufficient Space to Support Viable Populations within Each of the Six Recovery Units and to Provide for Movement, Dispersal, and Gene Flow

Permanent habitat conservation would implement recovery action 2.9, which is to "secure lands/habitat for conservation" through acquisition of real property and easements. The acquisition of lands within critical habitat and their subsequent management for conservation would be protective of this physical and biological feature because it would preclude future development on those sites, which would maintain space to support a viable population within the Superior-Cronese Critical Habitat Unit and to provide for movement, dispersal, and gene flow.

Sufficient Quality and Quantity of Forage Species and the Proper Soil Conditions to Provide for the Growth of these Species; Suitable Substrates for Burrowing, Nesting, and Overwintering; Burrows, Caliche Caves, and other Shelter Sites; and Sufficient Vegetation for Shelter from Temperature Extremes and Predators

We have grouped the second through fifth physical and biological features because they are closely interrelated ecologically and conservation activities would affect them in the same general manner.

Habitat restoration would implement recovery action 2.6, which is "restore desert tortoise habitat." The restoration of disturbed areas within critical habitat would increase the functionality of at least three of the four physical and biological features; it may not improve substrates that have been heavily compacted. Because desert tortoise habitat covers such a large area, the restoration of disturbed areas would not appreciably increase the area in which the physical and biological features are restored. Restoration activities would focus in larger part on unauthorized routes (*i.e.*, routes that are not part of the land managers' designated route network). However, restoration would reduce human use of these areas and thereby reduce the likelihood that such use increases.

Assisting the Bureau with developing seed sources would enable use of the necessary native plant materials for future restoration efforts. Increasing the prevalence of native forage plants in restoration is likely to increase productivity of these work areas. Consequently, increasing the Bureau's capacity for providing seed sources would promote the functionality of the second physical and biological feature, which is, in part, the sufficient quality and quantity of forage species.

Fencing to exclude desert tortoises from roads would partially implement recovery action 2.5, which is "restrict, designate, close, and fence roads." This recovery action would prevent desert tortoises from entering roads; in cases where roads do not have controlled access, these fences would also prevent vehicles from entering desert tortoise habitat. Specifically, it would be most effective along roads where either the California Department of Transportation or counties have not already controlled access. (Drivers cannot leave the road at any point on roads with controlled access, such as interstate highways because such roads already have barbed wire fencing.) Reducing the availability of unauthorized routes through fencing would allow for the active or passive restoration of critical habitat, which would increase the value of these physical and biological features for the conservation of the desert tortoise.

The closing/restoration of unauthorized roads or routes would partially implement recovery actions 2.5 and 2.6, which call for restricting, designating, closing, and fencing roads and restoring habitat, respectively. These recovery actions within critical habitat would also increase the value of these physical and biological features for the conservation of desert tortoises, as discussed in the previous sections.

Funding of visitor-contact patrols would implement recovery action 2.3, which is "establish/continue environmental education programs." This recovery action would assist in reducing unauthorized use of the desert (*e.g.*, dumping trash, unauthorized sheep grazing, use of closed roads, driving cross-country, *etc.*) within critical habitat and thereby increase the value of these physical and biological features for the conservation of desert tortoises.

<u>Habitat Protected from Disturbance and Human-caused Mortality</u>

Several of the recovery actions would serve to reduce disturbance and human-caused mortality. For example, land management agencies and non-governmental organizations can manage habitat more effectively for conservation and reduce disturbance resulting from recreation and development when it is permanently conserved (recovery action 2.9). Restored habitat (recovery action 2.6) discourages unauthorized recreation. Fencing and closing/restoration of unauthorized roads or routes (recovery actions 2.5 and 2.6) prevent disturbance associated with unauthorized use by off-highway vehicles. These recovery actions within critical habitat would increase the functionality of this physical and biological feature for the conservation of desert tortoises.

Summary

The proposed action would result in the long-term loss of the physical and biological features of critical habitat from approximately 62,045 acres of the Superior-Cronese Critical Habitat Unit. (*I.e.*, the area of the entire Western Training Area minus the areas of the East Paradise Conservation Area and the no-dig area; 70,045 – [4,300 + 3,700] = 62,045.) The Army is unlikely to use small areas of the most rugged terrain where the physical and biological features of critical habitat would persist. This reduction represents approximately 8.3 percent of the Superior-Cronese Critical Habitat Unit, in which the Western Training Area is located. (*I.e.*, 62,045 / 747,257 x 100 = 8.30. We revised the acreage of the Superior-Cronese Critical Habitat Unit to reflect the loss of the Southern Training Area; *i.e.*, 766,900 – 19,643 = 747,257.) As a whole, the proposed action would remove the physical and biological features of critical habitat from approximately 0.97 percent of critical habitat of the desert tortoise. (*I.e.*, 62.045 / 6,426,557 x 100 = 0.965. We also revised the acreage of all critical habitat to reflect the loss of the Southern Training Area.)

Effects of the Action on the Lane Mountain Milk-vetch

As indicated previously, we will analyze the Army's activities within the boundaries of Fort Irwin (i.e., use of the Western Training Area and ongoing activities and operations) separately from the recovery activities that would occur later in time under the Recovery and Sustainment Partnership Initiative.

Effects of the Army's Use of the Western Training Area and Operations and Activities on the Lane Mountain milk-vetch

The Service (2004) has previously analyzed the effects of the Army's proposed addition of maneuver training lands. Since the issuance of the biological opinion in 2004, the Army has implemented the conservation measures described in the Service's biological opinion and the Army's biological assessment (Charis Professional Services Corporation 2003; Army 2004). We have based the following analysis on that in our 2004 biological opinion; we have included minor updates based on the best available information. Because the Army has already implemented the conservation measures that it proposed in 2004, we included information on those actions in the Environmental Baseline - Status of the Lane Mountain Milk-vetch in the Action Area section of this biological opinion.

Effects of the Preparation of the Western Training Area

The only preparation that is likely to affect the Lane Mountain milk-vetch is the development of monitoring and communication sites and roads to these sites in the East Paradise Conservation Area and 'no-dig' areas. The Army may disturb a small but unquantified amount of habitat by the clearing of the sites and the construction of the roads. These activities are unlikely to disturb the Lane Mountain milk-vetch to a measurable degree because the roads and facilities would occupy a small portion of the protected areas and the Army has some flexibility to locate the roads and sites to avoid the Lane Mountain milk-vetch.

Construction of the communications sites and roads and subsequent use of the roads would generate dust. Given the small size of the area that the Army would disturb and the generally low use of the roads, we expect that the small amount of dust generated in this manner is likely to have negligible effect on the Lane Mountain milk-vetch. We will discuss the potential effects of dust later in this section.

Effects of the Use of the Western Training Area

Training and Development of Infrastructure

Vehicles associated with training and supporting activities would crush or uproot Lane Mountain milk-vetch plants and their host shrubs. Construction, digging and other earth-moving activities, temporary bivouacs, helicopter landings, and movement of numerous soldiers on foot would also destroy plants and degrade habitat.

In areas where training does not directly remove Lane Mountain milk-vetch plants and their habitat, partial removal of vegetation, erosion and compaction of sediments, and loss of cryptogamic crusts may degrade habitat over time to the point where individuals no longer persist. The Lane Mountain milk-vetch generally occurs on a thin layer of sediment overlaying granite; frequent foot and vehicle traffic would easily erode this thin layer of sediments and remove the substrates in which the plant roots. Additionally, areas that are stripped of vegetation and sediments by training will be unable to hold rainfall; the increased runoff from these areas is likely to remove sediment from downhill areas and further degrade adjacent habitat. Where sediments persist, the destruction of cryptogamic crusts would likely lead to an increase in weedy annual species, such as Mediterranean grass; these plants can compete with native species for moisture and nutrients and carry fire in plant communities that are not adapted to burning.

The Army divided the intensity of impacts to the Lane Mountain milk-vetch within its training areas into three classes (Charis Professional Services Corporation 2003). High-intensity use areas have few, if any, topographic constraints to the movement of vehicles. Training there would be frequent and intense; the Army would use these areas as battle corridors to support exercises such as force-on-force training. The Army estimates that training would cause the loss of up to 100 percent of the habitat and individuals of the Lane Mountain milk-vetch in such areas.

Moderate-intensity use would occur where the terrain is rocky and uneven. In general, such areas are located at the end of the battle corridors. The Army estimates that this level of training would, over time, render up to 60 percent of the habitat unsuitable for the Lane Mountain milk-vetch by training activities. Outside of restricted areas, such as Superior Dry Lake and the conservation areas, units can generally conduct exercises in any area that meets their training needs. For that reason, we considered these areas as lost to the long-term conservation of the Lane Mountain milk-vetch.

The Army also predicted that low-intensity use would occur on non-maneuverable steep slopes and along the borders of Fort Irwin that it does not expect to receive heavy use. The Lane Mountain milk-vetch and its habitat would likely sustain up to a 20 percent loss of over time.

The Montana Mine-Brinkman Wash occurrence of the Lane Mountain milk-vetch covers approximately 5,499 acres. (See Figure 3 for geographic references.) Approximately 3,627 acres of this occurrence would be subject to high- and moderate-intensity use. We expect that this use would disturb approximately 65.96 percent of the occurrence to the point that the Lane Mountain milk-vetch is unlikely to persist in the training area. The Army has designated approximately 1,872 acres of this occurrence as a “no-dig” area; the biological assessment (Charis Professional Services Corporation 2003) characterized the training in this area as low intensity. Because of the Army’s revised proposal for management of this area, we expect that less disturbance would occur than the Army predicted in the biological assessment and that the no-dig area will function for the long-term conservation of the species.

The Paradise Valley occurrence within Fort Irwin covers approximately 4,596 acres. (Approximately 200 acres of the 4,796-acre occurrence lie outside of Fort Irwin on lands managed by the Bureau.) The Army would conduct high- and moderate-intensity training on approximately 971 acres of this occurrence; this comprises 20.25 percent of the occurrence. The remainder of the occurrence on Army lands (approximately 3,634 acres) is located within the East Paradise Conservation Area.

Dust

Dust generated by training with large numbers of vehicles may affect the Lane Mountain milk-vetch. Our previous biological opinion regarding the Lane Mountain milk-vetch in the Western Training Area (Service 2004) discussed some potential effects of dust; we will not repeat that discussion here.

Wijayratne *et al*. (2009) conducted field and greenhouse studies of the effect of intentionally applied dust on the Lane Mountain milk-vetch. In the field experiments, they found that dust deposition on Lane Mountain milk-vetch reduced shoot growth compared to undusted plants. They also recorded an increase in average net photosynthesis as the dust on leaves increased in concentration; leaf temperatures also increased as dust increased. The effects on the Lane Mountain milk-vetch varied with the seasons. Dust induced increases in leaf temperatures and photosynthetic rates during early spring and extended the activity period that plants could maintain positive net photosynthetic rates. However, as temperatures increased later in the year, "leaf temperatures of dusted plants likely lowered net photosynthetic rates, thus reducing shoot growth."

Wijayratne *et al*. (2009) also measured the cumulative accumulation of dust in traps. They concluded that "With this low level of ambient cumulative deposition, we expect that (Lane Mountain milk-vetch) plants in (the Coolgardie Mesa) occurrence were not greatly affected by the dust they received from unimproved vehicle routes by the end of the study. In addition, all of our study plants recovered from experimental dusting after heavy winter rains and put out new growth for the 2005 season."

The potential exists that a heavy accumulation of dust could reduce photosynthesis to the extent that it affects growth and reproduction. Wijayratne *et al*. (2009) did not measure flower and fruit production in their study. However, we anticipate that, based the results from Wijayratne *et al*. (2009), dust would not accumulate to such a degree that it would hinder growth to the extent that it would hinder flower and fruit production.

Dust could affect the Lane Mountain milk-vetch indirectly by decreasing pollinator visits. Dust can abrade the integument of arthropods and cause them to lose water more quickly; this effect may reduce their fitness and have long-term negative effects on their populations. Decreases in the populations of pollinators could diminish the amount of pollination of the Lane Mountain milk-vetch and thereby decrease reproduction. We do not know if dust has affected pollinators within the range of the Lane Mountain milk-vetch. However, we expect that the ranges of pollinators do not overlap completely with the Lane Mountain milk-vetch and likely extend beyond areas affected by dust generated by the Army; they also likely extend beyond the range of the listed species. For example, the most common pollinator of Lane Mountain milk-vetch is a solitary bee (*Anthidium dammersi*) (76 FR 29108), which is a generalist that visits many other species of flower found in this area (Gonzalez and Griswold 2013).

The greatest potential source of dust is Superior Dry Lake and the clay sediments surrounding this playa in the western portion of the Superior Valley parcel; these clay sediments will generate much more dust once the surface crusts are broken than the granitic sediments to the east. The Army has designated the lakebed area as off-limits to vehicle use; this measure will eliminate this area as a potential source of dust.

In conclusion, we cannot predict the precise effects of dust on the Lane Mountain milk-vetch because of all of the variables. The amount of training would vary; increased training would generally increase the amount of dust. Wind speed and direction will vary. The distance of plants from training areas would affect the amount of dust they receive. Rainfall will remove dust from leaves; however, the amount and timing of rain is likely to change each year. The plants will drop leaves every year, which would prevent dust from accumulating over years.

Based on the best available information and our professional judgment, dust generated by the Army in the Western Training Area is unlikely to have a measurable effect on most Lane

Mountain milk-vetch plants in the conservation areas within Fort Irwin or in the no-dig area. We expect that plants closest to training areas are likely to experience more dust than other Lane Mountain milk-vetches. Additionally, although we have not studied the specific effects of dust on the reproduction of the Lane Mountain milk-vetch, we anticipate, based on the best available information, that dust would not cause a measurable effect on the species' reproduction.

Obscurants

The Army will likely use obscurants in the Western Training Area; generators emit obscurants to hide the movements of forces during training. Depending on the specific need, the composition of the obscurants may vary. The potential exists that obscurants may contact the Lane Mountain milk-vetch in the East Paradise Conservation Area and in the no-dig area. The effect of obscurants on the Lane Mountain milk-vetch would vary, depending on its composition and the frequency and volume of contact. We do not have specific information on the composition of the obscurants at this time.

We expect that obscurants are likely to contact Lane Mountain milk-vetch plants within conservation areas at a low level. We have reached this conclusion for several reasons. First, units are unlikely to use obscurants frequently adjacent to the conservation areas; that is, off-limit boundaries limit the ability to maneuver so units tend to avoid such areas. Second, if units use obscurants farther from the conservation areas for the Lane Mountain milk-vetch, the obscurants are likely to dissipate before they reach plants. The Army generally would not use obscurants during strong winds because it would be ineffective. Last, the Lane Mountain milk-vetch sheds its leaves every year; in the event that obscurant reached leaves, it would not accumulate over a long time because the species is deciduous. For these reasons, we expect that the use of obscurants is unlikely to have a measurable effect on the Lane Mountain milk-vetch within the East Paradise and National Training Center Goldstone Conservation Areas and the no-dig area. Plants that are located in training areas are more likely to endure more frequent exposure to greater amounts of obscurants.

Core Criteria for the Jeopardy Determination

The core criteria for jeopardy determinations for plants and animals are the same. Consequently, we will not repeat that discussion here. The following analysis differs from that of the desert tortoise in that the Service has not defined any recovery units for the Lane Mountain milk-vetch.

In the following sections, we will synthesize the analyses contained in the Effects of the Action section of this biological opinion to determine how the proposed action affects the reproduction, number, and distribution of the Lane Mountain milk-vetch. We will then assess the effects of the proposed action on the recovery of the species and whether it is likely to appreciably reduce the likelihood of both the survival and recovery of the Lane Mountain milk-vetch in the wild.

Reproduction

As we stated previously, we do not know if dust accumulation affects growth of the Lane Mountain milk-vetch to the extent that it would decrease reproduction. Because Lane Mountain milk-vetch plants are deciduous and regrow their leaves in the spring of years with sufficient rainfall, we expect that dust is unlikely to accumulate to the extent that it would measurably affect the reproductive capacity of the species. The potential exists that extremely heavy coatings of dust may slow growth to the extent that flowering is inhibited or pollinators cannot access the flowers. Plants closest to training would be at the greatest risk of this effect. However, strong winds, which are routine in the desert, would remove at least some dust from plants. Finally, most of the plants in the Army's conservation areas would be far removed from training areas and thus not exposed to high levels of dust. For these reasons, we conclude that dust is unlikely to affect reproduction of the Lane Mountain milk-vetch in a measurable manner.

Numbers

We expect that high- and moderate-intensity training is likely to remove all Lane Mountain milk-vetch within training areas. Based on the best available information, we expect plants within the East Paradise and NTC Goldstone Conservation Areas and the no-dig area would persist.

No one has conducted a complete survey of all the species' occurrences since the Army's effort from 1999 through 2001. Field workers found 5,723 plants during that survey (Service 2004). Sampling since that time (e.g., Redhorse 2021) indicates that the number of plants on survey plots has declined over time. On a relatively short-term basis, the number of live plants found each year has correlated closely with the amount of rainfall. We do not have information regarding how longer alterations in rainfall patterns, which occur regularly in the Mojave Desert (see Service 2014b) will affect the abundance of the Lane Mountain milk-vetch. Extended drought likely deceases the overall number of plants that survive from year to year.

Plants are not in the same locations as they were during the range-wide survey. That is, some of those plants are still alive, some have died, and others have germinated and grown to reproductive size. Therefore, we do not know the locations of individual plants and cannot predict the number of plants that training will affect outside the conservation areas and no-dig zone.

For those reasons, we have based our analysis on the effects of the use of the Western Training Area on the number of Lane Mountain milk-vetch plants on the change in the amount of habitat managed for the species. Training in the Western Training Area would disturb the plants on approximately 4,598 of the 21,349 acres occupied by the Lane Mountain milk-vetch range-wide. The Army is unlikely to conduct vehicular training and cause other substantial ground disturbances (e.g., digging trenches, building facilities) within the steeper, more rugged portions of the training areas. Consequently, Lane Mountain milk-vetch are likely to persist in these areas, although we cannot quantify the extent. Although this disturbance of habitat within training areas comprises a measurable impact with regard to the numbers of individuals, we expect that this impact is unlikely to cause an irreversible decline in the remainder of the Lane Mountain milk-vetch population. Most, if not all, of the remaining Lane Mountain milk-vetch plants are located within either conservation areas maintained by the Army or Bureau; the primary management goal in these areas is the maintenance of the habitat of these populations. All of the conservation areas are large enough to support viable populations. We base this assertion on the fact that the

Goldstone population, which is the smallest in area, covers approximately 1,283 acres and has likely never been substantially larger because the species is restricted to a specific type of substrate. Consequently, the remaining populations of Lane Mountain milk-vetch are likely to persist into the foreseeable future, at least with consideration of the numbers of individuals, as viewed through the amount of occupied habitat.

Distribution

As we discussed previously in this biological opinion, the Army would conduct high- and moderate-intensity training on approximately 4,598 acres of Lane Mountain milk-vetch habitat of the Paradise Valley and Montana Mine-Brinkman Wash occurrences. (*I.e.*, the Army would train on 971 acres of the former location and 3,627 acres of the latter.) As we discussed in the previous section, Lane Mountain milk-vetch plants may persist in the steeper, more rugged portions of training areas but we cannot quantify the extent.

Based on information in the Service's (2004) previous biological opinion for the expansion of Fort Irwin, the Lane Mountain milk-vetch occupies approximately 21,349 acres range-wide. The loss of 4,598 of 21,349 acres of occupied habitat comprises a measurable impact with regard to the distribution of the species. The remaining distribution of the Lane Mountain milk-vetch comprises blocks of habitat that we anticipate will persist over time because they are in conservation management. Although this disturbance of habitat within training areas comprises a measurable impact with regard to the distribution of the species, the remainder of the Lane Mountain milk-vetch habitat is sufficiently large and appropriately distributed. Lane Mountain milk-vetch would continue to be distributed across four separate areas, which reduces the likelihood that a stochastic event would substantially reduce the overall distribution of the species.

Recovery

The proposed action, with regard to the Army's activities in the Western Training Area, has not changed in a measurable way since the 2004 biological opinion. As a result of that consultation, the Army acquired some private lands within habitat of the Lane Mountain milk-vetch. The acquisition of these lands precluded their development and assisted, to some degree, in the long-term conservation of the species.

The loss of habitat and individuals of the Lane Mountain milk-vetch because of training in the Western Training Area and through ongoing operation and activities is likely to impede recovery of the species to some degree. However, the Lane Mountain milk-vetch would retain a sufficient number of individuals and have a sufficient amount of habitat to maintain a viable population at each of the four sites and to persist into the foreseeable future. For this reason, the overall effect on the recovery of the species is likely to be negligible.

Effects of Off-installation Recovery Efforts for the Desert Tortoise on the Lane Mountain Milk-vetch and its Critical Habitat

Off-installation recovery efforts for the desert tortoise may occur within habitat of the Lane Mountain milk-vetch or its critical habitat. The Service will coordinate with the manager of that recovery effort to determine whether the recovery efforts for the desert tortoise may affect the Lane Mountain milk-vetch or its critical habitat at that time.

In general, because of the anticipated nature of the recovery efforts for the desert tortoise, we expect that avoidance of adverse effects to the Lane Mountain milk-vetch and its critical habitat is likely. The potential exists that recovery efforts for the desert tortoise, such as restoration of disturbed areas, may result in some beneficial effects on the Lane Mountain milk-vetch and its critical habitat. For these reasons, we conclude that the off-installation recovery efforts for the desert tortoise may affect, but are not likely to adversely affect, the Lane Mountain milk-vetch and its critical habitat.

CUMULATIVE EFFECTS

"'Cumulative effects' are those effects of future state or private activities, not involving federal activities, that are reasonably certain to occur within the action area of the federal action subject to consultation" (50 CFR 402.02). Future Federal actions are not considered cumulative effects because they are subject to consultation, pursuant to section 7(a)(2) of the Endangered Species Act.

As we described previously in this biological opinion, the action area comprises Fort Irwin, the Manix Trail, and lands outside of Fort Irwin to which the Army may translocate desert tortoises from Fort Irwin and where it would implement recovery actions. The Army manages Fort Irwin and the Manix Trail; therefore, these are Federal lands and actions on these lands are not cumulative effects.

The Army will translocate desert tortoises to conservation areas it manages or to lands managed by the Bureau or non-governmental organizations; it will also conduct recovery actions on these lands. Future actions on federally managed lands are not cumulative effects. Activities on lands managed by non-governmental organizations promote the recovery of the desert tortoise. We are not aware of any actions on lands managed by non-governmental organizations that would adversely affect desert tortoises or the Lane Mountain milk-vetch that are reasonably certain to occur.

For these reasons, we do not anticipate any cumulative effects, as defined by the implementing regulations for section 7(a)(2) of the Endangered Species Act.

CONCLUSIONS

Desert Tortoise

Because we analyzed the effects of the Army's activities on the desert tortoise within the boundaries of Fort Irwin (i.e., use of the Western Training Area and ongoing operations and activities) separately from those of the Recovery and Sustainment Partnership Initiative, we will provide separate conclusions for those two components of the proposed action.

Conclusion regarding the Army's Use of the Western Training Area and Operations and Activities

After reviewing the current status of the desert tortoise, the environmental baseline for the action area, the effects of the Army's use of the Western Training Area and operations and activities, and the cumulative effects, we have determined that this aspect of the proposed action is not likely to jeopardize the continued existence of the desert tortoise. We have reached this conclusion for the following reasons:

1. The proposed action will not affect the reproductive capacity of desert tortoises,

2. The proposed action is not likely to appreciably reduce the number of desert tortoises within the action area and, by extension, throughout the range of the desert tortoise,

3. The proposed action will not appreciably decrease the distribution of the desert tortoise, and

4. The proposed action is not likely to appreciably affect the recovery of the desert tortoise.

Conclusion regarding Off-installation Recovery Efforts

After reviewing the current status of the desert tortoise, the environmental baseline for the action area, the effects of the proposed off-installation recovery efforts, and the cumulative effects, we have determined that this aspect of the proposed action is not likely to jeopardize the continued existence of the desert tortoise. We have reached this conclusion for the following reasons:

1. The proposed action is likely to benefit the reproductive capacity of desert tortoises,

2. The proposed action is likely to result in a small increase in the number of desert tortoises within the action area and, by extension, throughout the range of the desert tortoise,

3. The proposed action will not alter the distribution of the desert tortoise, and

4. The proposed action is likely to promote the recovery of the desert tortoise.

Critical Habitat of the Desert Tortoise

"Destruction or adverse modification means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species" (50 CFR 402.02). We determine whether a proposed action is likely to result in the destruction or adverse modification of critical habitat through an analysis of how a proposed action affects the physical and biological features of critical habitat within the action area in relation to the entirety of designated critical habitat. For critical habitat of the desert tortoise, this process involves considering the effects at the level of the action area, then at the level of critical habitat unit, and then finally for the entirety of designated critical habitat.

Logically, if a proposed action is unlikely to diminish the conservation value of critical habitat within the action area, it will not affect the conservation value of the critical habitat unit or the remainder of critical habitat. Conversely, an action with appreciable effects on the conservation value of critical habitat in the action area may degrade the status of critical habitat to the extent that it affects the critical habitat unit or the entire designated area of critical habitat.

Conclusion regarding the Army's Use of the Western Training Area and Operations and Activities

The use of the Western Training Area and operations and activities would reduce the amount of space available to support viable populations within the action area and decrease the ability of desert tortoises to move, disperse, and have gene flow north and south across a portion of the Superior-Cronese Critical Habitat Unit. (As a reminder, we considered the effects of the use of the Southern Training Area on critical habitat in a previous biological opinion.) This aspect of the proposed action would reduce the area in which the required substrates and vegetation for desert tortoises are available within the Superior-Cronese Critical Habitat Unit and would degrade the quality of these physical and biological features where training occurs. It would also increase the level of disturbance within the Western Training Area.

As this aspect of the proposed action would decrease the size of the Superior-Cronese Critical Habitat Unit by a measurable amount (i.e., an amount that is more than negligible), the question then is whether this decrease "appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species" (50 CFR 402.02).

After reviewing the current status of the critical habitat, the environmental baseline for the action area, the effects of the proposed use of the Western Training Area and operations and activities, and the cumulative effects, it is our biological opinion that this aspect of the proposed action is not likely to result in the destruction or adverse modification of critical habitat of the desert tortoise. We have reached this conclusion for the following reasons.

1. The Western Training Area does not support any physical and biological features that are unique to the action area, the critical habitat unit, or critical habitat as a whole;

2. Physical and Biological Feature 1. Sufficient space remains within the critical habitat unit to support viable populations and desert tortoises would be able to move, disperse, and have gene flow throughout the critical habitat unit, albeit over greater distances;

3. Physical and Biological Features 2–5. The remainder of the Superior-Cronese Critical Habitat Unit also supports the required substrates and vegetation for desert tortoises; and

4. Physical and Biological Feature 6. Levels of disturbance and human-caused mortality remain at levels that allow for the conservation of the desert tortoise.

Conclusion regarding Off-installation Recovery Efforts

After reviewing the current status of critical habitat of the desert tortoise, the environmental baseline for the action area, the effects of the proposed off-installation recovery efforts, and the cumulative effects, it is our biological opinion that this aspect of the proposed action is not likely to result in the destruction or adverse modification of critical habitat of the desert tortoise. We have reached this conclusion for the following reasons.

1. Physical and Biological Feature 1. This aspect of the proposed action would not further decrease the amount of space available to support viable populations within the action area; to a small extent, it could increase the ability of desert tortoises to move, disperse, and have gene flow within the Superior-Cronese Critical Habitat Unit by restoring disturbed areas that may not currently support desert tortoises.

2. Physical and Biological Features 2–5. The recovery actions that the Service and its partners would implement would improve the condition of these physical and biological features within focal areas of the Superior-Cronese Critical Habitat Unit and thereby enhance the value of critical habitat for the conservation of the desert tortoise.

3. Physical and Biological Feature 6. The recovery actions that the Service and its partners would implement would increase the amount of protection from disturbance and human-caused mortality in the focal areas of the Superior-Cronese Critical Habitat Unit and thereby enhance the value of critical habitat for the conservation of the desert tortoise.

Lane Mountain Milk-vetch

After reviewing the current status of the Lane Mountain milk-vetch, the environmental baseline for the action area, the effects of the proposed use of the Western Training Area and operations and activities, and the cumulative effects, we have determined that the proposed action is not likely to jeopardize the continued existence of the Lane Mountain milk-vetch. We have reached this conclusion for the following reasons:

1. The proposed action is not likely to affect the reproductive capacity of the Lane Mountain milk-vetch.

2. The proposed action is likely to reduce the number of Lane Mountain milk-vetch plants within its range; however, we expect that the number of plants varies to some degree naturally and that sufficient occupied habitat would remain after the onset of training in the Western Training Area to support a viable number of individuals into the foreseeable future.

3. The proposed action will decrease the distribution of the Lane Mountain milk-vetch but not to an appreciable degree; based on its requirement of a specific substrate, the Lane Mountain milk-vetch has naturally been restricted to a small distribution.

4. The Army implemented measures to offset the loss of Lane Mountain milk-vetch plants and habitat as part of its original proposal to use additional maneuver training lands in the Western Training Area (Service 2004). The proposed action with regard to the Western Training Area has not changed in a measurable manner since that time.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. The Service further defines "harm" to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not the purpose of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of an incidental take statement and occurs as a result of the action as proposed.

The measures described below are non-discretionary; the Army must undertake them for the exemption in section 7(o)(2) to apply. The Army has a continuing duty to regulate the activities covered by this incidental take statement. If the Army does not implement the proposed action as described in this biological opinion, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the Army must report the progress of its action and the impact on the species to the Service as specified in the incidental take statement (50 CFR 402.14(i)(3)).

SCOPE OF THE INCIDENTAL TAKE STATEMENT

The Army's overall proposed action consists of three components: the use of additional maneuver training lands in the Western Training Area, ongoing operations and activities within the entirety of Fort Irwin, and initial implementation of the Recovery and Sustainment Partnership Initiative. The Army would proceed with the first two components of the proposed action after issuing its record of decision for the legislative environmental impact statement for military training and the extension of the public land withdrawal; that is, these actions would proceed without further consultation under section 7(a)(2) of the Endangered Species Act because the Army has provided sufficient information to the Service to complete its analysis of those actions.

Although the Service had sufficient information to complete its analysis with regard to the overall goals of the Recovery and Sustainment Partnership Initiative, the specific recovery activities that the agencies would implement under that program are not defined and will require additional review by the Army, Bureau, Service, and possibly other partners. Consequently, we do not know the specific location or types of actions that will occur under this program.

For these reasons, we consider the overall proposed action in this biological opinion to be a "mixed programmatic action" (50 CFR 402.02). A mixed programmatic action "means, for purposes of an incidental take statement, a Federal action that approves action(s) that will not be subject to further section 7 consultation, and also approves a framework for the development of future action(s) that are authorized, funded, or carried out at a later time and any take of a listed species would not occur unless and until those future action(s) are authorized, funded, or carried out and subject to further section 7 consultation." In this case, the use of additional maneuver training lands in the Western Training Area and ongoing operations and activities within the entirety of Fort Irwin will not be subject to further section 7 consultation; in contrast, the Recovery and Sustainment Partnership Initiative serves as a framework for future consultation, pursuant to section 7(a)(2) of the Endangered Species Act.

For this reason, we do not address incidental take that may occur as a result of implementation of the Recovery and Sustainment Partnership Initiative in this incidental take statement. The Service will address incidental take associated with the implementation of the Recovery and Sustainment Partnership Initiative in one or more future consultations. The remainder of this incidental take statement addresses the use of additional maneuver training lands in the Western Training Area and ongoing operations and activities within Fort Irwin.

Also, "take" as defined in section 3(19) of the Endangered Species Act does not apply to listed plant species. Consequently, this incidental take statement does not include discussion of the Lane Mountain milk-vetch.

Incidental Take Associated with the Use of Additional Maneuver Training Lands in the Western Training Area and Ongoing Operations and Activities within Fort Irwin

We anticipate that Army activities associated with the use of additional maneuver training lands in the Western Training Area and ongoing operations and activities are reasonably certain to result in the incidental take of most desert tortoises within the boundaries of Fort Irwin. We consider this description to include the Army's activities on the Manix Trail, although the trail is located outside Fort Irwin's boundaries.

Previous survey and research efforts in the Western Training Area indicated that approximately 450 to 600 "adult" desert tortoises reside in this area (Karl 2002, Esque et al. 2009, Esque et al. unpublished data, Walde et al. unpublished data in Housman 2021c). The use of the term "adult" in this context does not necessarily mean desert tortoises larger than 180 millimeters; however, it conveys information that numerous large desert tortoises occur within Fort Irwin and that additional smaller individuals and eggs are also present.

Most of these individuals are located in the Western Training Area. Desert tortoises remain in the other areas of Fort Irwin; these individuals are generally located in areas where training is limited by steep, rugged terrain. We do not know how many desert tortoises occur in these areas but expect that they are relatively few in number and in fragmented populations.

Forms of Incidental Take

Depending on the circumstances, incidental take will occurs in different forms. We have summarized the amount or extent of the forms of incidental take in the following sections.

Capture

We anticipate that the Army will take most desert tortoises within Fort Irwin in the form of capture. We differentiate capture into translocating desert tortoises from Fort Irwin to off-base recipient sites and moving desert tortoises from harm's way to nearby areas on-base.

Most captured individuals would be in the Western Training Area; the Army will translocate these individuals to recipient sites within the Western Mojave Recovery Unit. The Army may also capture and translocate some desert tortoises from elsewhere in Fort Irwin to recipient sites within the Western Mojave Recovery Unit. Finally, the Army is also reasonably certain to capture some desert tortoises within Fort Irwin and along the Manix Trail and move them from harm's way.

We cannot anticipate the precise numbers of desert tortoises that the Army may capture because the numbers change over time and desert tortoises, particularly smaller individuals and eggs, are difficult to detect. For this reason and because this form of take is unlikely to kill or injure desert tortoises, we do not consider establishing a re-initiation criterion for captured desert tortoises to be reasonable or prudent.

Wound

If an injured (i.e., wounded) desert tortoise survives treatment and can return to the wild, we will not include it as a mortality. We will consider injured desert tortoises that survive but are not suitable for release to the wild because of their injury as mortalities.

Kill

As we discussed previously in this biological opinion, we cannot reasonably estimate the number of desert tortoises that the Army's activities are reasonably certain to kill because of the numerous variables involved. These variables include but are not limited to changes in the number of desert tortoises present within Fort Irwin over time, the unpredictability of when workers or soldiers may encounter a desert tortoise and the outcome of that encounter, and the likelihood that an error in handling of a desert tortoise may cause its death. Other variables, such as the size of the animals and whether it was underground, affect whether the Army would detect a desert tortoise that its activities have killed. For these and other reasons discussed previously, we used an estimate of the mortality of 50 large desert tortoises per year for the analysis in this biological opinion.

For the purposes of an incidental take statement, the implementing regulations for section 7(a)(2) clarify that the Service may use surrogates to express the amount or extent of anticipated take when "exact numerical limits on the amount of anticipated incidental take may be difficult" (80 FR 26832). The implementing regulations (50 CFR 402.14(i)(1)(i)) require that the Service meet three conditions for the use of a surrogate. To use a surrogate, the Service must:

Describe the causal link between the surrogate and take of the listed species: We are not aware of any research that addresses the ratio of found carcasses to the actual number of mortalities for desert tortoises. We have acknowledged that the Army would not detect every mortality and required that the Army re-initiate formal consultation if it found 10 desert tortoises that died because of its activities within a calendar year. Please refer to the discussion on page 52 of this biological opinion for a full explanation of the use of 10 large desert tortoises as a trigger for re-initiation of formal consultation. Consequently, we consider the finding of 10 large desert tortoises that died because of the Army's activities as a reasonable surrogate.

Describe why it is not practical to express the amount of anticipated take or to monitor take-related impacts in terms of individuals of the listed species: The Army cannot monitor the training activities in a practical or reasonable manner that would allow it to find most desert tortoises that die because they are struck by vehicles or ordnance, crushed or entrapped in burrows, or because of some other aspect of training. Large-scale training activities occur over wide areas and at great intensity; on-site monitoring during training could not cover such large areas and would be dangerous to monitors. Post-training monitoring is impractical because of the large areas involved; additionally, scavengers remove the carcasses of any animal soon after death.

Set a clear standard to determine when the proposed action has exceeded the anticipated amount or extent of the taking: The Army will re-initiate formal consultation when it finds 10 large desert tortoises that have likely died because of its activities in a calendar year.

Accordingly, we establish the surrogate of 10 large desert tortoises found dead because of the Army's activities at Fort Irwin in a calendar year for the re-initiation criterion described in 50 CFR 402.16(a).

We also anticipate that the proposed action is likely to result in the incidental take of small desert tortoises and eggs in the form of mortality. As we discussed previously in this biological opinion, the numbers of small desert tortoises and eggs vary throughout the year. We used large desert tortoises to establish the surrogate for this amount or extent of take because small desert tortoises are difficult to find and the method by which we calculate their abundance contains more assumptions and therefore more potential for variation than does our method for predicting the number of large desert tortoises. For this reason, we have not established a threshold for the number that the Army is reasonably certain to kill annually.

As we discussed in the Re-initiation Threshold section of this biological opinion, the Army and Service would include any desert tortoise that dies directly because of translocation activities in the annual assessment of the re-initiation threshold of 10 large desert tortoises.

The translocation plan for desert tortoises from the Western Training Area will contain detailed criteria for determining when re-initiation of consultation is appropriate, based on the metrics of success that it will include. We consider it to be reasonable and appropriate to formulate this re-initiation guidance upon development of the translocation plan because using translocation-specific methods, such as comparing survival rates among translocated, resident, and control populations, is appropriate and does not trigger any of the re-initiation criteria at 50 CFR 402.16, which we have listed at the conclusion of this biological opinion.

REASONABLE AND PRUDENT MEASURES AND TERMS AND CONDITIONS

We have not identified any reasonable and prudent measures or terms and conditions that we consider necessary or appropriate to minimize take of the desert tortoise at this time.

REPORTING REQUIREMENTS

Pursuant to 50 CFR 402.14(i)(3), the Army must report the progress of the action and its impact on the species to the Service as specified in this incidental take statement. We have determined that the following is necessary to monitor and report on the impacts described in this biological opinion. The Army must provide an annual report to the Service by January 31 of each year that this biological opinion is in effect. The annual report must include information regarding the death or injury of desert tortoises and the circumstances of such incidents. The Army must also provide information on desert tortoises that it moves from harm's way or translocates. Specifically, the reports must include, at a minimum:

1. The date and time of the incident (or when the Army discovered the carcass or moved it from harm's way);

2. The location, in a manner that we can use for mapping with GIS;

3. The size and condition of the carcass or desert tortoise; and

4. Any other specific information that may be useful to understand the circumstances of the incident; and

5. For translocated desert tortoises, the Army must provide an annual report as described in the final translocation plan.

Appendix A describes additional reporting activities associated with the off-installation recovery efforts for the desert tortoise. That reporting is not a requirement pursuant to 50 CFR 402.14(i)(3).

DISPOSITION OF DEAD OR INJURED DESERT TORTOISES

Within 24 hours of locating a dead desert tortoise, you must notify the Palm Springs Fish and Wildlife Office by telephone (760 322-2070) and by facsimile or electronic mail. The report must include the date, time, and location of the carcass, a photograph, cause of death, if known, and any other pertinent information.

Please notify us immediately if you find an injured desert tortoise. If the injured animal has the potential to survive, the Army must take it to a qualified veterinarian for treatment. If the desert tortoise survives, the Army must contact the Service regarding its final disposition.

After recording all pertinent information, we recommend that the Army dispose of the carcass in a manner that reduces the likelihood that someone else will find and report the same carcass. Appropriate methods of disposal include burying animals in the field or providing them to local animal service for disposal with other carcasses; we recommend that the Army provide the animal service office with a note that explains this arrangement with the Service.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Endangered Species Act directs Federal agencies to use their authorities to further its purposes by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. We offer the following conservation recommendations for your consideration and request that you notify us if you implement them so we may remain apprised of the best available information regarding the species.

We recommend that the Army continue its sampling dust program and monitoring of the Lane Mountain milk-vetch within the East Paradise and NTC Goldstone Conservation Areas and the no-dig area. This monitoring will allow the Army and Service to monitor potential dust accumulation in relation to changes in disturbance in the Western Training Area.

RE-INITIATION NOTICE

This concludes formal consultation on the Army's proposed actions. As provided in 50 CFR 402.16(a), re-initiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if:

1. The amount or extent of incidental take specified in the incidental take statement is exceeded;

2. New information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion;

3. The agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion or written concurrence; or

4. A new species is listed or critical habitat designated that may be affected by the action.

We appreciate the cooperation of your staff during this consultation. If you have any questions, please contact Ray Bransfield of my staff at (805) 677-3398 or Ray_bransfield@fws.gov.

Sincerely,
Scott A. Sobiech
Field Supervisor

Appendices

A. Department of Defense defined conservation commitment for desert tortoise recovery and sustainment partnership initiative.

B. Solar projects for which the U.S. Fish and Wildlife Service has issued biological opinions or incidental take permits.

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APPENDIX A

DEPARTMENT OF DEFENSE
DEFINED CONSERVATION COMMITMENT
DESERT TORTOISE RECOVERY AND SUSTAINMENT PARTNERSHIP INITIATIVE

INTRODUCTION

Desert tortoises (*Gopherus agassizii*) have experienced acute population declines in recent years. Between 2004 and 2014, adult desert tortoise numbers decreased across the range, with some recovery units experiencing a decrease of close to 50 percent. The adult populations in the Western Mojave and Eastern Mojave Recovery Units are 49 percent and 33 percent of their 2004 levels, respectively. The proportion of juveniles in these recovery units has also declined from 2004 levels (Allison and McLuckie 2018). Desert tortoises require 13 to 20 years to reach sexual maturity and experience high juvenile mortality rates, which negatively affects the rate of natural repopulation. Consequently, desert tortoise populations have a low potential for natural recovery without substantial and sustained conservation efforts.

In June 2018, the Department of Defense (DoD) and Department of Interior (DoI) signed a Memorandum of Understanding (MOU) to establish the Recovery and Sustainment Partnership (RASP) initiative to develop species conservation and recovery initiatives and provide increased flexibility for military missions (DoD and DoI 2018a). Stated purposes of the RASP in the MOU were to "develop and promote effective ecosystem and species conservation and recovery initiatives" and to "provide for increased flexibility for military mission activities."

DoD and DoI identified the desert tortoise as a priority species for recovery support through the RASP. DoD and the U.S. Fish and Wildlife Service (USFWS) coordinated on development of a species action plan in December 2018 (DoD and DoI 2018b), and later revised it in September 2019 (DoD and DoI 2019). The goal of the desert tortoise species action plan and RASP partnership is:

> "to identify actions required by DoD and the USFWS to reduce the regulatory burden on DoD for the management of the target species and its designated critical habitat, as part of an overall effort to accelerate the recovery of the desert tortoise in partnership with other federal and state agencies, and other partners. The plan will track the benefits of these contributions and provide a framework for reducing mission restrictions and/or streamlining regulatory processes associated with desert tortoises."

To accomplish this goal, the USFWS, in consultations with the military services, has developed biological opinions (biological opinions) under section 7(a)(2) of the Endangered Species Act to establish a streamlined process to address future training needs on several DoD installations within the range of the desert tortoise. DoD and the USFWS have also worked in partnership to begin developing a companion section 7(a)(1) program for this effort to address training impacts and ensure meaningful, long-term, and coordinated DoD contributions to desert tortoise recovery.

Section 7(a)(1) of the Endangered Species Act requires Federal agencies to use "their authorities in furtherance of the purposes of this Act by carrying out programs for the conservation of endangered species and threatened species listed ….". This document outlines a long-term section 7(a)(1) program applicable to the desert tortoise RASP initiative over an initial 5-year time horizon and describes its contribution to the broader interagency recovery effort in general terms. It discusses the relationship of the 7(a)(1) program to the section 7(a)(2) biological opinions, establishes program objectives, identifies recovery action types that the program will likely focus on, outlines an implementation process, and provides program-funding estimates. This document represents an outline for an initial 5-year plan, but DoD and the USFWS will coordinate over a one-year period (i.e., from the date we issue biological opinions to the installations) to finalize the initial 5-year plan in coordination with the Bureau of Land Management (BLM) and other recovery partners. Once completed, DoD and the USFWS, in consultation with BLM and other implementing partners, can modify this plan at any time to adjust implementation priorities in response to changing species recovery needs and land use changes that may occur. DoD and the USFWS will work together on updates in coordination with BLM, other parties implementing the plan, and the Desert Tortoise Management Oversight Group, when necessary.

Relationship of RASP Section 7(a)(1) Program to Installation RASP Biological Opinions

The USFWS has developed biological opinions in consultation with several DoD installations within the range of the desert tortoise to support the RASP initiative. These biological opinions achieve one aspect of the 2018 RASP MOU – "provide for increased flexibility for military mission activities." Each biological opinion documents the respective installation's proposed contribution to implementation of this section 7(a)(1) program. DoD and the USFWS intend for the implementation of the section 7(a)(1) program to be a joint effort by all RASP installations.

The RASP biological opinions fall into two categories, based on how the consultation approaches streamlining mission flexibility and how the installation will contribute to the section 7(a)(1) recovery program. The two categories are described below.

Sustained Participation Biological Opinions

The USFWS is issuing new base-wide biological opinions to DoD installations participating at this level to describe their military mission and recovery program participation. The USFWS worked with DoD in the development of these biological opinions to provide DoD with broad mission flexibility. In these biological opinions, the USFWS concluded that DoD's future mission activities at the installations were not likely to jeopardize the continued existence of the desert tortoise or result in the destruction or adverse modification of critical habitat of its critical habitat. The USFWS is issuing sustained participation biological opinions to the Marine Corps and Army for their training and other activities at the Marine Corps Air Ground Combat Center and the National Training Center at Fort Irwin, respectively. Participation in the RASP's section 7(a)(1) recovery program is subject to availability of funds, but inadequate funding could trigger re-initiation of consultation and may result in loss of this mission flexibility.

Transactional Participation Biological Opinion

The USFWS is developing and will issue a single biological opinion that outlines a streamlined process for approval of new mission actions on participating installations. Approvals under this process are contingent on sufficient accrual of recovery credits under a recovery accounting framework that will accompany that biological opinion. DoD installations participating at this level may accrue recovery value by implementing individual projects within the RASP's section 7(a)(1) recovery program. The USFWS will evaluate the recovery value based on the timeliness and appropriateness of the projects and the DoD's ability to continue funding through the completion of the projects and any and all monitoring and maintenance of the projects in order to meet the goals of the 7(a)(1) program. Those installations may later expend this accrued recovery value to offset new mission impacts or relieve existing biological opinion requirements. The USFWS and DoD will establish value accrual rates for each type of project in the recovery accounting framework; the expenditure requirement will be determined through coordination with the USFWS based on the amount of mission impact the installation desires to offset. Edwards Air Force Base, Marine Corps Logistics Base Barstow, and Naval Air Weapons Station China Lake have elected to participate at this level.

RASP Section 7(a)(1) Recovery Program Objectives

The USFWS identified recovery criteria for the desert tortoise in its 2011 recovery plan (USFWS 2011). These criteria focus on sustaining a trend of increasing population size and distribution within Tortoise Conservation Areas over a 25-year period and maintaining desert tortoise habitat within these areas until population viability is ensured. These Tortoise Conservation Areas encompass desert tortoise critical habitat and certain categories of conservation lands designated under Federal land use plans (*e.g.*, BLM areas of critical environmental concern, Wilderness Areas, National Conservation Lands, *etc.*). The long-term goal of the RASP initiative is to contribute to the achievement of the recovery plan's de-listing criteria in coordination and collaboration with other governmental and non-governmental recovery partners. The RASP section 7(a)(1) recovery program is designed to outline a meaningful DoD contribution toward the achievement of the delisting criteria. DoD and DoI are currently establishing short- and mid-term objectives for the program in an initial 5-year implementation plan that will outline DoD's contribution toward achievement of delisting criteria.

PRELIMINARY FIVE-YEAR ACTION PLAN

The RASP section 7(a)(1) recovery program will operate under the direction of an action plan with a 5-year planning horizon. DoD and the USFWS will fully develop the initial 5-year plan in coordination with BLM and other recovery partners within one year of biological opinion issuance. As stated previously, DoD and the USFWS may choose to modify or update this action plan, in coordination with implementing partners, at any time to adjust implementation priorities in response to changing species recovery needs.

The initial 5-year action plan will primarily focus on the Western Mojave Recovery Unit, as defined in the 2011 recovery plan (see Figure 1). It will identify actions at both a recovery unit and recovery focal area scale. Recovery unit actions could occur anywhere within the recovery unit but would primarily target Tortoise Conservation Areas. Recovery focal area actions would occur within specific focal areas within the Superior-Cronese, Fremont-Kramer, or Ord-Rodman Areas of Critical Environmental Concern. The final boundaries of these focal areas are being established through development of the initial 5-year plan. Because of the likelihood of mixed ownership within the focal areas, implementation of recovery actions will require coordination with multiple implementation partners.

To allow adequate consideration of the recovery program in the RASP biological opinions, DoD and the USFWS have developed the following subsections to outline potential recovery actions that will be considered during development of the initial 5-year plan along with a discussion of each action's role in recovery. Implementation of all recovery actions under the RASP is dependent on implementation authorization of the underlying landowner. All the incorporated actions are priorities of the Desert Tortoise Management Oversight Group and support the following strategic elements from the 2011 recovery plan:

1. **Recovery Plan Strategic Element 2**: Protect existing populations and habitat; institute habitat restoration, where necessary.
2. **Recovery Plan Strategic Element 3**: Augment depleted populations in a strategic manner.
3. **Recovery Plan Strategic Element 4**: Monitor progress toward recovery.

Although the initial 5-year plan is still under development and may deviate slightly from these priorities, DoD and the USFWS believe they represent actions necessary to address high-priority recovery needs in the Western Mojave Recovery Unit. This document uses them to inform resource and staffing needs and to make funding estimates for the recovery program.

Figure 1. Desert Tortoise Recovery Units delineated in the 2011 desert tortoise recovery plan (USFWS 2011).

Focal Area Actions

Under the RASP recovery program, DoD-supported recovery actions will target specific focal areas within Tortoise Conservation Areas in an effort to focus resources in a way that provides the greatest benefit to recovery of the desert tortoise. The final boundaries of these focal areas will be mapped in the initial 5-year plan but they will occur predominantly on public lands managed by the BLM, within designated critical habitat, and in the vicinity of Mojave DoD installations participating in the RASP. They will encompass subareas of critical habitat that have relatively high habitat potential (Nussear et al. 2009) and habitat intactness value (Randall et al. 2010), concentrations of live desert tortoise observations (USFWS unpublished data), and access to linkages (Averill-Murray et al. 2013). Their location and boundaries will also consider the location of active grazing allotments, open off-highway vehicle areas, and land ownership.

The RASP focal areas will represent areas with higher desert tortoise densities, higher habitat potential values, ecological intactness, and a location that supports landscape-scale connectivity.

In addition, they will minimize overlap with grazing allotments and exclude open off-highway vehicle recreation areas to reduce conflict with achievement of RASP objectives. Accordingly, the USFWS expects these focal areas to respond more readily to conservation investments, due to existing conservation designations and their existing habitat and population characteristics. Within focal areas, DoD and the USFWS anticipate that the initial 5-year RASP recovery plan would target recovery coordination and enforcement, passive or active restoration of unauthorized linear features (e.g., unauthorized routes), habitat restoration, and permanent habitat protection.

Recovery Coordination and Enforcement

Action: Fund BLM visitor contact park rangers to patrol RASP focal areas. These park rangers would provide increased BLM presence within these focal areas, monitor for illegal activity, identify management needs within the focal area, communicate management goals to public land users, and notify law enforcement to address illegal activity, when observed.

Rationale**:** Recovery action 2.4 from the 2011 recovery plan identified increasing law enforcement as a high-priority step for protecting existing desert tortoise populations and habitat in all recovery units. The recovery plan identified this need to address the following threats to the species:

1. Unauthorized off-road vehicle travel that damages habitat and can kill individual desert tortoises.
2. Deliberate maiming and killing of desert tortoises.
3. Unauthorized release of captive desert tortoises that can spread disease to wild populations.
4. Uncontrolled domestic dogs that can prey on desert tortoises.
5. Illegal dumping that damages habitat and can subsidize desert tortoise predators.
6. Illegal poaching/removal of desert tortoises from the wild

All the threats identified above occur at varying levels within the Western Mojave Recovery Unit, with damage from unauthorized off-road vehicle travel being of primary concern in the Superior-Cronese Critical Habitat Unit. Visitor contact patrols targeted at RASP focal areas will reduce these threats and help to protect the conservation investment made through implementation of other RASP focal area projects by providing a consistent BLM presence in these areas that can easily contact law enforcement about issues.

Restoration of Unauthorized Linear Features and other Habitat Restoration

Action: DoD will provide funding to support the BLM's legal authority to close unauthorized and undesignated routes and to implement desert tortoise habitat restoration activities in the RASP focal areas. DoD will also fund activities, such as seed-source development, that are needed to support restoration within the focal areas.

Rationale: Recovery actions 2.5 and 2.6 identify the following as high priorities for the protection of existing populations and habitat, respectively: 1) restrict, designate, close, and fence roads; and 2) restore habitat. These actions will address the following threats to the species:

1. Injury to and death of desert tortoises due to collision with vehicles.
2. Reduced densities of desert tortoises near routes.
3. Provision of access to remote areas where collection, vandalism, and poaching of desert tortoises may occur.
4. Introduction of invasive plant species by vehicles and humans into desert tortoise habitat.
5. Reduce the potential for wildfire ignition from vehicles and the spread of wildfire by invasive plants that act as fine fuels.

There is an extensive existing route network in the Western Mojave Recovery Unit, including BLM's designated route network (BLM 2019). The threats identified above are present throughout the Western Mojave Recovery Unit. Restoration of unauthorized linear disturbances (i.e., unauthorized routes) within RASP focal areas, which may include installation of barriers to prevent vehicle incursion, will enhance the condition of desert tortoise habitat, which will in turn improve baseline conditions and support the successful implementation of other recovery actions funded through the RASP initiative.

Permanent Habitat Protection

Action: Provide funding for acquisition and conservation of private inholdings within RASP focal areas and establish management endowments or other long-term funding mechanisms for their continued conservation and management needs. Although acquisition could occur in any focal area, the RASP program would focus in areas where there is a checkerboard of BLM and DoD conservation lands and where more rapid reduction of fragmented conservation management may be possible.

Rationale: Recovery action 2.9 from the 2011 recovery plan identifies the need for acquisition of private inholdings within Tortoise Conservation Areas to counter habitat loss and protect tortoises. The recovery plan recommends performing acquisitions strategically in particularly sensitive areas that would connect functional habitat or improve management capability. As discussed above, DoD and the USFWS have identified the RASP focal areas because they continue to support desert tortoise populations at densities where management actions could stabilize and improve population viability without more drastic intervention. However, implementation of these actions requires more management control across the focal areas to be effective.

Recovery Unit Actions

The RASP recovery program will also address targeted, high-priority recovery needs outside of the focal areas. The initial 5-year RASP recovery plan would target installation of highway exclusion fencing and population augmentation.

Highway Exclusion Fencing

Action: Provide funding for fencing of high-priority locations within the range of the desert tortoise with an emphasis on roads in the Western Mojave Recovery Unit.

Rationale: Road mortality contributes substantially to the ongoing range-wide decline of the desert tortoise. Roads deplete populations, shift the demography of desert tortoise populations toward smaller, younger animals; cause habitat and population fragmentation, lead to population as well as genetic isolation; and subsidize predator populations (Boarman and Sazaki 1996, Esque et al. 2010, USFWS 2011, Nafus et al. 2013, Peaden et al. 2015).

Desert tortoise exclusion fence, connected to existing flood control culverts and paired with shade structures, has been shown to increase adult survivorship, increase population connectivity, reduce predator subsidies, and reduce the risk of collection, vandalism, and poaching. This enables repopulation of road-effect zones, where populations have been significantly depleted (Nafus et al. 2013, Peaden et al. 2015). Using the Peaden et al. (2015) description of road-effect zone sizes, the USFWS estimates that the installation of fencing along all major roads within California's designated desert tortoise critical habitat would result in the repopulation over time of approximately 56,664 hectares of critical habitat.

Recovery action 2.5 from the 2011 recovery plan recommends fencing of all highways and paved roads within or adjacent to Tortoise Conservation Areas with appropriate modifications to avoid habitat and population fragmentation. The Desert Tortoise Management Oversight Group has identified installation of highway exclusion fencing as a top priority, and the USFWS has developed models to help prioritize where highway fencing would be most beneficial.

Population Augmentation and Headstarting

Action: In coordination with the USFWS, DoD will use desert tortoises displaced by training activities within the boundaries of heavily used training areas to augment depleted populations in designated off-installation conservation areas. DoD will also continue to fund headstarting research and recovery efforts, such as the Marine Corps Tortoise Research and Captive Rearing Site, to headstart small desert tortoises until they are large enough to be released into the wild to augment populations. Science-based monitoring of augmented populations will be undertaken to gauge the effectiveness of this action. If desert tortoise translocation areas involve checkerboard land ownership, translocation will not occur without an adequate habitat assessment, and the early engagement and subsequent authorization of the respective landowner and landowners/managers of potential dispersal sites.

Rationale: Recovery actions 3.3 and 3.4 from the 2011 recovery plan identify the following as high-priority components to a range-wide strategic program to augment depleted desert tortoise populations, respectively: 1) secure facilities and obtain desert tortoises for use in augmentation efforts; and 2) implement translocations in target areas to augment populations using a scientifically rigorous, research-based approach.

Population augmentation will help to improve population density and thus viability in areas where population density is at levels low enough to preclude or significantly impede natural population recovery. Within all Tortoise Conservation Areas in the western Mojave Desert, desert tortoise densities are below what the USFWS considers to be a minimum viable density threshold of 3.9 adults per square kilometer. Below this threshold, reproductive potential within populations is diminished and the species becomes at risk of losing evolutionary potential and diminished ability to persist long-term (USFWS 1994). Additionally, recruitment of small desert tortoises into reproductive size classes is inhibited by high rates of predation. DoD support to augment depleted populations in the western Mojave Desert will bolster reproductive success by adult desert tortoises and will enhance recruitment of small desert tortoises into adult populations.

PLAN IMPLEMENTATION

Implementation Process

The completed initial 5-year plan will guide implementation of the RASP section 7(a)(1) recovery program. DoD and the USFWS will work with the BLM and other RASP recovery partners and will seek input on the final content of the plan from the Desert Tortoise Management Oversight Group. Once completed, implementation of the initial 5-year plan will proceed under a memorandum of agreement (MOA) between the RASP recovery partners. RASP recovery partners will meet annually to review the 5-year plan, identify recovery actions to implement that year, report out the prior year's work, and identify appropriate contracting/funding mechanisms to meet requirements of the plan. Additional meetings will occur when needed to discuss project designs or implementation, the content of requests for proposals (RFPs), and contractor selection, when applicable.

For recovery actions that occur on its installations, DoD will implement actions through its own in-house resources or through contract. For off-installation activities, DoD will fund recovery actions through one or all of the following mechanisms:

1. *Direct contract* – DoD would contract directly to a third party for implementation of specific actions or sets of actions within the focal areas. For actions contracted to occur on BLM-managed land, a project-specific MOA that ensures BLM's operational control would be established between the BLM, the DoD, and the contractor and BLM would be involved in the contractor selection. For actions on non-BLM lands within the focal areas, the need for project specific agreements for contracted work would be determined with the appropriate landowner/manager.
2. *Military Interagency Purchase Request (MIPR)* - DoD would issue a MIPR to an agency recovery partner that would implement the identified recovery action;
3. *National Fish and Wildlife Foundation (NFWF) Recovery Account* – DoD would place funds in a NFWF account. NFWF would act as a fiduciary and disburse funds for implementation of recovery projects according to the terms of a funding MOA between the RASP recovery partners. Under this option, DoD would make annual payments to the account, but it would not need to perform project-specific contracts or agreements. NFWF could contract for implementation of recovery actions or sets of recovery actions.

DoD and other RASP recovery partners identified in the MOA would help to develop and approve requests for proposals and would select contractors for project implementation. For actions occurring on BLM managed land, a project-specific MOA that ensures BLM's operation control will be established between the BLM, DoD, NFWF, and the contractor and the BLM will be involved in the contractor selection. Currently, DoD and the USFWS anticipate that this funding option will form the basis of most implementation under the recovery program.

Monitoring

Effectiveness Monitoring

DoD and the USFWS intend for the RASP recovery program to be responsive to new information, which includes a formalized process for incorporating effectiveness and baseline data into the management prescription for each focal area. The initial 5-year plan will identify effectiveness monitoring that can be completed with the appropriate funding provided for implementation of recovery actions, where needed. Project-specific recovery actions will include monitoring designs and funding requirements for effectiveness monitoring. The implementing parties, DoD, and the USFWS will use information obtained through effectiveness monitoring to inform future updates to the implementation plan. Not all projects will require effectiveness monitoring. The RASP recovery partners will determine effectiveness monitoring needs during annual 5-year plan reviews and during the project design phase. For projects requiring effectiveness monitoring, appropriate funding will be part of the long-term funding needs for the project.

RASP Objective Monitoring

DoD will fund the implementation of monitoring efforts to determine progress toward the mid-term RASP objectives outlined in the initial 5-year plan. The initial 5-year plan will contain a study design for this monitoring, which will focus on tracking the population trend and demographic variables targeted in the mid-term objectives. Monitoring could include transect surveys, demographic plots, and/or other methods. Data from the USFWS range-wide-monitoring program will be used when/where it overlaps the data needs for mid-term objective monitoring.

Range-wide Monitoring

The recovery units identified in Figure 1 form the basis for monitoring progress toward delisting criteria. To support a future delisting decision, the recovery plan's Recovery Criterion 1 calls for extensive range-wide monitoring across Tortoise Conservation Areas within each recovery unit to document that rates of population change are increasing for a period of at least 25 years. In 1999, the Desert Tortoise Management Oversight Group endorsed the use of line distance sampling, and it has since formed the basis for the USFWS range-wide monitoring effort.

DoD will provide annual funds to contribute to the USFWS range-wide monitoring effort. These contributions will continue DoD's past efforts to help fund this interagency-supported program.

Although some data from this monitoring may overlap data needs for RASP objectives, its primary purpose is to track progress toward achievement of species recovery criteria.

Reporting

The DoD and the USFWS will develop an annual RASP recovery program report in collaboration with BLM and other implementing RASP partners. Annual reports would be tracked and filed by the USFWS and would be presented at annual Desert Tortoise Management Oversight Group meetings to provide information to other interagency recovery partners.

Plan Modification

The DoD and the USFWS will review the RASP recovery plan annually and update it at least every 5 years in collaboration with BLM and other applicable recovery partners. Updates will apply new information gained through monitoring and incorporate new recovery priorities and recommendations from the Desert Tortoise Management Oversight Group, where applicable. Although plan updates may modify the focus of implementation, it will not modify DoD's annual funding commitment under the RASP (see *Funding* section).

Regulatory Compliance

Recovery actions outlined in the 5-year plan are subject to analysis and approval under the National Environmental Policy Act (NEPA), Endangered Species Act (ESA), National Historic Preservation Act (NHPA), and other applicable laws. In some cases, programmatic documents are in place or under development to cover implementation of recovery actions in certain locations. Examples include the BLM's programmatic section 7 consultation for activities in the California deserts, which will cover section 7(a)(2) compliance for the majority of recovery actions taken under the RASP program. The USFWS and BLM are also jointly working on a NEPA document to cover installation of highway exclusion fencing along roadways, which could cover agency decision making on some RASP fencing projects. If additional regulatory compliance is necessary, the RASP partners will complete it on a project-by-project basis and will look for methods to streamline compliance through additional programmatic compliance documents.

RASP Staffing

The RASP section 7(a)(1) program will require staff capacity for implementation of the tasks listed below. Some of these activities are inherently BLM activities and will likely require funding for BLM staff. Final decisions on the level of staffing required for RASP implementation, necessary skill sets, and appropriate placement (i.e., BLM and/or FWS) are being determined during development of the initial 5-year implementation plan.

1. Assist with implementation of RASP biological opinions to provide greater mission flexibility and reduce training restrictions;
2. Coordinate regulatory compliance for recovery actions taken under the RASP 5-year plan(s);

3. Plan, coordinate, and facilitate annual RASP partner meetings, recovery project-design meetings, and RASP monitoring program meetings;
4. Coordinate development of RFPs and Statements of Work and contractor selection, when applicable, for recovery actions;
5. Track contract implementation, monitor contract expenditures and accomplishments, and coordinate QA/QC for monitoring data;
6. Manage NFWF account under the direction of line officers for the agencies who are signatories to the NFWF MOA;
7. Monitor and track overall RASP budget;
8. Perform and/or coordinate additional administrative functions, where needed, for various RASP funding mechanisms;
9. Develop annual RASP reports and give presentations to the Desert Tortoise Management Oversight Group and other RASP partners upon request;
10. Serve as the desert tortoise RASP program's point of contact for all RASP partners, the Desert Tortoise Management Oversight Group, and NFWF; and
11. Coordinate and facilitate updates to the RASP 5-year action plan.
12. Oversee route closure/restoration work;
13. Coordinate with law enforcement for trespass issues or damage to existing restoration, fencing, or facilities;
14. Perform regular monitoring and inspection of all field activities and resolve issues with contracting office or NFWF, as appropriate;
15. Review, comment, and perfect any plans submitted for specific tasks associated with desert tortoise recovery actions on public lands within the California Desert Conservation Area outlined under the RASP recovery program;
16. Ensure the appropriate processes are adhered to related to permitting activities on public lands, including NEPA, NHPA and ESA;
17. Write or lead a team that writes NEPA documents as required for RASP implementation;
18. Ensure contracted individuals tasked with on-the-ground work are performing tasks appropriately under BLM regulation and guidance; and
19. Communicate regularly with the BLM line officer as to status of implementation actions and issues.

FUNDING

DoD will fund implementation of the RASP recovery program as outlined in the initial 5-year plan. Funding for the initial 5-year plan may come through a combination of Readiness and Environmental Protection Integration program funding, DoD Legacy Funds, installation appropriations, or other sources. DoD and the participating installations will work with the USFWS to identify funding sources and develop a funding plan that will accompany the initial 5-year plan. Agreement on installation contributions to the total RASP recovery cost and other details of the funding plan will be addressed in the RASP MOA, where needed. DoD will sustain recovery support until the RASP mid-term recovery objectives, outlined in the initial 5-year plan, are achieved.

As stated in the *Implementation Process* section, funding could occur through direct contracts for implementation, MIPRs, or payment into a RASP NFWF recovery account. The USFWS and DoD consider development of a NFWF account to be the most efficient and effective way to implement the majority of the recovery program. DoD and the USFWS, in collaboration with other RASP partners, will work to develop this account after issuance of the biological opinions.

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APPENDIX B

SOLAR PROJECTS FOR WHICH THE U.S. FISH AND WILDLIFE SERVICE HAS ISSUED BIOLOGICAL OPINIONS OR INCIDENTAL TAKE PERMITS

(AUGUST 2021)

Table A1 summarizes information regarding the solar projects for which the Fish and Wildlife Service has issued a biological opinion, pursuant to section 7(a)(2), or an incidental take permit, pursuant to section 10(a)(1)(B) of the Endangered Species Act, with regard to the desert tortoise. We are aware of five solar projects for which we issued biological opinions that are no longer on the Federal agency's list of projects; we have removed these projects from this list.

Table A1. List of solar projects that have received biological opinions or incidental take permits.

Project	Recovery Unit	Acres of Desert Tortoise Habitat[1]	Desert Tortoises Estimated[2]	Desert Tortoises Observed[3]	Citations[4]
Ivanpah Solar Electric Generating System	Eastern Mojave	3,582	1,136	175	Service 2011a, Davis 2014
Stateline	Eastern Mojave	1,685	947	55	Service 2013a, Ironwood Consulting 2014
Silver State North	Eastern Mojave	685	14	7	Service 2010, Newfields 2011
Silver State South	Eastern Mojave	2,427	1,020	152	Service 2013a, Cota 2014
Nevada Solar One	Eastern Mojave	400	-[5]	-[5]	Burroughs 2012, 2014
Copper Mountain North	Eastern Mojave	1,400	-[5]	-[5]	Burroughs 2012
Copper Mountain	Eastern Mojave	380	-[5]	-[5]	Burroughs 2012, 2014
Townsite	Eastern Mojave	885	-[5]	-[5]	Service 2014b
Techren Boulder City	Eastern Mojave	2,200	-[5]	-[5]	Service 2012b
Valley Electric Association	Eastern Mojave	80	4	4	Service 2015a
Canyon Mesa	Eastern Mojave	123	2	-	Service 2019a
Yellow Pine	Eastern Mojave	4,285	1,032	-	Service 2020b
Mojave	Western Mojave	Primarily in abandoned agricultural fields	4	0	Service 2011b
Cinco	Western Mojave	500	53	2	Service 2015b, Daitch 2015
Soda Mountain	Western Mojave	1,726	78	-	Service 2015c

Project	Recovery Unit	Acres of Desert Tortoise Habitat[1]	Desert Tortoises Estimated[2]	Desert Tortoises Observed[3]	Citations[4]
High Desert	Western Mojave	547	24	4	Service 2019b, ECORP Consulting 2020
Res Americas Moapa Solar Energy Center (MSEC; totals adjusted based on overlapping ACSP acreage)	Northeastern Mojave	104	37	-	Service 2014a
Moapa K Road	Northeastern Mojave	2,141	208	177	Service 2012a, Cardno 2018
Playa	Northeastern Mojave	1,538	258	77	Service 2015d, Ironwood Consulting 2016
Invenergy Harry Allen	Northeastern Mojave	594	242	-	Service 2015d
NV Energy Dry Lake Solar Energy Center	Northeastern Mojave	751	45	-	Service 2015d
NV Energy Dry Lake Solar Energy Center at Harry Allen	Northeastern Mojave	55	15	-	Service 2015d
Aiya	Northeastern Mojave	672	91	-	Service 2015e
Mountainview	Northeastern Mojave	146	-[5]	-[5]	Wise 2018
Gemini	Northeastern Mojave	7,113	5,215	-	Service 2019c
Eagle Shadow Mountain	Northeastern Mojave	2,285	2,941	-	Service 2019d
Arrow Canyon Solar Project (ACSP; MSEC expansion)	Northeastern Mojave	2,124	1,863	-	Service 2020c
Southern Bighorn Solar I	Northeastern Mojave	2,642	3,128	-	Service 2021a
Southern Bighorn Solar II	Northeastern Mojave	1,025	1,336	-	Service 2021b
Genesis	Colorado	1,774	8	0	Service 2010b, Fraser 2014a
Blythe	Colorado	6,958	30	0	Service 2010c, Fraser 2014b
Desert Sunlight	Colorado	4,004	56	7	Service 2011c, Fraser 2014a
McCoy	Colorado	4,533	15	0	Service 2013c, Fraser 2014b
Desert Harvest	Colorado	1,300	5	-	Service 2013b

Project	Recovery Unit	Acres of Desert Tortoise Habitat[1]	Desert Tortoises Estimated[2]	Desert Tortoises Observed[3]	Citations[4]
Rice	Colorado	1,368	18	1	Service 2011d, Fraser 2014a
Palen Solar Power Project	Colorado	3,140	42	0	Service 2018
Desert Quartzite	Colorado	2,831	4	-	Service 2019e
IP Athos	Colorado	3,440	5	-	Service 2019f
Crimson	Colorado	2,201	20	-	Service 2020a
Total		73,644	19,896	661	

[1] The acreages may include substations and other ancillary facilities.

[2] The numbers in this column are not necessarily comparable because the methodologies for estimating the numbers of desert tortoises occasionally vary between projects. The largest numbers included the estimated number of small desert tortoises, which likely far exceeded the numbers of individuals present. In some cases, desert tortoises will remain inside the security fence for the solar project; we anticipated that some mortalities would occur during operation of the facility and included these numbers in the estimated total.

[3] This column reflects the numbers of desert tortoises reportedly taken within project areas. It includes translocated animals and those that were killed by project activities. Project activities may result in the deaths of more desert tortoises than are found. Dashes represent projects for which we have no information at this point; some projects had not broken ground at the time of this biological opinion.

[4] The first citation in this column is for both the acreage and the estimate of the number of desert tortoises. The second is for the number of desert tortoises observed during construction of the project; where only one citation is present, construction has not begun or data are unavailable at this time.

[5] These projects occurred under the Clark County Multi-species Habitat Conservation Plan; the provisions of the habitat conservation plan do not require the removal of desert tortoises. In some case, the Service issued biological opinions for access roads and generator tie-in line for these projects. We did not include the acreages and number of desert tortoises for those aspects of the overall action; we did not want to provide the impression that those effects were directly associated with the solar facility.

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APPENDIX I – LAWS, REGULATIONS, POLICIES, AND EXECUTIVE ORDERS

Federal

American Indian Religious Freedom Act of 1978 (Public Law 95-341; 42 United States Code [USC] §1196) – requires the US, where appropriate, to protect and preserve religious rights of the American Indian, Eskimo, Aleut, and Native Hawaiians, including but not limited to access to sites, use and possession of sacred objects, and the freedom to worship through ceremonials and traditional rites.

Animal Damage Control Act of 1931 (7 USC §426 *et seq.*) – provides broad authority for investigation, demonstrations and control of mammalian predators, rodents and birds.

Anti-Deficiency Act of 1982 (31 USC §1341 *et seq.*) – provides that no federal official or employee may obligate the government for the expenditure of funds before funds have been authorized and appropriated by Congress for that purpose.

American Antiquities Act of 1906 (Public Law 59-209; 16 USC §431-433) – authorizes the President to designate historic and natural resources of national significance, located on federal lands, as National Monuments for the purpose of protecting items of archeological significance.

Archeological and Historical Preservation Act of 1974 (Public Law 95-96; 16 USC §469 *et seq.*) – provides for the preservation of historical and archeological data, including relics and specimens, threatened by federally funded or assisted construction projects.

Archeological Resources Protection Act of 1979 (16 USC §470 *et seq.*) – prohibits the excavation or removal from federal or Indian lands any archeological resources without a permit from the land manager.

Bald and Golden Eagle Protection Act of 1940 (Public Law 87-884; 16 USC §668a-d) – prohibits taking or harming bald or golden eagles, their eggs, nests, or young without appropriate permit.

Clean Air Act of 1970, as amended (42 USC §7401 *et seq.*) – regulates air emissions from area, stationary, and mobile sources. This law authorizes the United States Environmental Protection Agency (USEPA) to establish National Ambient Air Quality Standards (NAAQS) to protect public health and the environment.

Clean Water Act (CWA) of 1972 (Public Law 92-500; 33 USC §1251 *et seq.*) – aims to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. Under Section 401, states have authority to review federal permits that may result in a discharge to wetlands or water bodies under state jurisdiction. Under section 404, a program is established to regulate the discharge of dredged or fill material into the Nation's waters, including wetlands.

Conservation and Rehabilitation Program on Military and Public Lands (Public Law 93-452; 16 USC §670 *et seq.*) – provides for fish and wildlife habitat improvements, range rehabilitation, and control of off-road vehicles on federal lands.

Conservation Programs on Military Reservations (Public Law 90-465; 16 USC §670 *et seq.*) – Requires each military department to manage natural resources and to ensure that services are provided which are necessary for management of fish and wildlife resources on each installation; to provide their personnel with professional training in fish and wildlife management; and to give priority to contracting work with federal and state agencies that have responsibility for conservation or management of fish and wildlife. In addition, it authorizes cooperative agreements (with states, local governments, non-governmental organizations, and individuals) which call for each party to provide matching funds or services to carry out natural resources projects or initiatives.

Emergency Wetlands Resources Act of 1986 (16 USC §3901-3932) – requires reporting of wetland loss by the Secretary to Congress; authorizes the purchase of wetlands; requires the Secretary to establish a National Wetlands Priority Conservation Plan; and requires states to include wetlands in their Comprehensive Outdoor Recreation Plans, among others.

Endangered Species Act of 1973, as amended (16 USC §1531 *et seq.*) – provides for the identification and protection of threatened and endangered plants and animals, including their critical habitats. Requires federal agencies to conserve threatened and endangered species and cooperate with state and local authorities to resolve water resources issues in concert with the conservation of threatened and endangered species. This law establishes a consultation process involving federal agencies to facilitate avoidance of agency action that would adversely affect species or habitat. Further, it prohibits all persons subject to US jurisdiction from taking, including any harm or harassment, endangered species.

Federal Insecticide, Fungicide, and Rodenticide Act of 1947 (Public Law 92-516; 7 USC §136) – governs the use and application of pesticides in natural resource management programs. This law provides the principal means for preventing environmental pollution from pesticides through product registration and applicator certification.

Federal Land Policy and Management Act (43 USC §1701) – establishes public land policy and guidelines for its administration and provides for the management, protection, development, and enhancement of the public lands.

Fish and Wildlife Conservation Act of 1980 (Public Law 96-366; 16 USC §2901) – provides for the protection of non-game fish and wildlife.

Fish and Wildlife Coordination Act of 1934 (16 USC §661 *et seq.*) – provides mechanism for wildlife conservation to receive equal consideration and be coordinated with water-resource development programs.

Forest and Rangeland Renewable Resources Planning Act (16 USC §1601 *et seq.*) – requires and inventory of potential renewable resources and an evaluation of opportunities for improving their yield on goods and services. Agencies must provide an opportunity for public involvement and consultation with other agencies in establishing policies for multiple use and sustained yield.

Land and Water Conservation Act of 1965 (16 USC §4601 *et seq.*) – assists in preserving, developing, and assuring accessibility to outdoor recreation resources.

Legacy Resource Protection Program Act (Public Law 101-511) – established a program for the stewardship of biological, geophysical, cultural and historic resources on Department of Defense (DoD) lands.

Migratory Bird Conservation Act of 1929 (16 USC §715 *et seq.*) – establishes a Migratory Bird Conservation Commission to approve areas recommended by the Secretary of the Interior for acquisition with Migratory Bird Conservation Funds.

Migratory Bird Treaty Act of 1918, as amended (Public Law 65-186; 16 USC §703-712) – prohibits the taking or harming of a migratory bird, its eggs, nests, or young without the appropriate permit.

Military Reservations and Facilities: Hunting, Fishing and Trapping (an update to the Military Construction Authorization Act; 10 USC §2671) – dictates that the Secretary of Defense require that all hunting, fishing, and trapping on military installations be in accordance with the fish and game laws of the State in which it is located, that license be obtained (except with respect to members of the armed forces), and that safety protocols be enacted.

National Environmental Policy Act of 1969 (NEPA), as amended (Public Law 91-190; 42 USC §4321 *et seq.*) – provides a national charter for protection of the environment and requires federal agencies to prepare a statement of environmental impact in advance of each major action that may significantly affect the quality of the human environment.

National Historic Preservation Act of 1966 (16 USC §470 *et seq.*) – provides for the preservation of historic properties throughout the US.

Native American Graves Protection and Repatriation Act of 1990 (Public Law 101-601; 25 USC §§3001-3013) – addresses the recovery, treatment, and repatriation of Native American and Native Hawaiian cultural items by federal agencies and museums. It includes provisions for data gathering, reporting, consultation, and issuance of permits.

Non-indigenous Aquatic Nuisance Prevention and Control Act of 1990, as amended (16 USC 4701 *et seq.*) – establishes program to prevent the introduction of and to control the spread of introduced aquatic nuisance species and the brown tree snake.

Non-Indigenous Aquatic Nuisance Prevention and Control Act of 1990 – created the Aquatic Nuisance Species Task Force which is committed to preventing and controlling aquatic nuisance species and implementing the act.

Noxious Plant Control Act (Public Law 90-583) – provides for the control and management of nonindigenous weeds that injure or have the potential to injure the interests of agriculture and commerce, wildlife resources, or the public health.

Plant Protection Act of 2000 (7 USC §7701 et seq.) (replaces Federal Noxious Weed Act of 1973 [PL 93-629] – authorizes the USDA to prohibit or restrict the importation or interstate movement of any plant, plant product, biological control organism, noxious weed, article, or means of conveyance if the Secretary of Agriculture determines it is necessary to prevent introduction or spread of plant pests or noxious weeds.

Plant Quarantine Act (7 USC §151-167) – regulates the importation and interstate movement of nursery stock and other plants that may carry pests and diseases that are harmful to agriculture.

Readiness and Environmental Protection Initiative (within Section 2811, FY 2003 National Defense Authorization Act) (10 USC §2684a) – outlines agreements to limit encroachments and other constraints on military training, testing, and operations.

Resource Conservation and Recovery Act of 1976 (42 USC §6901 *et seq.*) – establishes a comprehensive program which manages solid and hazardous waste. Subtitle C, Hazardous Waste Management, sets up a framework for managing hazardous waste from its initial generation to its final disposal. Waste pesticides and equipment/containers contaminated by pesticides are included under hazardous waste management requirements.

Sale of Certain Interests in Land, Logs (10 USC §2665) – authorizes the sale of forest products and the reimbursement of the costs of managing forest resources for timber production.

Sikes Act Improvement Act of 1997 (Public Law 105-85; 16 USC §670a et seq.) – amends the Sikes Act of 1960 to mandate the development of an integrated natural resources management plan through cooperation with the Department of the Interior (through the US Fish and Wildlife Service [USFWS]), Department of Defense, and each state fish and wildlife agency for each military installation supporting natural resources.

Soil Conservation Act (16 USC §590a *et seq.*) – provides for soil conservation practices on federal lands.

Watershed Protection and Flood Prevention Act (PL 84-566; 16 USC §1001-1009) – the Soil Conservation Service at the Department of Agriculture provides planning assistance and construction funding for projects constructed by local sponsors, often in the form of flood control districts.

Federal Executive Orders (EOs)

Consultation and Coordination with Indian Tribal Governments (EO 13175) – ensures that all federal departments and agencies consult with Indian tribes and respect tribal sovereignty as they develop policy on issues that impact Indian communities.

Environmental Safeguard for Activities for Animal Damage Control on Federal Lands (EO 11870) - restricts the use of chemical toxicants for mammal and bird control.

Exotic Organisms (EO 11987) – restricts federal agencies in the use of exotic plant species in any landscape and erosion control measures.

Energy Efficiencies and Water Conservation at Federal Facilities (EO 12902) – federal agency use of energy and water resources is directed towards the goals of increased conservation and efficiency.

Facilitation of Hunting Heritage and Wildlife Conservation (EO 13443) – directs the Department of the Interior and its component agencies, bureaus and offices facilitate the expansion and enhancement of hunting opportunities and the management of game species and their habitat.

Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (EO 12898) – requires environmental protection for all communities by focusing federal attention on the environmental and human health effects of federal actions on minority and low-income populations.

Floodplain Management (EO 11988) – specifies that agencies shall encourage and provide appropriate guidance to applicant to evaluate the effects of their proposals in floodplains prior to submitting applications. This includes wetlands that are within the 100-year floodplain and especially discourages filling.

Planning For Federal Sustainability In The Next Decade (EO 13693) – seeks to cut the federal government's greenhouse gas emissions and increase the share of electricity the federal government consumes from renewable sources. The EO also requires federal agencies to ensure 25% of their total energy (electric and thermal) consumption is from clean energy sources by 2025, reduce energy use in federal buildings by 2.5% per year between 2015 and 2025, reduce per-mile greenhouse gas emissions from federal fleets by 30% by 2025 and increase the percentage of zero-emission and plug-in hybrid vehicles in federal fleets, and reduce water intensity in federal buildings by 2% per year through 2025.

Indian Sacred Sites (EO 13007) – provides for the protection of and access to Indian sacred sites.

Invasive Species (EO 13112) – requires federal agencies to: (1) prevent the introduction of invasive species; (2) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner; (3) monitor invasive species populations accurately and reliably, provide for restoration of native species and habitat conditions in ecosystems that have been invaded; (4) conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species; and (5) promote public education on invasive species and the means to address them.

Off Road Vehicle Use on Public Lands (EO 11989) – limits the use of off-road vehicles on federal lands soil, water, or natural resources could be adversely affected.

Protection of Children from Environmental Health Risks and Safety Risks (EO 13045) – requires that the USEPA evaluate the effects of a planned regulation on children and explain why the regulation is preferable to potentially effective and reasonably feasible alternatives.

Protection and Enhancement of the Cultural Environment (EO 11593) – supports previous laws and provides for additional protection of cultural resources.

Protection and Enhancement of Environmental Quality (EO 11514) – provides for environmental protection of federal lands and enforces requirements of NEPA.

Protection of Wetlands: Amends Executive Order 11990 (EO 12608) – directs all federal agencies to take action to minimize the destruction loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands. This applies to the acquisition, management, and disposal of federal lands and facilities; to construction or improvements undertaken, financed, or assisted by the federal government; and to the conduct of federal activities and programs which affect land use.

Recreational Fisheries (EO 12962) – requires federal agencies, to the extent practicable and where permitted by law, to improve the quantity, function, sustainable productivity, and distribution of US aquatic resources for increased recreational fishing opportunities.

Responsibilities of Federal Entities to Protect Migratory Birds (EO 13186) – directs all federal agencies taking actions that have a potential to negatively affect migratory bird populations to develop and implement a Memorandum of Understanding with the US Fish and Wildlife Service (USFWS) by January 2003 that shall promote the conservation of migratory bird populations.

Strengthening Federal Environmental, Energy, and Transportation Management (EO 13423) – requires federal agencies to lead by example in advancing the nation's energy security and environmental performance by establishing new and updated goals, practices, and reporting requirements for environmental, energy, and transportation performance and accountability.

Presidential Memorandum, Government-to-Government Relations with Native American Tribal Governments (1994) – outlines principles that federal executive departments and agencies must follow in their interactions with Native American tribal governments such that the federal government operates within a government-to-government relationship with federally-recognized Native American Tribes.

Executive Order 11991 Protection and Enhancement of Environmental Quality: Amends Executive Order 11514 – amends NEPA analysis process.

Executive Order 13148 Greening The Government Through Leadership In Environmental Management - requires the head of each federal agency to ensure that all necessary actions are taken to integrate environmental accountability into agency day-to-day decision-making and long-term planning processes - across all missions, activities, and functions.

California State Laws

California Desert Protection Act (CDPA) of 1994 (16 U.S.C. §§ 410aaa through 410aaa-83) – federally owned desert lands of southern California constitute a public wildland resource of extraordinary and inestimable value for this and future generations. Established Mojave National Preserve, designated Death Valley and Joshua Tree as national parks, and designated nearly 3.6 million acres of desert administered by the BLM as wilderness. Flights by military aircraft over lands designated by the Act are not restricted or precluded, including overflights that can be seen or heard from these lands.

California Desert Native Plant Act (CDNPA) – requires permits for the removal or harvest of specific endemic desert plant species in the Mojave desert and prohibits the take of specific species except for educational or scientific purposes.

California Endangered Species Act (FGC § 86, 2050 et seq.; CCR, Title 14, § 783 et seq.) – enacted in 1970 and amended in subsequent years. Provides for the identification and protection of state listed threatened and endangered species of animals, plants, and their habitats. Violations can result in a fine of up to $5,000 and/or one year in prison. While this law does not apply to federal actions, it does apply to state agencies and private landowners. In the spirit of the law and as a service to state agencies and private landowners, federal agencies operate under these guidelines.

California Environmental Quality Act (CEQA) - requires public agency decision-makers to document and consider the environmental implications of their actions. Contains substantive provisions requiring agencies to deny approval of a project with significant adverse effects when feasible alternatives or feasible mitigation measures can substantially lessen such effects. Note: this does not apply on Fort Irwin, since it is federal property.

Fish and Wildlife Protection and Conservation (FGC § 1600-1616) - The Legislature finds and declares that the protection and conservation of the fish and wildlife resources of this state are of utmost public interest. Fish and wildlife are the property of the people and provide a major contribution to the economy of the state, as well as providing a significant part of the people's food supply; therefore their conservation is a proper responsibility of the state.

Native Plant Protection Act (NPPA; FGC § 1900) – allows the Fish and Game Commission to designate plants as rare or endangered. NPPA prohibits take of endangered or rare native plants but includes some exceptions for agricultural and nursery operations; emergencies; and after properly notifying CDFW for vegetation removal in certain situations.

Natural Community Conservation Planning Act (NCCPA; FGC § 2800) – allows for the development of broad-based ecosystem-level plans for the protection and perpetuation of biological diversity. The primary objective of Natural Community Conservation Plans prepared under the NCCPA is to conserve natural communities at the ecosystem level while accommodating compatible land use. Plants protected under an approved Natural Community Conservation Plan may be "taken" by activities covered under the plan, but also typically receive a large amount of conservation and protection.

Noxious Weed Species (3 CCR § 4500) – provides authority to the state to regulate the movement of listed noxious weed species into or within California. Provides a list of noxious weeds as defined by the Food and Agricultural Code 5004.

DoD Regulations and Guidance

Army Regulations and Guidance

- **Army Regulation (AR) 200-1 –** Environmental Protection and Enhancement dated 13 December 2007
- **AR 210-9 –** Use of Off-Road Vehicles on Army Lands
- **AR 215-1 –** Morale, Welfare, and Recreation Activities and Non-appropriated Fund Instrumentalities
- **AR 315-19 –** The Army Sustainable Range Program
- **AR 405-80 –** Management of Title and Granting Use of Real Estate
- **AR 420-40 –** Historic Preservation
- **AR 420-90 –** Fire and Emergency Services
- **Memorandum,** DAIM-ZA (200-3) Army Wildland Fire Policy Guidance, 04 September 2002

DoD Instruction and DoD Directive Regulations and Guidance

- **DoD Instruction (DoDI) 4150.07 –** DoD Pest Management Program
- **DoDI 4715.03 –** Natural Resources Conservation Program
- **DoDI 6055.6 –** DoD Fire and Emergency Service Program
- **DoDI 4165.57 –** Air Installations Compatible Use Zones
- **DoDI 4715.1 –** Environmental Security
- **DoDI 4715.9 –** Environmental Planning and Analysis
- **Department of Defense Directive (DoDD) 4710.1 –** Archaeological and Historic Resources Management
- **DoDD 4715.1E –** Environment, Safety, and Occupational Health
- **DoDD 6050.1 –** Environmental Effects in the US of DoD Actions
- **DoDD 6050.2 –** Use of Off-Road Vehicles on DoD Lands
- **Memorandum,** Assistant Deputy Under Secretary of Defense (Environment, Safety and Occupational Health), *Interim Policy on Management of White Nose Syndrome in Bats*, 20 September 2011.

- **Memorandum,** Assistant Deputy Under Secretary of Defense (Environment, Safety and Occupational Health), *Guidance to Implement the Memorandum of Understanding to Promote the Conservation of Migratory Birds,* 3 April 2007.

- **Memorandum,** DAIM-ED Guidance for Implementation of the Sikes Act Improvement Act (SAIA) (Updated), *USFWS and State involvement in developing INRMPs; defining "mutual agreement" with the USFWS and the appropriate State agency; and coordinating INRMPs with other planning statutes*, 25 May 2006.

- **Memorandum,** Assistant Deputy Under Secretary of Defense (Environment, Safety and Occupational Health), *Implementation of Sikes Act Improvement Amendments: Supplemental Guidance concerning Leased Lands*, 17 May 2005.

- **Memorandum,** Assistant Deputy Under Secretary of Defense (Environment), *Access to Outdoor Recreation Programs on Military Installations for Persons with Disabilities*, 5 August 2002.

NTC and Fort Irwin Regulations and Guidance

- **National Training Center Regulation (NTC Reg) 200-1 –** Environmental Quality Environmental Protection and Enhancement, December 2016
- **NTC Reg 385-63 –** Range Safety, 1 March 2018
- **NTC Reg 420-3 –** Hunting, 14 May 2021