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CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE

Western Joshua Tree Conservation Plan

VOLUME I: WESTERN JOSHUA TREE CONSERVATION PLAN

Presented to the California Fish and Game Commission

JUNE 2025

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Western Joshua Tree Conservation Plan

JUNE 2025

Prepared for:
California Fish and
Game Commission

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The California Department of Fish and Wildlife (CDFW) recognizes that the lands we care for were originally and are still inhabited and cared for by California Native American tribes. We honor and pay respect to their elders and descendants — past, present, and emerging — as they continue their relationship with these lands. These Tribes continue to maintain their political sovereignty and cultural traditions as vital members of Joshua tree habitat. We acknowledge their tremendous contributions to the lands managed by CDFW and thank them for their ongoing stewardship. It is important to CDFW that we be inclusive of these contributions and provide the ability for Tribes to carry forward these traditional cultural teachings, reflecting our relationships and commitment to righting historical wrongs and bringing California Native American people back to the land to help in the restoration and healing of California.

CDFW recognizes the importance of taking action to support tribal values, traditions, and interests. The Western Joshua Tree Conservation Plan embodies the intent for action through co-management of western Joshua tree conservation with Tribes. Tribal co-management planning and strategies also incorporate Traditional Ecological Knowledge. CDFW is preparing the Conservation Plan in collaboration with California Native American tribes and the Native American Land Conservancy. Tribes participating in consultation with CDFW as of the date of publication of the Conservation Plan are listed in Section 3.1 and Appendix C. CDFW will continue ongoing consultation with Tribes to further refine actions based on tribal input and co-management participation in the conservation of western Joshua tree and its habitat.

LIST OF ABBREVIATIONS

Acronym or Abbreviation	Definition
A&M	avoidance and minimization
ACTCI	Agua Caliente Tribe of Cupeño Indians
BLM	US Bureau of Land Management
CAL FIRE	California Department of Forestry and Fire Protection
Cal-IPC	California Invasive Plant Council
Caltrans	California Department of Transportation
CDCA	California Desert Conservation Area
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CESA ITP	California Endangered Species Act incidental take permit
CESA	California Endangered Species Act
CNRA	California Natural Resources Agency
Combat Center	Marine Corps Air Ground Combat Center
Commission	California Fish and Game Commission
Conservation Fund	Western Joshua Tree Conservation Fund
Conservation Plan	Western Joshua Tree Conservation Plan
CSLC	California State Lands Commission
CSP	California State Parks
DOD	US Department of Defense
DRECP	Desert Renewable Energy Conservation Plan
DWR	California Department of Water Resources
EO	executive order
EPA	US Environmental Protection Agency
ESA	Endangered Species Act
E&A	education and awareness
FTBMI	Fernandeño Tataviam Band of Mission Indians

GIS	geographic information system
HCP	habitat conservation plan
INRMP	integrated natural resources management plan
ITP	incidental take permit
KVIC	Kern Valley Indian Community
LC&M	land conservation and management
LUPA	land use plan amendment
MDSL	Mojave Desert Sentinel Landscape
MIST	minimum impact suppression techniques
MOU	memorandum of understanding
MSHCP	multi-species habitat conservation plan
NALC	Native American Land Conservancy
NASA	National Aeronautics and Space Administration
NCCP	Natural Community Conservation Plan
NCCPA	Natural Community Conservation Planning Act
NEPA	National Environmental Policy Act
NFWF	National Fish and Wildlife Foundation
NGO	non-governmental organization
NPS	National Park Service
NWCG	National Wildfire Coordinating Group
OHV	off-highway vehicles
RCIS	Regional Conservation Investment Strategies
Ripley State Park	Arthur B. Ripley Desert Woodland State Park
R&I	research and information
sq km	square kilometer
sq mi	square miles
SVRA	State vehicular recreation area
SWAP	State Wildlife Action Plan
TCM	Tribal co-management

TEK	Traditional Ecological Knowledge
THPO	Tribal historic preservation officer
TPBMI	Twenty-Nine Palms Band of Mission Indians
Tribes	California Native American tribes
USFS	US Forest Service
USFWS	US Fish and Wildlife Service
USGS	US Geological Survey
WCB	California Wildlife Conservation Board
WHPP	wildlife habitat protection plan
WJTCA ITP	Western Joshua Conservation Act incidental take permit
WJTCA	Western Joshua Tree Conservation Act

FOREWORD

Western Joshua trees are beloved members of California's spectacular biodiversity. They are emblematic of Mojave Desert vegetation and Native American tribes have nurtured and coexisted with Joshua trees since time immemorial. Their spiky silhouettes have long captivated our interest, and their survival in desert ecosystems is a testament to life's ability to adapt. But western Joshua trees are facing an increasing variety and intensity of threats. Climate change, habitat loss, and wildland fire are the primary threats to western Joshua tree and represent significant challenges for us to overcome.

With this Western Joshua Tree Conservation Plan, we hope to lay the groundwork for long-term conservation of the species and the desert ecosystems on which it depends. Our conservation work will depend on science including Traditional Ecological Knowledge, principles of tribal co-management, and collaboration to succeed. Conservation of western Joshua tree will not be easy, but I believe that we can do it through dedicated partnerships with California Native American tribes, agencies, and other organizations, and by embracing the western Joshua tree management actions and strategies outlined in this plan.

I'm proud of the California Department of Fish and Wildlife's work in preparing this plan and of the many collaborative partnerships we've forged in its preparation. I look forward to continuing our western Joshua tree conservation efforts in the future.

Charlton H. Bonham
CDFW Director

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1 INTRODUCTION

> *"Joshua tree forests tell a story of survival, resilience, and beauty borne through perseverance."*
> *- Jane Rodgers, Superintendent, Joshua Tree National Park.*

Western Joshua tree (*Yucca brevifolia*) is an iconic plant species with substantial ecological and cultural importance in California. The California Fish and Game Commission (Commission) made western Joshua tree a candidate for listing as a threatened species under the California Endangered Species Act (CESA) in September 2020. As a result, western Joshua tree now benefits from the protections afforded by CESA (discussed in Section 1.1.2). In addition, the Western Joshua Tree Conservation Act (WJTCA) was passed and signed into law in July 2023 to conserve western Joshua tree and its habitat. WJTCA requires the California Department of Fish and Wildlife (CDFW) to develop and implement a Western Joshua Tree Conservation Plan (Conservation Plan) in collaboration with the Commission, governmental agencies, California Native American tribes (Tribes), and the public (Fish & G. Code, § 1927.6, subd. (a)). CDFW developed the Conservation Plan based on the best available information, consisting of "credible science" as defined in the California Fish and Game Code section 33, including Traditional Ecological Knowledge (TEK); collaboration with California Native American tribes; collaboration with federal, state, and local government agencies; and public feedback. This chapter provides an overview of the need for western Joshua tree conservation, the vision and objectives of the Conservation Plan, CDFW's collaboration with other entities in developing the Conservation Plan, and the Conservation Plan organization.

The Conservation Plan provides guidelines for western Joshua tree conservation, criteria to help define effectiveness of management actions, monitoring of management outcomes, and a process of adaptive management to refine and improve the management actions over time. Western Joshua tree conservation will require action from many different people, governments, and organizations. The management actions in the Conservation Plan can be voluntarily adopted and implemented by project proponents, land managers, and philanthropists to help conserve and protect the species from harm. California Native American tribes and the State can work together to co-manage conservation consistent with the Conservation Plan's guidance. The management actions can be incorporated into project approvals by local, state, and federal government agencies that authorize projects or resource management programs in western Joshua tree's range in California. Researchers can implement management actions related to research and private citizens and other organizations can implement actions related to education and awareness. While statutory sections from WJTCA are referenced where relevant, the Conservation Plan does not create new statutory or regulatory mandates.

***Western Joshua Tree Conservation Act** is the law that regulates take of western Joshua tree and mandates the permitting process. It also requires CDFW to develop and implement a Conservation Plan in collaboration with the Commission, governmental agencies, California Native American tribes, and the public.*

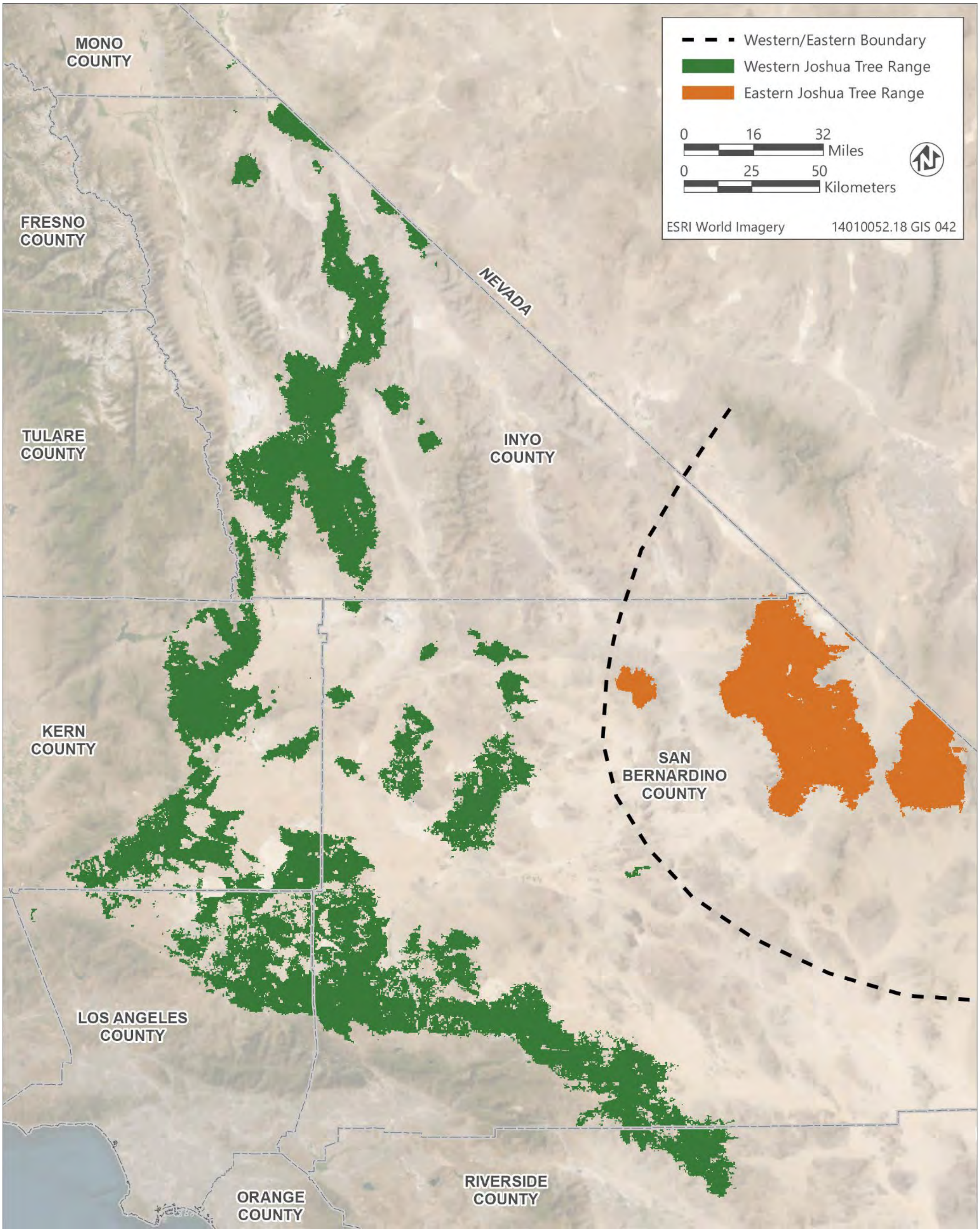
*The **Western Joshua Tree Conservation Plan** provides voluntary guidelines and management actions that will conserve the species – there are no regulations in the Conservation Plan.*

WJTCA states that CDFW and the Commission "shall, if necessary, periodically update the conservation plan to ensure the conservation of the species" (Fish & G. Code, § 1927.6. subd. (a)) after the Commission approves an initial Conservation Plan. In addition, the Commission shall consider recommendations from CDFW for Conservation Plan amendments "beginning in 2026, and at least every two years thereafter" (Fish & G. Code, §1927.8 subd. (a)). As such, the Conservation Plan is designed to be a living document that will be modified over time to effectively conserve western Joshua tree. Section 6.8, "Monitoring, Species Status Reviews, Plan Amendment, and Adaptive Management," describes the process for evaluating management outcomes and amending the Conservation Plan.

1.1 NEED FOR WESTERN JOSHUA TREE CONSERVATION

1.1.1 Summary Description of Western Joshua Tree

Western Joshua tree is one of two species of Joshua tree; the second species is eastern Joshua tree (*Yucca jaegeriana*) (Figure 1-1). Although eastern Joshua tree is noted in some instances in the Conservation Plan, western Joshua tree is the only species protected by and subject to CESA, WJTCA, and the guidance provided in the Conservation Plan. For the purposes of the Conservation Plan, the term "Joshua tree" means both western Joshua tree and eastern Joshua tree collectively, or it may be used when the information presented is not known to be specific to one of the two species.



Source: Esque et al. 2023; adapted by Ascent in 2024.

Figure 1-1 Western and Eastern Joshua Tree Range in California

Western Joshua tree is an important part of California's desert ecosystem and provides habitat for numerous birds, mammals, insects, reptiles, and other organisms. Western Joshua tree also possesses considerable cultural value for California Native American tribes, many of which use the species to make traditional tools and products and for culinary and medicinal purposes (Louderback et al. 2013; Sutton and Earle 2017). In addition, silhouettes of Joshua trees carry cultural significance for many Tribes (FTBMI, pers. comm., 2024).

In California, western Joshua tree is found within the Mojave Desert, parts of the Great Basin, and in transition zones within the southern Sierra Nevada and Southern California mountains bordering those areas, where precipitation levels are low and vary between wetter and drier conditions annually and over multiyear and multidecade timescales. Western Joshua tree is currently relatively widespread and abundant throughout this range, grows slowly, and may require approximately 50 to 70 years to reach reproductive maturity and begin producing flowers. The species is reliant on its sole obligate pollinator, the yucca moth (*Tegeticula synthetica*), to produce seeds, and on scatter-hoarding rodents to disperse and cache seeds at a soil depth suitable for germination. Joshua tree seedlings may establish most successfully after large mast seeding events. Mast seeding is the production of many seeds by many individuals of a species at the same time and in the same region. Joshua tree mast seeding events currently occur at an average frequency of more than once every 4 years (Yoder et al. 2024). Presence under a nurse plant (i.e., a plant that facilitates the growth and development of other plant species beneath its canopy) and several successive years of sufficiently wet and cool conditions are likely required for successful seedling establishment and sufficient growth for western Joshua trees to withstand drier and hotter conditions. Western Joshua tree is also capable of asexual growth, which may allow individuals to survive in marginal climate conditions for long periods of time. Western Joshua tree ecology and threats to the species are described in detail in Chapter 4, "Summary of Resource Conditions."

The major threats to western Joshua tree include human activities, climate change, and wildland fire. The combined threats to western Joshua tree, coupled with the species' biology and specific habitat requirements, are causes for substantial concern about the ability of the western Joshua tree population to persist in California long-term. Without some level of direct management, the future of the species will largely depend on its ability to withstand continued habitat loss and to adapt to the hotter and drier conditions that are expected due to climate change. Therefore, thoughtful conservation actions and careful land management are needed to sustain and enhance the western Joshua tree population in California.

1.1.2 Background of the Western Joshua Tree Conservation Act

In October 2019, the Center for Biological Diversity submitted to the Commission a petition to list western Joshua tree as threatened under CESA. The petition identified climate change and wildland fires as the greatest threats to the persistence of the species. It also included habitat loss due to development; seed and plant predation, especially during drought; and competition with invasive species as other factors affecting the species' ability to survive and reproduce (Center for Biological Diversity 2019).

The Commission found, based in part on CDFW's evaluation of the petition and related recommendation, that there was sufficient information indicating that listing the species as threatened under CESA may be warranted. The Commission designated western Joshua tree a candidate species in September 2020 (CDFW 2022), conferring upon western Joshua tree temporary legal protection under CESA.

Source: National Park Service.

CDFW evaluated the petition and submitted a written status review report to the Commission in March 2022 (CDFW 2022). The report concluded that western Joshua tree is not likely to be in danger of becoming extinct throughout all, or a significant portion, of its range in the foreseeable future in the absence of special protection and management efforts required by CESA. In June 2022, the Commission considered the status review report and could not reach a decision regarding whether listing the species as threatened was warranted. In February 2023, while the Commission was still considering its final decision on the petition, legislation was introduced to protect western Joshua tree. In response to the legislative proposal, the Commission postponed further consideration of the petition under CESA.

In July 2023, the California State Legislature passed and the governor signed into law WJTCA, codifying as Chapter 11.5 of Division 2 of the California Fish and Game Code (commencing with Fish & G. Code, § 1927). WJTCA does the following:

- Provides protections for western Joshua tree by prohibiting the import, export, take, possession, purchase, or sale of any western Joshua tree in California (Fish & G. Code, § 1927.2, subd. (a)). Pursuant to Fish and Game Code Section 86, "take" means "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill."
- Allows CDFW to authorize take of western Joshua tree if certain conditions are met (Fish & G. Code, § 1927.3, subds. (a)-(b)).

- Authorizes CDFW to enter into a written agreement with any county or city to delegate to the county or city limited authority to authorize take of western Joshua tree if specified conditions are met (Fish & G. Code, § 1927.3, subd. (c)).
- Allows CDFW to authorize, by issuing permits, the removal or trimming of dead western Joshua trees or the trimming of live western Joshua trees that pose a risk to structures or public health and safety if certain conditions are met. (Fish & G. Code, § 1927.4, subd. (a)).
- Authorizes CDFW to enter into a written agreement with any county or city to delegate to the county or city limited authority to authorize the removal or trimming of dead western Joshua trees or the trimming of live western Joshua trees that pose a risk to structures or public health and safety if specified conditions are met (Fish & G. Code, § 1927.4, subd. (b)–(c)).
- Allows permittees to elect to pay specified fees in lieu of completing mitigation obligations (Fish & G. Code, § 1927.3, subd. (a)(3)).
- Establishes the Western Joshua Tree Conservation Fund (Conservation Fund). Any monies in the fund will be continuously appropriated to CDFW solely for the purposes of acquiring, conserving, and managing conservation lands and completing other activities to conserve western Joshua tree. (Fish & G. Code, § 1927.5, subd. (a)).
- Directs CDFW to develop and implement a conservation plan for western Joshua tree in collaboration with the Commission, other governmental agencies, California Native American tribes, and the public. (Fish & G. Code, § 1927.6, subd. (a)). CDFW must consult with California Native American tribes and include co-management principles (Fish & G. Code, § 1927.6, subd. (b)). CDFW must present the draft Conservation Plan at a public meeting of the Commission no later than December 31, 2024, and WJTCA calls for the Commission to take final action on the plan by June 30, 2025. (Fish & G. Code, § 1927.6, subd. (a)).
- Directs CDFW to submit an annual report assessing the conservation status of western Joshua tree to the Commission and the State Legislature by January 31 of each year, starting in 2025 (Fish & G. Code, §1927.7, subd. (a)).
- Requires CDFW to submit to the Commission an updated status review report by January 1, 2033, unless the Commission directs CDFW to complete it sooner (Fish & G. Code, § 1927.2, subd. (c)(2)(F) & 1927.9). The Commission shall consider determining whether the petitioned action to list western Joshua tree under CESA is warranted (Fish & G. Code, §1927.9). In the interim, western Joshua tree is, and will remain, a candidate species under CESA.

1.2 CONSERVATION PLAN VISION, PURPOSE, AND OBJECTIVES

1.2.1 Vision

The vision of the Conservation Plan is to prevent the extinction of western Joshua tree in the wild, preserve functioning ecosystems that support western Joshua tree, and maintain sustainable populations of western Joshua tree in California over the long term, such that listing the species under CESA will not be warranted.

1.2.2 Purpose

The purpose of the Conservation Plan is to fulfill the requirements articulated in Fish and Game Code Section 1927.6. Upon approval by the Commission, the Conservation Plan will guide the conservation of western Joshua tree in California by focusing on the most urgent and important management actions, as informed by science including TEK; collaboration with California Native American tribes; collaboration with federal, state, and local government agencies; and public feedback.

1.2.3 Objectives

The following objectives are identified in WJTCA:

- Describe management actions necessary to conserve western Joshua tree and objective, measurable criteria to assess the effectiveness of such actions (Fish & G. Code, §1927.6, subd. (a)).
- Provide guidance for the avoidance and minimization of impacts to western Joshua trees (Fish & G. Code, § 1927.6, subd. (a)).
- Include in the Conservation Plan protocols for the successful relocation of western Joshua trees and provide for the relocation of western Joshua trees to tribal lands upon a request from a Tribe (Fish & G. Code, § 1927.6, subds. (a)-(b)).
- Include co-management principles and incorporate Traditional Ecological Knowledge into the Conservation Plan (Fish & G. Code, § 1927.6, subd. (b)).
- Prioritize actions and acquiring and managing lands that are identified as appropriate for western Joshua tree conservation (Fish & G. Code, § 1927.6, subd. (c)).

1.2.4 Geographic Focus Area

The Conservation Plan includes a geographic focus area for conservation activities encompassing 37,749 square kilometers (9,327,981 acres, or 14,575 square miles) in southeastern

California. It reflects the general location of currently occupied western Joshua tree habitat plus an 8-kilometer (5-mile) buffer in California to encompass areas that could be suitable for implementation of conservation management actions (Figure 1-2). However, application of WJTCA and implementation of the management actions described in the Conservation Plan (see Chapter 5, “Conservation Management Actions and Effectiveness Criteria”) are not limited to the geographic focus area. In addition, the geographic focus area may be modified through amendment of this Conservation Plan based on evolving information regarding current and future western Joshua tree habitat resulting from ongoing scientific analysis.

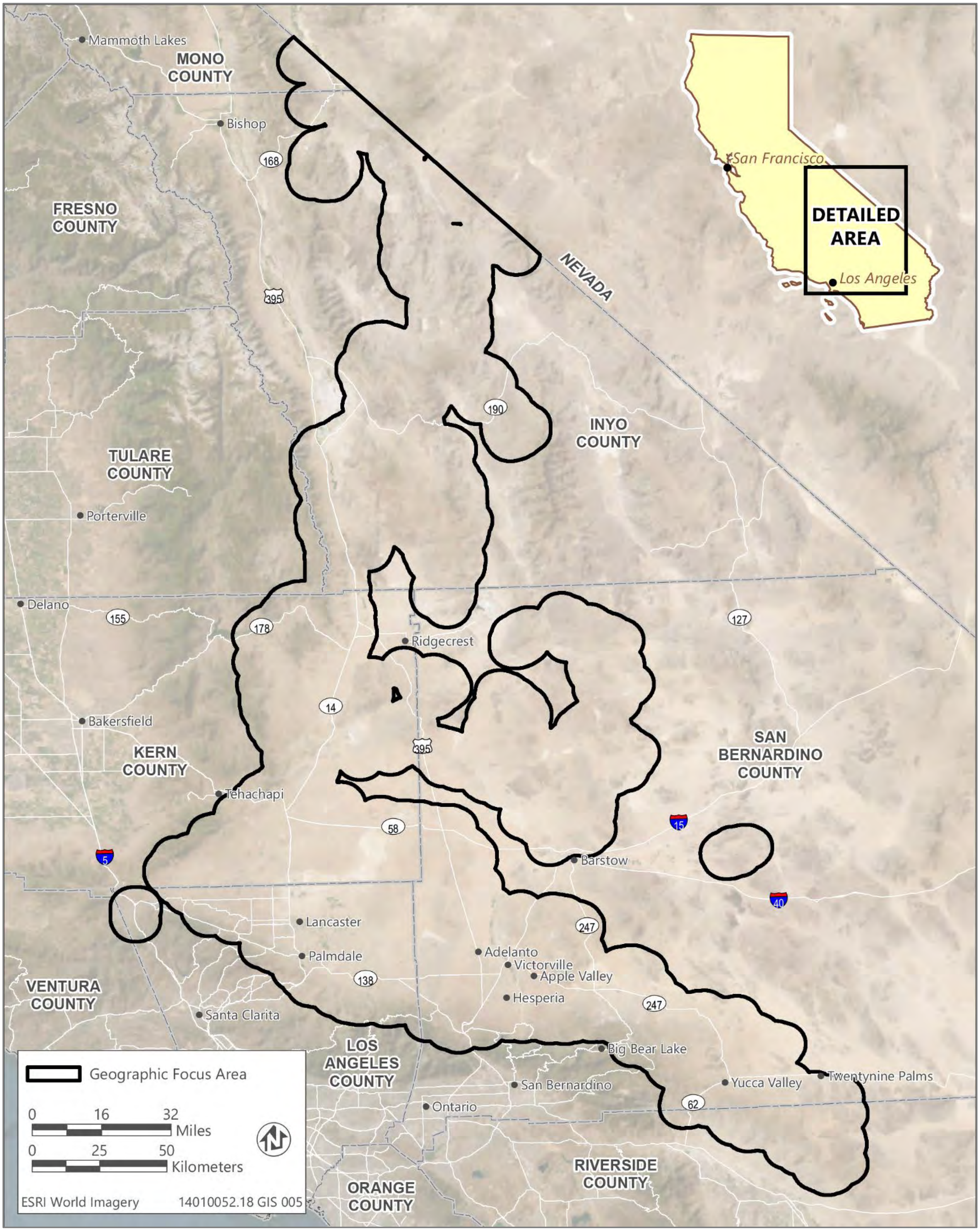
1.3 COLLABORATION, OUTREACH, AND PUBLIC REVIEW

WJTCA requires CDFW to develop this Conservation Plan for western Joshua tree in collaboration with the Commission, governmental agencies, California Native American tribes, and the public (Fish & G. Code, §1927.6 subds. (a)–(b)). This collaboration has occurred throughout the development of the Conservation Plan via in-person and virtual consultation and outreach with Tribes; virtual meetings with federal, state, and local agencies and other interest groups; virtual meetings with the public; and correspondence with interested organizations and individuals.

Additional information on outreach, review, and public proceedings related to the approval of this Conservation Plan is available on the Commission’s website, including the process for public review of the draft Conservation Plan prior to final action.

1.3.1 Local, State, and Federal Government Agencies

CDFW conducted two rounds of virtual outreach meetings with local, state, and federal agencies that own, manage, or have jurisdiction over lands within the Conservation Plan’s geographic focus area (Figure 1-2). In the first round of meetings, CDFW provided an overview of WJTCA, an overview of the types of permits that may be issued under WJTCA authorizing take of western Joshua tree, and a summary of the Conservation Plan contents required under WJTCA. Meeting attendees had an opportunity to provide feedback on content that should be included in the Conservation Plan, information regarding the current management of western Joshua tree, and ways agencies might collaborate with CDFW in implementing management actions set forth in the Conservation Plan. In the second round of meetings, CDFW provided a summary of the management actions developed since the previous meetings and a description of the draft conservation “management units,” which aim to organize where specific management actions should be prioritized and implemented. Attendees were asked for input on additional management actions, details or issues that could be addressed in the Conservation Plan, and opportunities for collaboration with CDFW in implementing the Conservation Plan.



Source: Esque et al. 2023; adapted by Ascent in 2024.

Figure 1-2 Geographic Focus Area

After each round of outreach meetings, CDFW contacted the agencies that requested a follow-up meeting or failed to attend the group outreach meetings. Follow-up meetings focused on discussion of proposed management actions, recommendations, and potential issues with management action implementation (Table 1-1). They also included, where applicable, discussion of current western Joshua tree management activities on agency properties and the potential to incorporate those activities into a written memorandum of understanding (MOU) or other written agreement with CDFW. Email correspondence sent to staff from agencies that did not attend the outreach meetings included a link to the meeting recordings, PDF copies of the meeting presentations, and a questionnaire (see Appendix A, "Agency Feedback Questionnaire") designed to help CDFW identify existing western Joshua tree management actions by asking for the following information:

- The agency's current management of western Joshua tree or vegetation in general.
- The agency's best management practices for wildland fire suppression or prevention, invasive species control, relocation of western Joshua tree, prevention of soil erosion, grazing, and off-highway vehicle (OHV) recreation within western Joshua tree habitat.
- Western Joshua tree–specific restoration/conservation efforts in the past, present, or future planning (e.g., seed collection/banking, replanting western Joshua tree, replanting/seeding native nurse plants for western Joshua tree, or western Joshua tree relocation).
- The description of existing agency collaborations or written agreements with local California Native American tribes, if any.

CDFW also sought input from agencies regarding potentially acceptable terms for a written MOU between federal, state, and local jurisdictions regarding western Joshua tree conservation. The questionnaire focused on the implementation of management actions recommended in this Conservation Plan (see Section 5.2, "Management Actions Necessary to Conserve Western Joshua Tree"). These and other potential written agreement terms are described in Section 6.3, "Collaboration."

Table 1-1 CDFW Agency Outreach Meetings and Meetings with Individual Agencies

Date	Agency or Agencies	Requested By
February 29, 2024	State and federal agencies	CDFW
February 29, 2024	Local agencies	CDFW
March 27, 2024	California State Parks (CSP)	CSP
May 8, 2024	CSP	CDFW
May 15, 2024	State and federal agencies	CDFW
May 15, 2024	Local agencies	CDFW
May 22, 2024	California State Lands Commission	CDFW
June 12, 2024	CSP	CSP
July 15, 2024	California Department of Forestry and Fire Protection (CAL FIRE)	CAL FIRE

Source: Compiled by Ascent in 2024.

A full list of agencies invited to collaborate, including those that provided specific input for this version of the Conservation Plan, is in Appendix B, "Agency and Public Input Summary Memo."

1.3.2 California Native American Tribes

Collaboration with Tribes and inclusion of tribal co-management principles are critical aspects of CDFW's development of the Conservation Plan. At CDFW's request, the Native American Heritage Commission provided a list of contacts for 170 federally and non-federally recognized Tribes culturally affiliated with the geographic focus area. CDFW sent email invitations to these Tribes to view an online presentation regarding the Conservation Plan and to participate in a related tribal listening session. CDFW also mailed hard-copy letters with the same information to the Tribes, then followed up via phone and email to ensure Tribes received notice of available opportunities to participate in the development of the Conservation Plan and to answer any questions. A summary of CDFW's tribal engagement and collaboration process is described in Appendix C, "Tribal Input Summary Memo."

The Native American Land Conservancy (NALC) secured grant funding from the California Wildlife Conservation Board (WCB) to reimburse Tribes for their time spent contributing to the development of the Conservation Plan, including travel costs incurred from participating in Conservation Plan meetings.

Source: Alessandra Puig-Santana, National Park Service.

In coordination with the Commission, CDFW prepared and mailed formal joint consultation invitation letters to notify Tribes of the development of the Conservation Plan and to request tribal input under CDFW's Tribal Communication and Consultation Policy and the Commission's Tribal Consultation Policy. CDFW emailed the tribal consultation letters to the tribal contacts from the Native American Heritage Commission list on February 22, 2024, and mailed hard copy letters on March 4, 2024. CDFW then called Tribes beginning on March 19, 2024, to describe three available meeting options: facilitated meetings led by NALC, informational meetings/tribal listening sessions with CDFW, and consultation with CDFW and/or the Commission. Facilitated meetings were conducted by NALC staff and funded by the WCB grant. All notes taken by NALC staff at meetings with Tribes were reviewed and approved by participating Tribes prior to their provision to CDFW to inform its development of the Conservation Plan. These meetings began on May 9, 2024, are ongoing, and may be requested at any time. The three meeting options are described below:

1. **Facilitated meetings** provide an opportunity for Tribes to engage in a closed, internal discussion with a facilitator. The goal of these meetings is for the facilitator to help organize thoughts and ideas to reach a mutual written agreement on what information shared by Tribes will be publicly disclosed and included in the draft Conservation Plan. CDFW does not participate in these meetings, and the meetings do not constitute government-to-government consultation. In these meetings, the facilitator provides background information to tribal representatives and allows for open discussion centered around the tribal community. The facilitator works with the Tribe to develop ideas, input, and recommendations to share with CDFW for potential incorporation into the Conservation Plan.

2. **Informational meetings** include CDFW and one or more Tribes. In informational meetings, CDFW informs Tribes about WJTCA and the Conservation Plan and provides Tribes with an opportunity to ask questions and seek clarification. These meetings consist of a phone call or virtual meeting or tribal listening session that can include one or more tribal chairpersons, Tribal Historic Preservation Officers (THPOs), tribal representatives, and/or tribal members. An informational meeting is not considered to be consultation, as defined in CDFW policy.

3. **1:1 consultation**, as defined in CDFW's Tribal Communication and Consultation Policy, means the process of engaging in government-to-government dialogue with Tribes in a timely manner and in good faith to provide Tribes with necessary information and to seek out, discuss, and give full and meaningful consideration to the views of Tribes in an effort to reach a mutually agreed upon resolution of any concerns expressed by the Tribes or CDFW. CDFW acknowledges and respects that Tribes are unique and separate governments within the United States with inherent Tribal Sovereignty, including the rights to independence, self-governance, self-determination, and economic self-sufficiency. These principles form the basis for government-to-government consultations. Consultation may occur jointly or individually with CDFW or the Commission and a Tribe or one or more

designated representative(s) of the Tribe. A consultation may also include multiple Tribes, but each Tribe would need to agree. A Tribe may request consultation at any time. Consultation may be virtual or in-person at a location acceptable to the Tribe.

The Tribes that CDFW and NALC have met with thus far were invited to review and provide comments on a preliminary draft of this Conservation Plan and following CDFW's submittal of the draft Conservation Plan to the Commission. Tribes will have additional opportunities to review and provide input on an ongoing basis for future versions of the Conservation Plan (see Sections 6.4, "Tribal Co-Management," and Section 6.8). CDFW currently maintains a dedicated email address for communication with Tribes regarding the Conservation Plan: WJT.TribalEngage@wildlife.ca.gov.

CDFW received feedback from tribal members that a meeting with multiple Tribes would be beneficial for Tribes to learn more about WJTCA and the Conservation Plan, and to share knowledge about western Joshua tree. Subsequently, two multi-tribe Western Joshua Tree Community Workshops were held. The workshops were intended to provide tribal communities an interactive space to access valuable information and resources about WJTCA and the Conservation Plan, to share information about the cultivation and preservation of western Joshua trees, and to assist in the development and implementation of the Conservation Plan. Tribes that had previously expressed interest in collaborating on the Conservation Plan were invited via email and phone to attend the workshops. The first workshop, sponsored by NALC and the Lone Pine Paiute-Shoshone Tribe, was held on October 26, 2024 in the town of Lone Pine. Sixteen Tribe members from seven Tribes attended the workshop. The second workshop was sponsored by CDFW and NALC and was held on two dates: February 21, 2025 in the community of Joshua Tree and February 22, 2025 in the town of Yucca Valley. Ten Tribe members from six Tribes attended. A full list of Tribes that attended each of the workshops is in Appendix C.

Tribal outreach and consultation are ongoing and will continue to inform updates to the Conservation Plan and to identify California Native American tribes' interested in engaging in co-management practices with CDFW and in receiving western Joshua trees relocated from other areas. Section 3.2, "Tribal Values Related to, and Uses of, Joshua Tree," discusses traditional tribal values and uses of western Joshua tree, and Section 3.3, "Traditional Ecological Knowledge for Conservation," describes Traditional Ecological Knowledge for conservation. Section 5.2.3, "Tribal Co-Management," identifies tribal co-management actions that were developed and will be implemented in coordination with California Native American tribes. Co-management principles will be guided by foundational commitments initially developed by CDFW and described in Appendix G, "Foundational Commitments by CDFW for Developing Western Joshua Tree Conservation Plan Co-Management Principles with California Native American Tribes." The foundational commitments may be refined in the future, in collaboration with Tribes co-managing western Joshua tree and its habitat.

1.3.3 Public

CDFW initially engaged with the public by launching a website dedicated to the Conservation Plan on November 22, 2023. The website includes an email address, WJT@wildlife.ca.gov, through which the public can share suggestions, ask questions, and provide feedback. The website also provided the public with notices of two virtual outreach meetings held on April 4 and July 11, 2024 and two virtual workshops on March 10, 2025. Invitations to the 2024 meetings and the 2025 workshops were distributed to subscribers of “CDFW News” and “CDFW western Joshua tree updates” topics through the California Department of General Services public email subscription service between 14 and 30 days prior to the meetings. Coinciding with the timing and content of the 2024 scheduled public meetings, CDFW also held focused meetings with researchers and other interested organizations.

CDFW also emailed the July 2024 public meeting invitation directly to individuals representing communities and organizations working in environmental justice within the Conservation Plan geographic focus area. CDFW sent emails to individuals and organizations that are connected to communities that have been excluded from environmental policy-setting and/or decision-making. These emails were intended to initiate meaningful engagement and to bridge the gap between underserved communities and environmental conversations that affect them most by providing the opportunity to provide input on the Conservation Plan.

As with the government agency meetings, during the first public meeting, CDFW provided an overview of WJTCA, an overview of the types of permits authorizing take of western Joshua tree, and a summary of the Conservation Plan content. In an open forum, meeting attendees had an opportunity to provide feedback, ask questions, and raise issues or concerns they would like to see addressed in the Conservation Plan. Attendees were also encouraged to submit written comments about the Conservation Plan summary to the WJT@wildlife.ca.gov email address by April 30, 2024. During the second meeting, CDFW provided a summary of the management actions and a description of the management units where the management actions would be implemented and presented some mechanisms for implementing the management actions. CDFW also addressed previous questions and concerns posed by the public during and following the first public meeting. In the March 10, 2025 workshops, CDFW provided an overview of WJTCA provisions, permits required for impacts to western Joshua tree under WJTCA, an overview of the Conservation Plan, and a summary of the comments received and anticipated changes to the draft changes to the draft Conservation Plan since its first release to the public on November 27, 2024.

Meeting invitees and attendees included property owners, real estate brokers, trade association representatives, nonprofit land conservancy and conservation association representatives, leaders in the environmental justice community, town council association representatives, regulatory consultants, biologists, local agency staff, and legislative office representatives. A summary of input received during the meetings is provided in Appendix B.

Additional information on public proceedings related to the approval of this Conservation Plan is available on the Commission's website. In addition, the public may continue to provide input to CDFW and the Commission on the Conservation Plan to inform periodic updates (see Section 6.8).

1.4 ORGANIZATION OF THE CONSERVATION PLAN

The Conservation Plan describes the steps required to achieve the vision of conserving western Joshua tree and its habitat in California such that listing under CESA will not be needed. The Conservation Plan can be divided into two parts: The first part summarizes guiding concepts and currently available information, and the second part describes management actions and the implementation approach for conserving western Joshua tree and achieving the vision of the Conservation Plan. The chapters of the Conservation Plan are briefly described under the following two parts of the Conservation Plan:

Guiding Concepts and Information Needed for Conservation

- Chapter 1, "Introduction," summarizes the western Joshua tree conservation need; identifies the vision, purpose, and objectives of the Conservation Plan; and describes the collaboration process for Conservation Plan development.
- Chapter 2, "Planning Influences," describes existing regulations, policies, and planning initiatives that influence management actions. Identifying planning influences affecting the Conservation Plan facilitates collaboration and helps efficiently determine conservation opportunities.

Joshua tree seeds.
Source: Sarinah Simmons, National Park Service.

- Chapter 3, "Traditional Values and Uses of Western Joshua Tree by California Native American Tribes," focuses on the tribal values and uses of western Joshua tree and TEK that influenced the persistence of the species and its habitat over millennia. The information in this chapter is designed to inform the co-management activities that would be co-created by CDFW and participating California Native American tribes.

- Chapter 4, "Summary of Resource Conditions," presents information on the ecology of western Joshua tree; the ecosystem it inhabits; its past, current, and potential range; and environmental stressors and threats that have affected and will affect the persistence of the species. This chapter also identifies gaps in current knowledge needed to inform effective conservation.

Conservation Management Actions and Implementation Mechanisms

- Chapter 5, "Conservation Management Actions and Effectiveness Criteria," as informed by the information in Chapters 1 through 4, describes the intended use of management actions as guidance for conservation; the specific management actions necessary to conserve western Joshua tree; where specific management actions should be prioritized based on areas of predicted climate refugia, habitat conservation value, existing land use type, and ownership designation within the species' range; and criteria for measuring the effectiveness of those actions.
- Chapter 6, "Implementation," outlines the mechanisms established to implement the Conservation Plan management actions presented in Chapter 5, as well as the roles and responsibilities of the implementing parties. The chapter identifies potential types of written agreements with collaborators, the permitting framework described in WJTCA, Conservation Fund management, land acquisition procedures, the annual reports documenting permitting and mitigation performance metrics (Fish & G. Code, § 1927.7, subd. (a)), and the process for updating and amending the Conservation Plan.

1.5 WESTERN JOSHUA TREE CONSERVATION ADAPTIVE MANAGEMENT FRAMEWORK

To be effective, the Conservation Plan must be able to address near-term threats to the species and preserve existing western Joshua trees and their habitat on the site-specific scale while gathering the additional information needed to enact range-wide conservation in the long term. To achieve this, the Conservation Plan is designed to be implemented in an adaptive management framework within the broader context of WJTCA. An adaptive management framework provides a structured process that allows for management actions, closely monitoring and evaluating outcomes, and reevaluating and adjusting decisions as more information is learned. The adaptive management framework for western Joshua tree conservation has five conceptual phases, which are illustrated in Figure 1-3, "Western Joshua Tree Conservation Adaptive Management Framework," and described below.

1. **Prepare the Draft Plan**

   Preparation of the draft Conservation Plan is the first phase in the framework. The Conservation Plan describes existing resource conditions, California Native American tribes' values, western Joshua tree conservation needs, collaborators in achieving the conservation vision, and guidance for management actions with implementation mechanisms.

2. **Public Review and Plan Approval**

   The Conservation Plan and any updates to it in the future are circulated for public review, presented at a public meeting, and formally approved by the Commission. This public process will allow public agencies, interested parties, and California Native American tribes to provide input on the Conservation Plan prior to approval by the Commission.

3. **Implement the Conservation Plan**

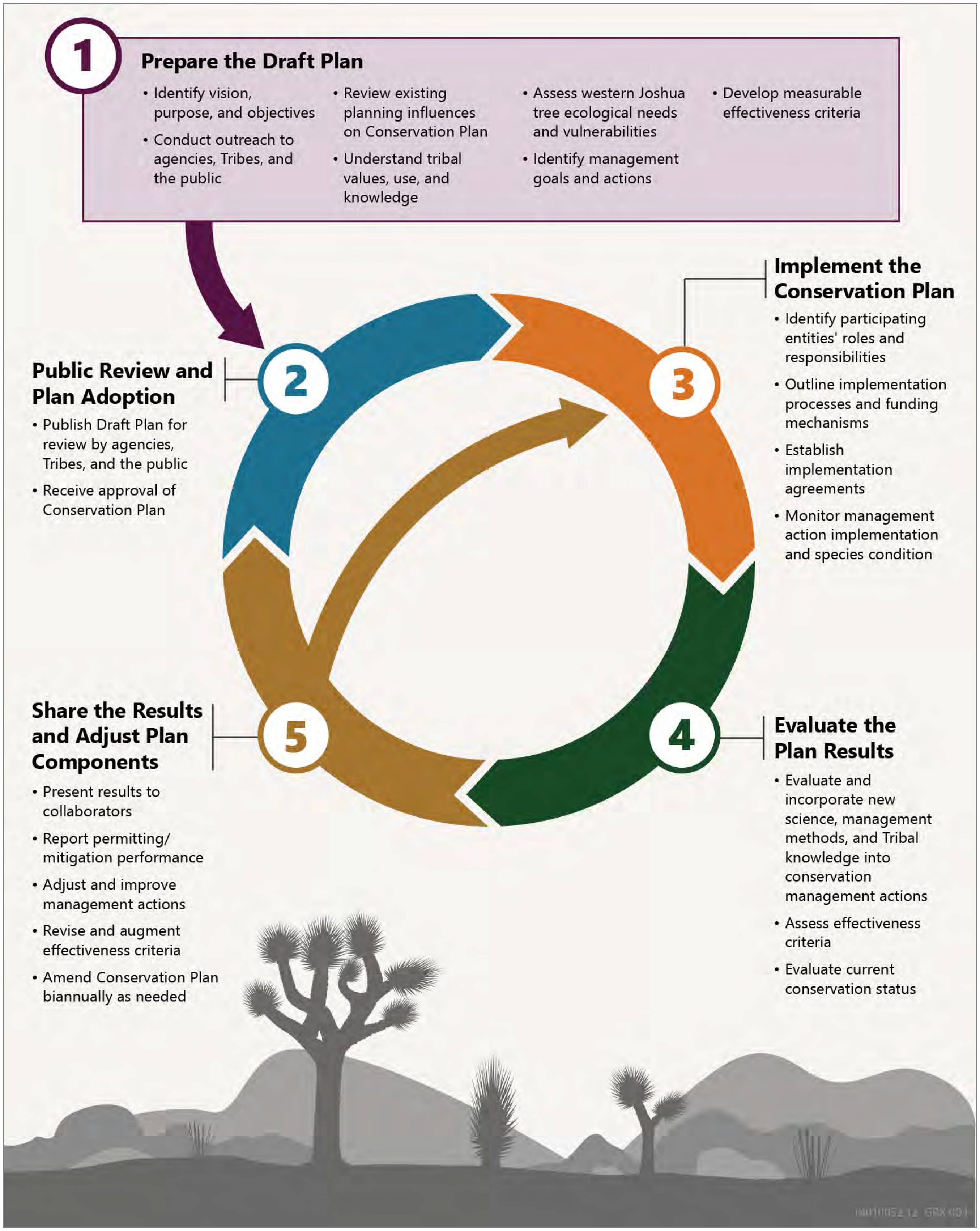
   Once the Conservation Plan is approved, the conservation management actions will be implemented through continued collaboration between CDFW and local, state, and federal agencies by establishing interagency written agreements or written memoranda of understanding and by developing co-management written agreements and written memoranda of understanding with tribal collaborators. CDFW will monitor conservation management actions that have been implemented, including those in progress since the species' candidacy for listing under CESA, and others that have been developed specifically in response to WJTCA and the western Joshua tree population condition.

4. **Evaluate the Plan Results**

   CDFW will gather and evaluate new knowledge from the scientific community, agencies, and Tribes needed to achieve or improve effectiveness of management actions. As new information is incorporated into management actions, CDFW will monitor the outcome on western Joshua tree conservation status, as measured by the effectiveness criteria presented in Section 5.3, "Effectiveness Criteria."

5. **Share the Results and Adjust Plan Components**

   CDFW will report on the performance of the permitting and mitigation program and provide an assessment of the conservation status of western Joshua tree in annual reporting, described in Section 6.8.1, "Monitoring and Reporting," and required by WJTCA (Fish & G. Code, § 1927.7, subd. (a)). Management actions will be adjusted based on new scientific and other information, effectiveness of management actions, permit and mitigation performance, and ongoing feedback from collaborators. Through adaptive management, strategy refinements, and new information will be incorporated into the Conservation Plan (Fish & G. Code, § 1927.6, subd. (a)). CDFW will also recommend Conservation Plan amendments to the Commission every 2 years at a public meeting, as necessary (Fish & G. Code, § 1927.8, subd. (a)). Through this process, management actions and implementation mechanisms may be adjusted to improve conservation of western Joshua tree and achieve the vision of this Conservation Plan.



Source: Created by Ascent in 2024.

Figure 1-3 Western Joshua Tree Conservation Adaptive Management Framework

2 PLANNING INFLUENCES

Science including Traditional Ecological Knowledge (TEK) forms the foundation of conservation strategies for western Joshua tree. The planning, policy, and statutory/regulatory context of the geographic focus area also helps guide the management actions. This chapter summarizes existing federal, state, and local plans, as well as adopted policies, legislation, regulations, and ordinances related to western Joshua tree and discusses how they influence the Conservation Plan.

Because western Joshua tree's range is in multiple jurisdictions and under varying land ownership, successful implementation of range-wide conservation strategies will require coordinated efforts between landowners, the public, nongovernmental organizations (NGOs), government agencies, and California Native American tribes (Tribes). Using species distribution modeling data, Table 2-1 summarizes the area and percent of western Joshua tree's total range in California that is on federal, state, local government, and private lands. Figure 2-1 provides a graphic representation of land ownership within the Conservation Plan geographic focus area. Western Joshua tree's range is described further in Section 4.1.1, "Range and Distribution." These species distribution modeling data (Esque et al. 2023) are used throughout this chapter and the Conservation Plan, and represent the presence of western Joshua trees within 0.25-square-kilometer grid cells (approximately 62 acres) but do not provide information on the number or density of trees within these grid cells.

Tribal lands, as referenced in Fish and Game Code section 1927.6, subdivision (b), include lands meeting the definition of "Indian country" in 18 US Code section 1151 held in trust by Tribes (rancherias/reservations) or tribal members (individual allotments usually within rancherias/reservations); fee lands held by Tribes (land purchased and owned by a Tribe typically outside of rancherias/reservations); or fee lands held by tribally led NGOs (e.g., the Native American Land Conservancy [NALC]) or NGOs formed by non-federally recognized Tribes to act on the Tribe's behalf as a vehicle to hold land. However, because complete mapping for these other categories is not available, other than lands held in trust by Tribes (approximately 4 square kilometers [1.5 square miles] mapped by the Bureau of Indian Affairs), tribal lands are not included in Figure 2-1. Coordination with Tribes will continue to confirm the amount and location of tribal lands for incorporation into future Conservation Plan updates.

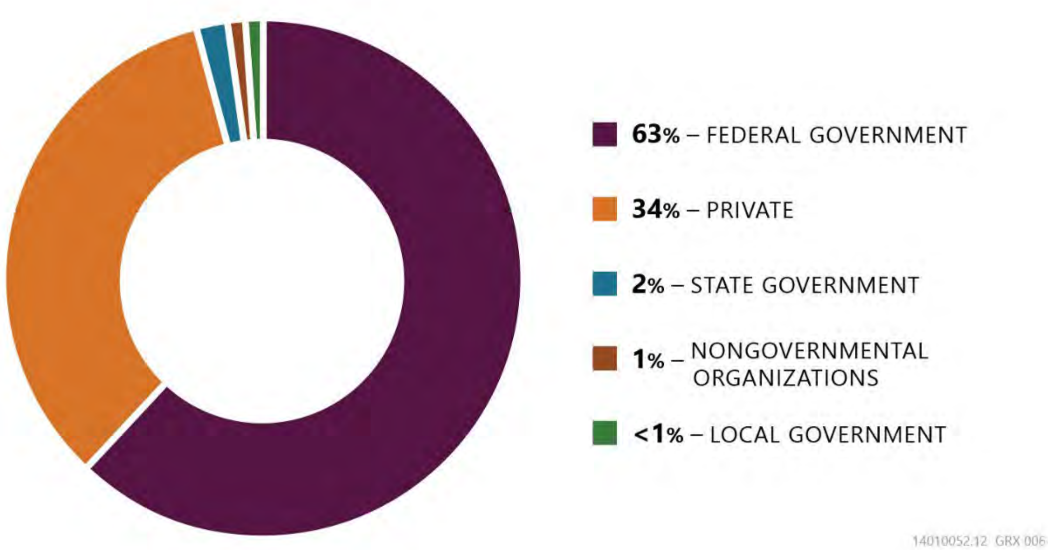
Table 2-1 Land Ownership in Western Joshua Tree Range in California

Entity[1]	Area in Square Kilometers (sq mi)	Percent of California Range (%)
Federal (Total)	**8,207 (3,168.7)**	**63**
US Bureau of Land Management	3,703 (1,429.9)	28
US Department of Defense	2,321 (896.3)	18
National Park Service	1,934 (746.5)	15
US Forest Service	245 (94.6)	2
Bureau of Indian Affairs	4 (1.5)	<1
Natural Resources Conservation Service	0.3 (0.1)	<1
Private, NGOs, Local (Total)	**4,608 (1,779.2)**	**35**
Private Land	4,470 (1,726.0)	34
Nongovernmental Organizations (NGOs)	104 (40.5)	1
Local Government	34 (13.0)	<1
State (Total)	**272 (104.9)**	**2**
California State Parks	149 (57.4)	1
California State Lands Commission	87 (33.7)	1
California Department of Fish and Wildlife	34 (13.2)	<1
Other State lands	2 (0.6)	<1

Notes: sq mi = square miles.

[1] Lands in all ownership categories include lands held as easements for which the landowner is not disclosed.

Source: Esque et al. 2023; compiled by Ascent in 2024 and 2025.



Source: Created by Ascent in 2024.

Figure 2-1 Land Ownership within the Western Joshua Tree Range in California

Figure 2-2 shows the land within the geographic focus area owned by the federal government, state government, local government, NGOs, and private entities. As explained in Section 1.2.4, “Geographic Focus Area,” the geographic focus area is currently occupied western Joshua tree habitat plus an 8-kilometer (5-mile) buffer within California to encompass areas that could be suitable for implementation of conservation management actions.

2.1 WESTERN JOSHUA TREE CONSERVATION ACT REQUIREMENTS

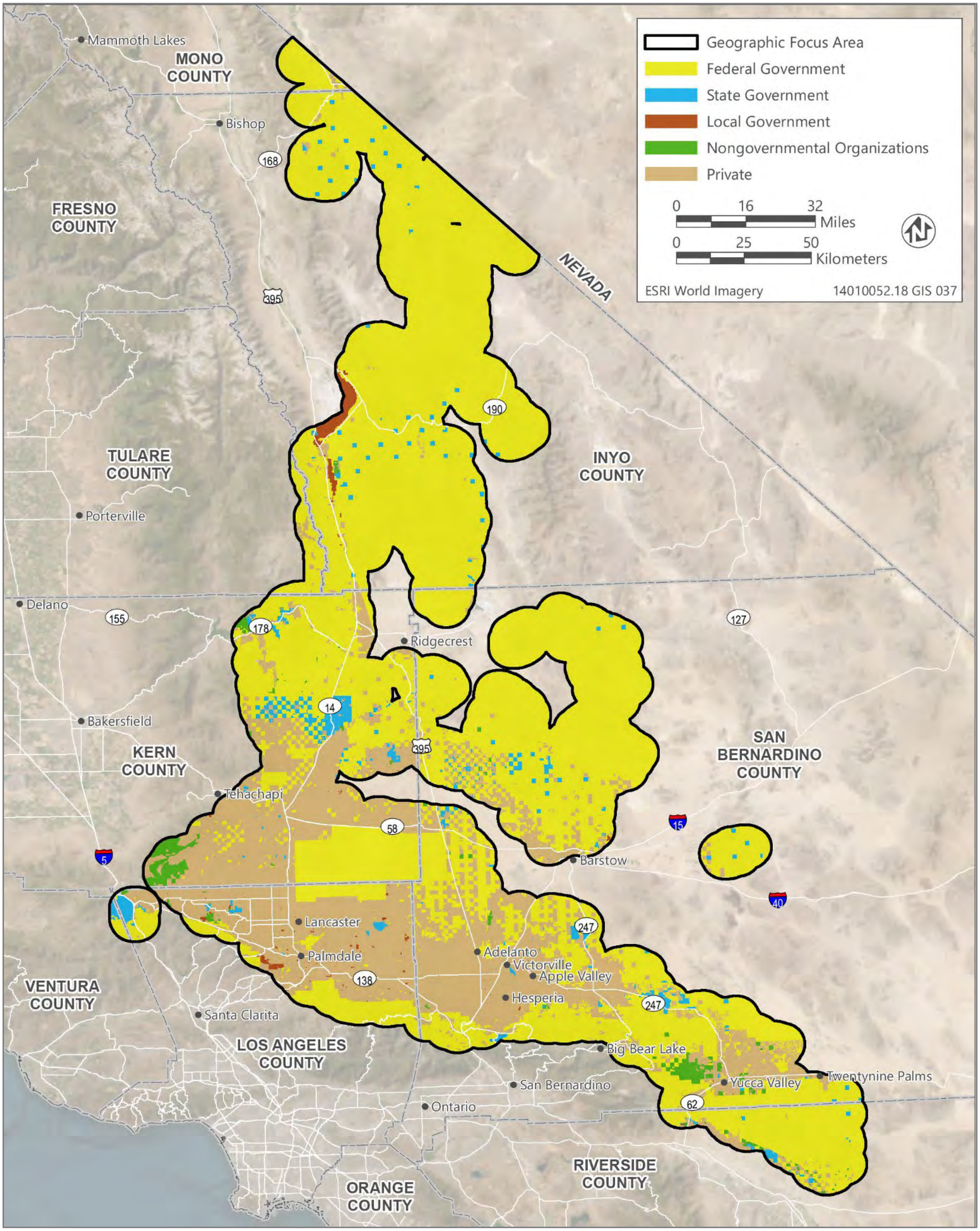
Statutory requirements for the Conservation Plan are set forth in Western Joshua Tree Conservation Act (WJTCA), which is codified at Fish and Game Code section 1927 et seq. The legal status of western Joshua tree under state and federal law also influences conservation planning. The following discussion summarizes key requirements of WJTCA relevant to the Conservation Plan and the current legal protection status of the species.

2.1.1 Conservation Plan

Under Fish and Game Code section 1927.6, CDFW is required to develop and implement a western Joshua tree Conservation Plan in collaboration with the Commission, governmental agencies, Tribes, and the public. Specifically, Fish and Game Code section 1927.6, subdivisions (a) and (b) state what the Conservation Plan must include (see Section 1.2.3, “Objectives”) and the schedule for preparation, review, and approval of the Conservation Plan (see Section 1.1.2, “Legal Status of Western Joshua Tree,” and Section 1.3.3, “Public”). The Fish and Game Code also defines “conservation” as the use of methods and procedures necessary to bring species listed under California Endangered Species Act (CESA) to the point at which CESA protection is no longer needed and, for species not listed under CESA, to maintain or enhance the condition of the species so that listing will not become necessary (Fish & G. Code, § 1927.1, subd. (c)).

2.1.2 Conservation Fund

The Western Joshua Tree Conservation Fund (Conservation Fund) is the key source of funding for implementation of management actions by CDFW. Fish and Game Code section 1927.5, subdivision (a) establishes the Western Joshua Tree Conservation Fund and requires all fees submitted to CDFW under WJTCA to be deposited into the Conservation Fund (Fish & G. Code, § 1927.5, subd. (b)). Moneys in the Fund are appropriated to CDFW solely for the purposes of acquiring, conserving, and managing western Joshua tree conservation lands and completing other activities to conserve western Joshua tree (Fish & G. Code, § 1927.5, subd. (a)). Fish and Game Code section 1927.8, subdivision (b) directs CDFW to annually adjust the amount of western Joshua tree fees. That section requires CDFW to adopt by December 31, 2026, and subsequently amend every 3 years thereafter, regulations adjusting the fees as necessary to ensure the conservation of the species.



Source: Adapted by Ascent in 2024.

Figure 2-2 Land Ownership within the Geographic Focus Area

2.1.3 Reporting and Review

Beginning in 2025, CDFW is required to submit an annual report to the Commission by January 31 of each calendar year assessing the conservation status of western Joshua tree (Fish & G. Code, § 1927.7). Fish and Game Code section 1927.7 outlines the required contents of the report.

Beginning in 2026, and at least every 2 years thereafter, the Commission is required to review the status of western Joshua tree and the effectiveness of the Conservation Plan at a public meeting. Concurrently with each review, CDFW is required to make recommendations to the Commission, as necessary, for amendments to the Conservation Plan to ensure the conservation of the species (Fish & G. Code, § 1927.8, subd. (a)).

CDFW is required to submit an updated status review report to the Commission by January 1, 2033, unless the Commission directs CDFW to complete it sooner (Fish & G. Code, §§ 1927.2, subd. (c)(2) & 1927.9). The report must incorporate any new scientific information relevant to the status of the species and must evaluate the effect of conservation and management efforts being taken pursuant to WJTCA. The Commission will consider the updated status review report in deciding whether petitioned action to list the western Joshua tree under CESA is warranted.

2.2 LEGAL STATUS OF WESTERN JOSHUA TREE

Western Joshua tree's legal status has a fundamental influence on the Conservation Plan. While western Joshua tree's status under state law is of primary importance to the Conservation Plan, its status under federal law is also important, because approximately 63 percent of western Joshua tree's range in California is on federal land. Western Joshua tree currently receives state protection under WJTCA and as a candidate for listing under CESA. The species is not listed under the federal Endangered Species Act (ESA) as of the publication of this Conservation Plan. The following sections describe the listing status of western Joshua tree under CESA and ESA and the influence of these laws on conservation of the species.

2.2.1 State Listing Status

Western Joshua tree is currently a candidate for listing under CESA (Fish & G. Code, § 2050 et seq.). As discussed in Section 1.1.2, western Joshua tree receives the same protections as species listed as endangered or threatened under CESA while it remains a candidate for listing (Cal. Code Regs., tit. 14, § 783.1, subd. (b)). Take of western Joshua tree within California is prohibited (see Fish & G. Code, § 86), except as authorized under CESA, WJTCA, or the Natural Community Conservation Planning Act (NCCPA) (Fish & G. Code, § 1927.2, subd. (a)). While western Joshua tree is a candidate species under CESA, any person or public agency may seek a take authorization for western Joshua tree under either CESA or WJTCA (Fish & G. Code, § 1927.2, subd. (b)).

Pursuant to Fish and Game Code section 1927.9, the Commission is required to reconsider listing western Joshua tree by 2033. In determining whether listing western Joshua tree under CESA is warranted, the Commission shall consider, among other enumerated factors, the Conservation Plan and the effectiveness of any conservation measures funded by the Conservation Fund (Fish & G. Code, § 1927.2, subd. (c)(2)). In making this determination, the Commission may keep the western Joshua tree as a candidate or make one of the following determinations:

1. **Listing is not warranted**. The Conservation Plan identifies management actions that are intended to conserve western Joshua tree and its habitat such that listing under CESA will not be necessary. If the Commission determines that listing western Joshua tree as endangered or threatened pursuant to CESA is not warranted, WJTCA will remain operative and the authorization of take of a western Joshua tree shall be pursuant to WJTCA (Fish & G. Code, § 1927.2, subd. (d)). The Conservation Plan would continue to guide management decisions in the long term, unless future evidence indicates that listing of the species is warranted.

2. **Listing is warranted**. If the Commission determines that listing western Joshua tree as endangered or threatened pursuant to CESA is warranted despite the management actions in the Conservation Plan, WJTCA will become inoperative and the authorization of take of western Joshua tree shall be pursuant to only CESA or NCCPA (Fish & G. Code, § 1927.2, subd. (e)).

Regardless of whether western Joshua tree is ultimately listed under CESA, take authorization for western Joshua tree can be issued under a Natural Community Conservation Plan (NCCP) as long as western Joshua tree is a covered species under the NCCP and the NCCP provides for the conservation of the species. NCCPs are discussed further below, in Section 2.3.

CDFW may also develop nonregulatory recovery plans for species listed under CESA (Fish & G. Code, § 2079.1, subd. (a)). CDFW is currently developing recovery planning guidelines, which will provide a framework for how CDFW will approach recovery planning for CESA-listed species. Recovery plans will be based on best available scientific information and will include site-specific management actions necessary for recovery of the species and objective, measurable criteria that would result in the potential delisting of the species (Fish & G. Code, § 2079.1, subd. (c)). The management actions and other recommendations in the Conservation Plan could be incorporated into a future recovery plan for western Joshua tree in the event the species is listed under CESA.

2.2.2 Federal Listing Status

Western Joshua tree is not currently listed under ESA. ESA (16 U.S.C. §§ 1531–1544) requires federal agencies, in consultation with US Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service, to ensure that actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of any ESA-listed species or result in the destruction or adverse modification of designated critical habitat of such species.

Fallen western Joshua tree.
Source: National Park Service.

In September 2015, the NGO WildEarth Guardians submitted a petition to the Secretary of the Interior requesting to list Joshua tree (both western Joshua tree and eastern Joshua tree [*Yucca jaegeriana*], collectively) as a threatened species and, if applicable, designate critical habitat under ESA (Jones and Goldrick 2015). At the time of petition, western Joshua tree and eastern Joshua tree were considered two subspecies of the same species, but they are now recognized as individual species. In response to the petition, USFWS completed a special-status assessment (Sirchia et al. 2018) and published findings in the Federal Register (84 Federal Register 41694) concluding that listing Joshua tree was not warranted. In November 2019, WildEarth Guardians filed a complaint in the US District Court, Central District of California, challenging USFW's analyses and decision not to list Joshua tree under ESA. The court ordered USFWS to reconsider its listing decision. USFWS reassessed its initial finding and prepared a revised special-status assessment (USFWS 2023). Using a review of updated information, USFWS again concluded that neither western nor eastern Joshua tree are in danger of extinction now and are not likely to become extinct in the foreseeable future in any significant portion of their ranges. USFWS concluded that the two species do not meet the definition of either an endangered or threatened species under ESA, and determined that listing either species was not warranted. In March 2024, WildEarth Guardians filed a second lawsuit requesting that the court vacate USFW's 2023 listing decision. Western Joshua tree (and eastern Joshua tree) remains unlisted and not subject to protection under ESA.

Joshua tree is identified as "FWS Focus" on the USFWS website (USFWS n.d.). USFWS does not explicitly define "FWS Focus" species, and the designation does not provide special legal protections to any species. However, the term is used to highlight species that receive a high level of interest or that are the subject of conservation efforts. USFWS staff are actively engaged in western Joshua tree conservation efforts and host an interagency biological working group for the species (see Appendix B, "Agency and Public Input Summary Memo").

Because western Joshua tree is not listed under ESA, there is no legal requirement for federal agencies to consider the effects of their actions on western Joshua tree under ESA. However, Joshua tree woodland is considered a special vegetation feature that should be assessed under the National Environmental Policy Act (NEPA) according to the US Bureau of Land Management (BLM) Desert Renewable Energy Conservation Plan (DRECP) Land Use Plan Amendment (LUPA) (see Section 2.3.3). The US Forest Service (USFS) would consider the effects of their actions on western Joshua tree under NEPA and the National Forest Management Act if the species was designated a USFS species of conservation concern. Securing participation by federal land management agencies to coordinate implementation of management actions for conservation of western Joshua tree on lands under federal jurisdiction would need a written memorandum of understanding (MOU) or other agreement. CDFW has contacted federal land management agencies about potential agreements during preparation of the Conservation Plan and will continue to seek their participation in actions beneficial to western Joshua tree conservation. Federal agencies with existing management plans or practices related to western Joshua tree conservation may agree to entering into a written MOU or other agreement with CDFW to implement management actions in the Conservation Plan.

The National Park Service (NPS) is expected to partner with CDFW on conservation activities because the agency is already conducting research on western Joshua tree climate refugia and implementing land management practices for the benefit of the species within Joshua Tree National Park (e.g., climate refugia plan, wildland fire management, habitat restoration, and assisted migration). CDFW and NPS have been communicating about this research.

Interagency communication and cooperation with other federal agencies, such as the BLM and the US Department of Defense (DOD) could provide an opportunity for CDFW to execute a written MOU or other agreement with these agencies to conserve western Joshua tree on federal lands, similar to existing durability agreements and MOUs between CDFW and BLM.

Source: National Park Service.

CDFW and BLM have executed two agreements: the statewide durability agreement, known as the *Memorandum of Understanding by and between the Bureau of Land Management and the California Department of Fish and Wildlife*, dated November 27, 2012 (BLM and CDFW 2012); and the DRECP durability agreement, known as the *Agreement by and between the United States Bureau of Land Management and the California Department of Fish and Wildlife*, dated October 2, 2015 (BLM and CDFW 2015). Both agreements acknowledge the importance and possibility of using BLM National Conservation Lands to contribute to the satisfaction of CDFW compensatory mitigation requirements in whole or in part. These MOUs lay out a general framework for future project-specific mitigation efforts that involves using one of more of the following tools to protect mitigation on BLM federal lands: (1) protecting mitigation lands using BLM land-use designations (e.g., wilderness areas, National Conservation Lands, areas of critical environmental concern, and wildlife allocations); (2) layering on protective measures in leases, easements, and rights-of-way; and (3) entering into co-management agreements.

The Onyx Ranch durability agreement is the first project-specific durability agreement. The agreement was enacted with a site-specific amendment to the 1983 statewide Sikes Act agreement between BLM and CDFW (*Addendum No. 5 to the Master Memorandum of Understanding between the California Department of Fish and Wildlife and the Bureau of Land Management for Sikes Act Implementation of the Portion of the Rudnick Common Allotment Relinquished Pursuant to Public Law 112-74* [BLM and CDFW 2022]), a grazing relinquishment (BLM 2020), and a co-management agreement (pending). This effort mitigated impacts from 16,453 acres of solar projects and resulted in grazing relinquishment and long-term funding of enhancement actions on 215,000 acres of the western Mojave Desert. Although impacts on western Joshua tree were not specifically being mitigated, the removal of grazing and implementation of enhancement actions for desert habitats will benefit the species. This is another example of the types of future interagency cooperative efforts that could benefit western Joshua tree on some types of federal lands.

There are also other opportunities for CDFW to execute a written MOU or other agreement with these agencies to specifically conserve western Joshua tree on federal lands. The Conservation Plan therefore focuses on the potential to collaborate with federal agencies, with an understanding that the capacity to implement specific management actions may differ among agencies based on their priority mandated responsibilities and that such efforts are more readily feasible on federal lands with conservation designations.

If listing of western Joshua tree under ESA occurs in the future, the species would receive protection under Section 9 of ESA (16 U.S.C. §1538(a)(2)), and additional conservation activity would be reasonably expected. For example, USFWS would be required to designate critical habitat, if prudent and determinable, and would be required to periodically monitor and evaluate the status of the species. In addition, USFWS may issue protective regulations and develop and implement a recovery plan to benefit the conservation of the species (16 U.S.C. § 1533 (d), (f)). Actions on federal land would be subject to interagency consultation under Section 7 of ESA (16 U.S.C. § 1536). Listing under ESA would provide additional opportunities for cooperation between CDFW and federal agencies in developing a written MOU or other agreement and implementing coordinated conservation actions on federal land. In addition, conservation measures to protect western Joshua tree and its habitat on non-federal land may be included in habitat conservation plans (HCPs) under Section 10 of ESA (16 U.S.C. § 1539(a)).

2.3 CONSERVATION PLANNING PROGRAMS

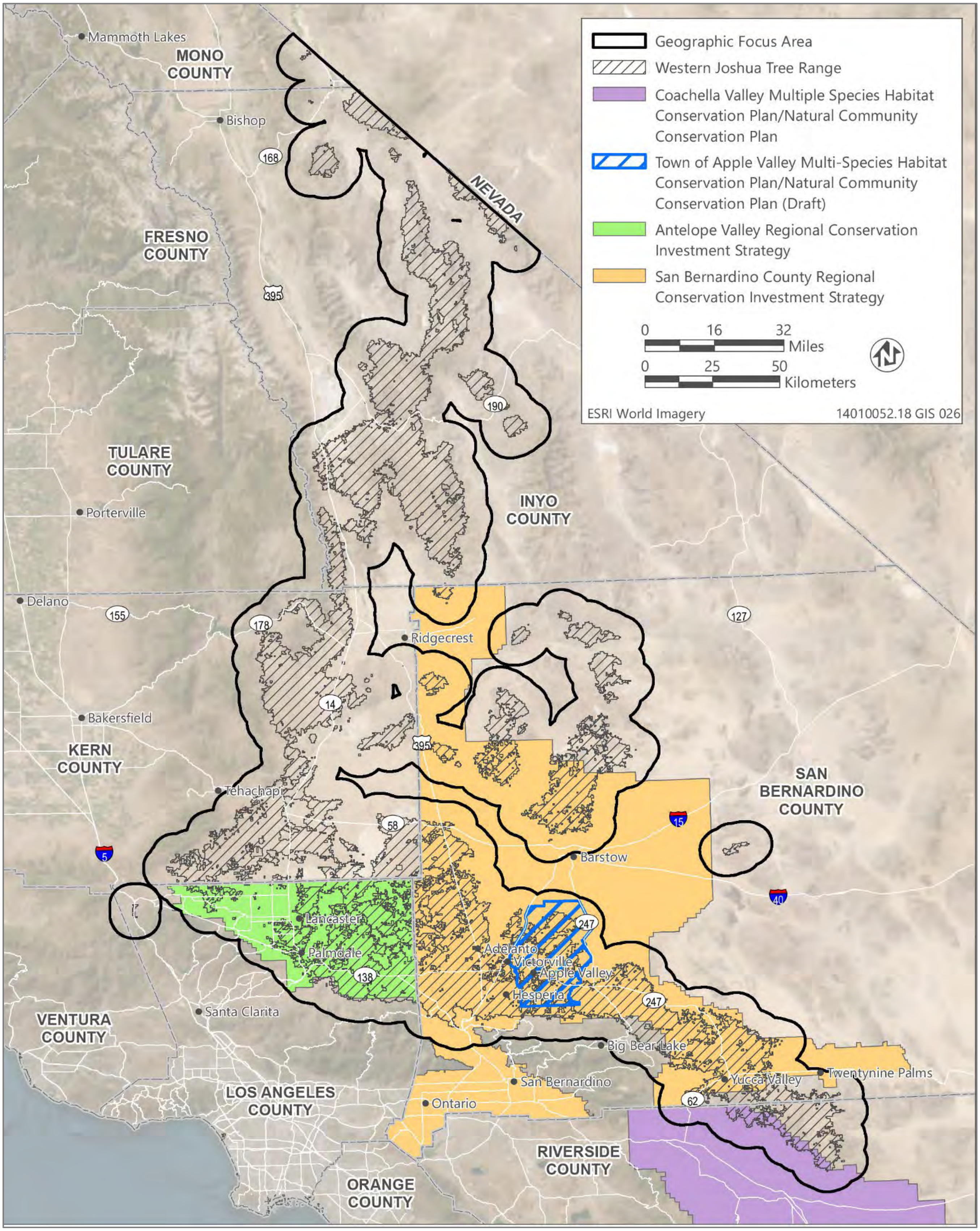
2.3.1 Natural Community Conservation Planning Program

NCCPs are developed under NCCPA (Fish & G. Code, § 2800 et seq.). Required contents of an NCCP and standards related to conservation of biological resources are described in Fish and Game Code, section 2820, subdivision (a). NCCPs must identify and provide measures necessary to conserve and manage natural biological diversity within the plan area while allowing compatible and appropriate economic development, growth, and other human uses. NCCPs that have been approved so far cover relatively large geographic areas, allowing for more strategic conservation planning and siting of development activities within the plan area. With the approval of an NCCP, CDFW may authorize the taking of any species that is covered by the NCCP, which significantly streamlines development and other activities within the plan area (Fish & G. Code, § 2835).

In the geographic focus area of the Conservation Plan, no NCCPs that cover western Joshua tree have yet been approved. The geographic focus area overlaps a portion of the Coachella Valley Multiple Species Habitat Conservation Plan/Natural Community Conservation Plan (MSHCP/NCCP); however, this approved plan does not provide any specific conservation or management measures for western Joshua tree. The boundaries of the Coachella Valley MSHCP/NCCP are shown in Figure 2-3. Approximately 1 percent of western Joshua tree's range in California is within the Coachella Valley MSHCP/NCCP boundary (Figure 2-3).

2.3.2 Regional Conservation Investment Strategies Program

The CDFW Regional Conservation Investment Strategies (RCIS) Program is a voluntary program that establishes high-quality conservation outcomes at a landscape level and enables advanced mitigation through three primary components: Regional Conservation Assessments (RCAs), Regional Conservation Investment Strategies (RCISs), and Mitigation Credit Agreements (MCAs).



Source: Data provided by CDFW in 2024; adapted by Ascent in 2024.

Figure 2-3 Conservation Planning Programs Overlapping the Geographic Focus Area

RCAs and RCISs are intended to be ecologically based and may encompass a wide range of habitat types; however, an RCA is broad and is not required to develop an RCIS. MCAs can only be developed under an approved RCIS.

The RCIS program allows any public agency or federally recognized Tribe that is willing to be the lead or co-lead of an RCIS to propose an RCIS document that guides protection of a range of focal plant and wildlife species and habitat types within a specified boundary for regionwide, holistic conservation. An RCIS is a comprehensive guidance document, not a binding regulatory plan. An RCIS document includes goals, objectives, actions, and priorities to guide large-scale conservation within the RCIS area. The RCIS document is developed by the agency or federally recognized Tribe in collaboration with other local entities and interested parties. Once the whole document is drafted, reviewed, and approved by CDFW, the RCIS document becomes publicly available for implementation. Existing or potential conservation and mitigation projects that fall within the RCIS boundary may elect to implement one or more conservation actions.

Within an approved RCIS boundary, an individual or entity may develop an MCA in collaboration with CDFW. An MCA is a mitigation crediting mechanism by which ecological improvements resulting from the implementation of RCIS actions can create mitigation credits for a variety of targeted species, habitats, or other sensitive resources included in an RCIS document. MCA credits can be used to mitigate project impacts, and excess credits can be sold to other entities.

The following sections describe RCIS documents that have been approved within the geographic focus area. The boundaries of these RCIS areas are shown in Figure 2-3.

ANTELOPE VALLEY REGIONAL CONSERVATION INVESTMENT STRATEGY

The Antelope Valley RCIS, developed by the Desert and Mountain Conservation Authority, was approved by CDFW in January 2022 (DMCA et al. 2021). Approximately 10 percent of western Joshua tree's range in California is within the Antelope Valley RCIS. The RCIS document describes focal species for which conservation priorities, including permanent protection, enhancement, and habitat restoration, are identified. Western Joshua tree (presumed to be western Joshua tree based on location, but not specified) is identified in the Antelope Valley RCIS as a focal species of high conservation priority. In addition, Joshua tree woodland is identified as a special interest community elevated to the highest emphasis level because of local conservation concern and major threats to over 90 percent of their range, especially with respect to the potential effects of climate change. Joshua tree woodland is also considered a CDFW sensitive natural community (refer to "California Department of Fish and Wildlife" in Section 2.3.4 for additional information on sensitive natural communities).

The Antelope Valley RCIS identifies 43,738 acres of predicted habitat for western Joshua tree within the RCIS area (1 percent of western Joshua tree's range in California) and sets a conservation goal of protecting 23,901 acres of western Joshua tree stands (0.7 percent of western Joshua tree's range in California). Within the 23,901 acres identified for protection, the Antelope Valley RCIS identifies 19,052 acres for permanent protection and 4,849 acres for uplift from their current protection status. These areas represent 0.6 percent and 0.2 percent of western Joshua tree's range in California, respectively. In the context of the Antelope Valley RCIS, "uplift" means a benefit over the current protection status and can include actions such as (1) establishing a conservation easement; (2) providing secure, perpetual funding for management and monitoring of habitat, enforcement of applicable legal and permitting requirements (e.g., CESA, California Environmental Quality Act [CEQA]), and protecting habitat; or (3) implementing specific management actions to improve habitat conditions.

SAN BERNARDINO REGIONAL CONSERVATION INVESTMENT STRATEGY

The San Bernardino County RCIS, developed by the San Bernardino County Transportation Authority, was approved by CDFW in April 2024 (SBCOG 2023). Approximately 31 percent of western Joshua tree's range in California is within the San Bernardino County RCIS. The San Bernardino County RCIS identifies western Joshua tree as a focal species.

2.3.3 Federal Land Management

Approximately 63 percent of western Joshua tree's range in California is on federal land. There are currently no federal range-wide management efforts or recovery plans specifically for western Joshua tree. However, the species receives special protection and focused management by some federal agencies. Relevant management plans are discussed in the following sections. Many of these management plans were developed when western and eastern Joshua tree was considered a single species. Based on the currently known western Joshua tree's range, it is presumed that these plans refer to western Joshua tree where Joshua tree is mentioned, unless otherwise noted.

Source: National Park Service.

Because western Joshua tree's range within California extends into federal land, which is outside the jurisdiction of the State, the conservation approach for the species will be more effective where state and federal agencies can coordinate to support and enhance conservation actions.

Written MOUs or other agreements executed by CDFW and federal agencies may promote the conservation of western Joshua tree by identifying protective measures not currently being implemented on federal land, as discussed further in Chapter 6, "Implementation." The following sections outline protective measures that are already incorporated in some federal agency management plans and are being implemented in select areas within western Joshua tree's range in California.

Lands managed by federal agencies (e.g., DOD, NPS, BLM, USFS) in the geographic focus area are shown on Figure 2-4. Wilderness areas managed by NPS, BLM, or USFS in the geographic focus area are shown on Figure 2-5. Natural resources in wilderness areas generally receive a high level of protection, including some active management for the benefit of natural resources.

US BUREAU OF LAND MANAGEMENT

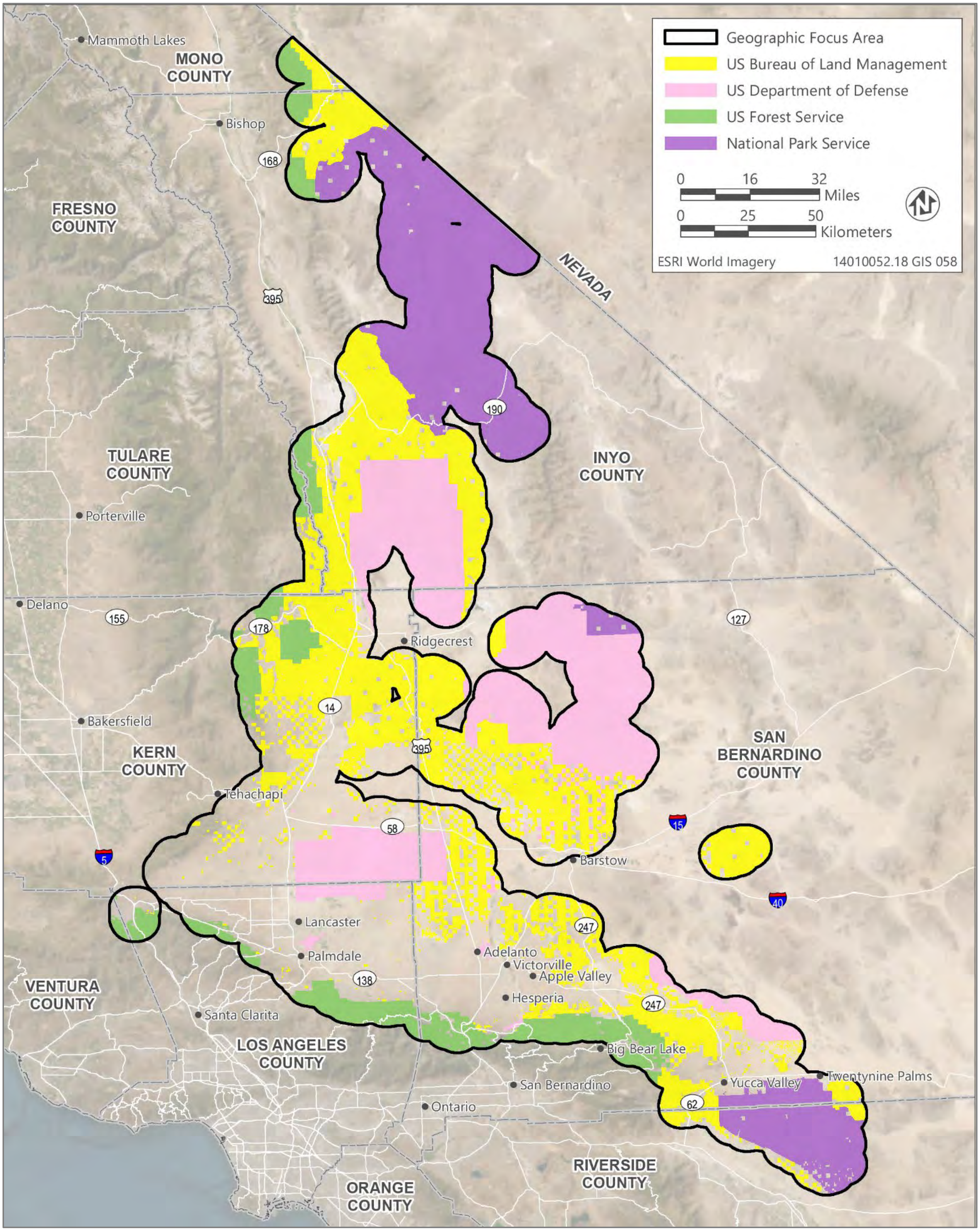
Approximately 3,703 square kilometers (1,429.9 square miles), or 28 percent, of western Joshua tree's range in California, is distributed within lands managed by BLM. BLM was established for the purpose of managing public lands for a variety of uses, such as energy development, livestock grazing, recreation, and timber harvesting while ensuring natural, cultural, and historic resources are maintained for present and future use. BLM lands within the geographic focus area are shown on Figure 2-6.

Wilderness Areas

Several wilderness areas in California managed by BLM support populations of western Joshua tree and provide the species with a high level of protection. These wilderness areas are shown on Figure 2-6 and described in Table 2-2.

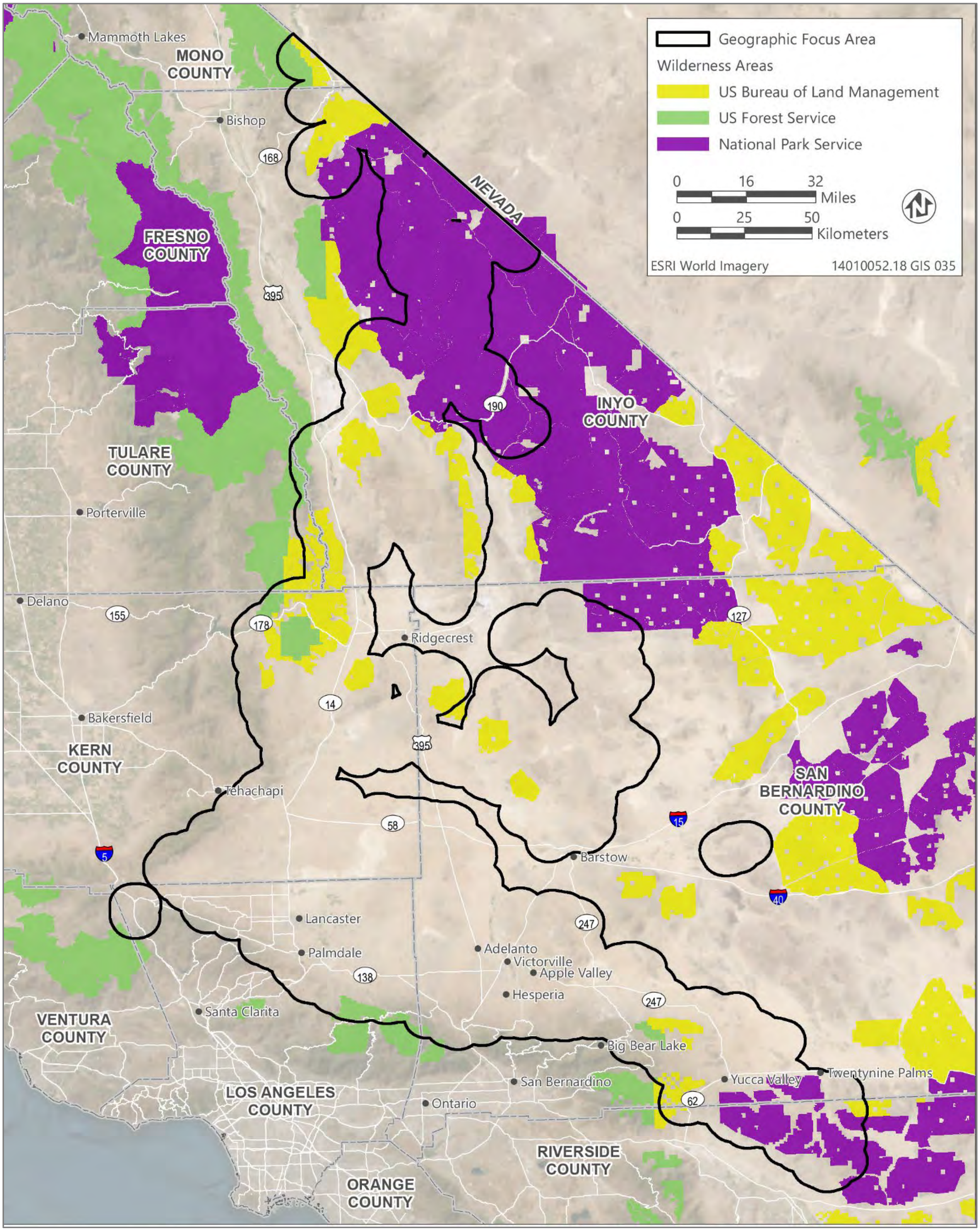
Non-Wilderness Areas

Outside of wilderness areas, populations of western Joshua tree on BLM lands may receive various levels of protection, but some lands supporting western Joshua tree may also be used for purposes other than conservation, such as renewable energy development. BLM has adopted various management plans within the range of western Joshua tree, as discussed in the following sections.



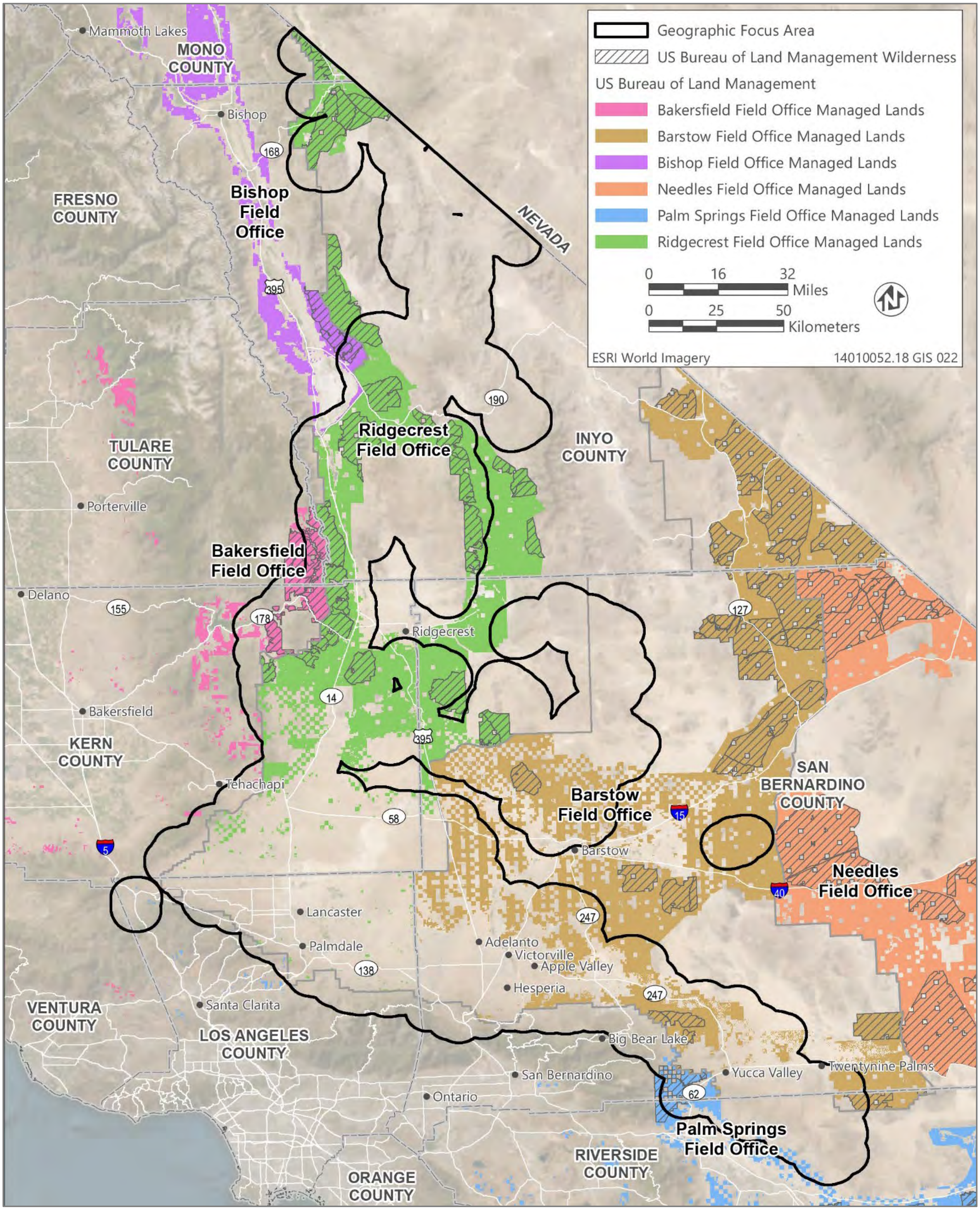
Source: Adapted by Ascent in 2024.

Figure 2-4 Federal Lands within the Geographic Focus Area



Source: Adapted by Ascent in 2024.

Figure 2-5 Federal Wilderness Areas Overlapping the Geographic Focus Area



Source: BLM 2024; adapted by Ascent in 2024.

Figure 2-6 US Bureau of Land Management Lands and Wilderness Areas Overlapping the Geographic Focus Area

Table 2-2 US Bureau of Land Management Wilderness Areas in Western Joshua Tree Range in California

Wilderness Area	County	BLM Field Office	Wilderness Area in Square Kilometers (sq mi)	Range in Square Kilometers (sq mi), Percent of Range (%)	Description
Owens Peak Wilderness	Kern	Bakersfield and Ridgecrest	298.5 (115.3)	187.2 (72.3), 1.4	The wilderness area contains creosote bush scrub communities on the bajadas; scattered yuccas (*Yucca* spp.), western Joshua trees, cacti, flowering annuals, cottonwoods (*Populus* spp.), and oaks (*Quercus* spp.) in the canyons and valleys; and juniper and pinyon woodlands with sagebrush and foothill pines (*Pinus sabiniana*) on the upper elevations.
Coso Range Wilderness	Inyo	Ridgecrest	199.4 (77.0)	170.9 (66.0), 1.3	The wilderness area contains large stands of western Joshua trees mixed with low desert shrubs, annuals, cactuses, and creosote bushes (*Larrea* spp.).
Kiavah Wilderness	Kern	Bakersfield and Ridgecrest	357.3 (138.0)	129.9 (50.1), 1.0	The wilderness area is at a transition zone between the Sierra Nevada mountains and the Mojave Desert, with vegetation that includes creosote bush, western Joshua tree, burro bush (*Ambrosia salsola*), and shadscale (*Atriplex confertifolia*) growing near pinyon pine (*Pinus quadrifolia* or *Pinus monophylla*), juniper (*Juniperus* spp.), canyon oak (*Quercus chrysolepis*), and foothill pine.
Bighorn Mountain Wilderness[1]	San Bernardino	Barstow and Palm Springs	155.2 (59.9)	101.5 (39.2), 0.8 [2]	The wilderness area is a transition zone between the yucca- and western Joshua tree-covered desert floor and stands of Jeffrey pine (*Pinus jeffreyi*) in the higher elevations.

Wilderness Area	County	BLM Field Office	Wilderness Area in Square Kilometers (sq mi)	Range in Square Kilometers (sq mi), Percent of Range (%)	Description
Malpais Mesa Wilderness	Inyo	Ridgecrest	129.1 (49.8)	95.8 (37.0), 0.7	The wilderness area contains creosote, low desert shrubs, and grasses in the lower elevations; western Joshua trees at middle elevations on the eastern side; and pinyon pines and junipers at higher elevations.
Sacatar Trail Wilderness	Inyo	Bakersfield and Ridgecrest	210.0 (81.1)	91.7 (35.4), 0.7	The wilderness area contains western Joshua trees, creosote bush, and other desert shrubs in the lower elevations and scattered pinyon and juniper woodlands dotted with cactuses in the higher elevations.
Sylvania Mountains Wilderness	Inyo	Ridgecrest	75.6 (29.2)	74.3 (28.7), 0.6	This wilderness area contains sagebrush scrub in the eastern portions and pinyon pine and juniper at higher elevations. Western Joshua trees are widely distributed in the wilderness area.
Grass Valley Wilderness	San Bernardino	Ridgecrest and Barstow	122.2 (47.2)	69.4 (26.8), 0.5	The wilderness area contains a few western Joshua trees, but the vegetation is dominated by a creosote bush scrub community.
Piper Mountain Wilderness	Inyo	Bishop and Ridgecrest	293.7 (113.4)	55.7 (21.5), 0.4	The wilderness area contains one of the northernmost stands of western Joshua tree at the base of the Inyo Mountains. Sagebrush and pinyon-juniper woodlands are the most common vegetation communities, although conifers grow in some of the higher elevations.
Argus Range Wilderness	Inyo	Ridgecrest	266.0 (102.7)	49.3 (19.0), 0.4	This wilderness area contains creosote scrub communities on the lower slopes, occasional pinyon-juniper communities at higher elevations, and western Joshua tree forests.

Wilderness Area	County	BLM Field Office	Wilderness Area in Square Kilometers (sq mi)	Range in Square Kilometers (sq mi), Percent of Range (%)	Description
Bright Star Wilderness	Kern	Ridgecrest	38.5 (14.9)	24.4 (9.4), 0.2	The wilderness area contains stands of pinyon pine and juniper in the higher elevations, and the lower elevations contain shrubs, large granite outcropping, and western Joshua trees.
El Paso Mountains Wilderness	Kern	Ridgecrest	96.2 (37.1)	16.4 (6.3), 0.1	The wilderness area is dominated by creosote bushes, whereas western Joshua trees are found on the western side of Black Mountain.
Inyo Mountains Wilderness[1]	Inyo	Ridgecrest	506.2 (195.4)	14.9 (5.7), 0.1	The wilderness area is dominated by creosote, shadscale scrub, and sagebrush at lower elevations. Riparian habitat found in the canyons, pinyon-juniper woodlands are found on some slopes, and bristlecone pine (*Pinus longaeva*) and limber pine (*Pinus flexilis*) grow in the higher elevations. Western Joshua trees are found in the southeasternmost portion of the wilderness area.
Darwin Falls Wilderness	Inyo	Ridgecrest	33.1 (12.8)	11.4 (4.4), 0.1	The wilderness area is dominated by a creosote bush community, with western Joshua tree woodlands higher in the hills.
Golden Valley Wilderness	San Bernardino	Ridgecrest	152.9 (59.0)	6.4 (2.5), 0.1	The wilderness area contains flowering annuals and is dominated by creosote bush scrub community, but also contains western Joshua trees on the mountainsides.
Domeland Wilderness	Tulare, Kern	Bakersfield	526.4 (203.2)	2.5 (1.0), <0.1	The wilderness area contains mostly pinyon pine and sagebrush. Western Joshua trees are found in the southernmost portion of the wilderness area.

Wilderness Area	County	BLM Field Office	Wilderness Area in Square Kilometers (sq mi)	Range in Square Kilometers (sq mi), Percent of Range (%)	Description
White Mountains Wilderness[2]	Mono	Bishop and Ridgecrest	934.7 (360.9)	2.0 (0.8), <0.1	The wilderness area contains one of the largest and highest desert mountain ranges. The wilderness area is known for its high-elevation bristlecone pine forest, but western Joshua trees have been observed in the desert portions.
Black Mountain Wilderness	San Bernardino	Barstow	83.2 (32.1)	1.0 (0.4), <0.1	The wilderness area contains a mesa rising above an expanse of desolate, ancient lava flows. Western Joshua trees are present in the wilderness area.
San Gorgonio Wilderness[3]	San Bernardino, Riverside	Barstow and Palm Springs	390.9 (150.9)	0.1(<0.1), <0.1	This wilderness area is in a landscape that transitions between desert, coastal, and mountain environments, including different types of vegetation representative of each elevation. Western Joshua trees are present in the BLM-managed part of the wilderness area.

Notes: sq mi = square miles.

1 BLM and USFS manage separate parts of this wilderness area; however, western Joshua trees occur only in the area managed by BLM. Therefore, the sizes of the wilderness area and western Joshua tree range in the wilderness area represent only the area of land managed by BLM.

2 BLM and USFS manage separate parts of this wilderness area. The western Joshua tree range in the wilderness area represents only the area of land managed by BLM.

3 BLM and USFS manage separate parts of this wilderness area.

Sources: Esque et al. 2023; BLM 2024; compiled by Ascent in 2024.

Source: Jesse Pluim, Bureau of Land Management.

California Desert Conservation Area Plan

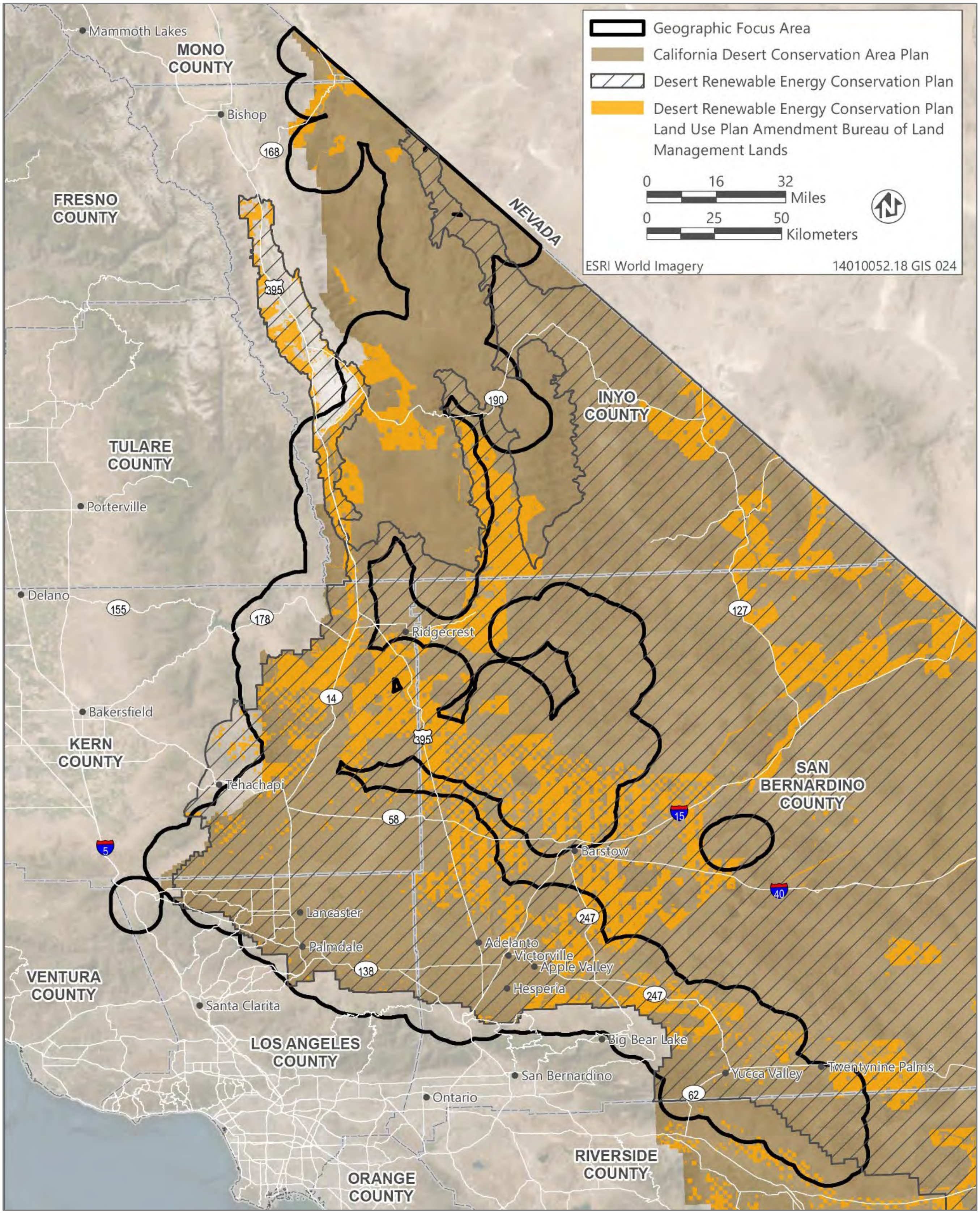
The Federal Land Policy and Management Act was enacted by Congress in 1976 to direct the management of public lands of the United States. Section 601 of the Federal Land Policy and Management Act established the California Desert Conservation Area (CDCA), which encompasses 25 million acres of resource-rich desert lands in Southern California. Twelve million acres within CDCA are public lands administered by BLM. Section 601 of the Federal Land Policy and Management Act directs BLM to prepare a comprehensive long-range plan for CDCA that establishes guidelines for the management of public lands. The CDCA Plan was completed in 1980 and amended in 1999.

The CDCA Plan does not identify specific protections for western Joshua tree, but includes a Vegetation Element that contains goals related to conserving listed species, preserving unusual plant assemblages, managing wetland and riparian areas, maintaining the continued existence and biological viability of vegetation resources in CDCA while providing for consumptive needs, providing guidance for the manipulation of plant habitats or vegetation, and encouraging the use of private lands for commercial production of valuable desert plants. The CDCA Plan identifies 55 acres of Joshua tree woodland in the Superior Valley of San Bernardino County as a management area with the goal to “protect, stabilize, and enhance values” (BLM 1999). DRECP, an amendment to the CDCA Plan, is discussed in the following section. The CDCA Plan boundary, as amended, is shown in Figure 2-7.

Desert Renewable Energy Conservation Plan

DRECP is a landscape-level plan that was developed to provide effective protection and conservation of desert ecosystems while allowing for the appropriate development of solar, wind, and geothermal energy projects and promoting outdoor recreation opportunities within CDCA. DRECP covers 22.5 million acres in seven California counties—Imperial, Inyo, Kern, Los Angeles, Riverside, San Bernardino, and San Diego—including 10.8 million acres of public lands managed by BLM.

DRECP was developed by BLM, USFWS, CDFW, and the California Energy Commission, collectively known as the Renewable Energy Action Team. In addition to the Renewable Energy Action Team, the planning process involved the California State Lands Commission (CSLC), California Public Utilities Commission, California State Parks (CSP), NPS, and DOD, as well as cities, counties, Tribes, industry groups, utilities, and nongovernmental environmental organizations.



Source: Conservation Biology Institute 2024; adapted by Ascent in 2024.

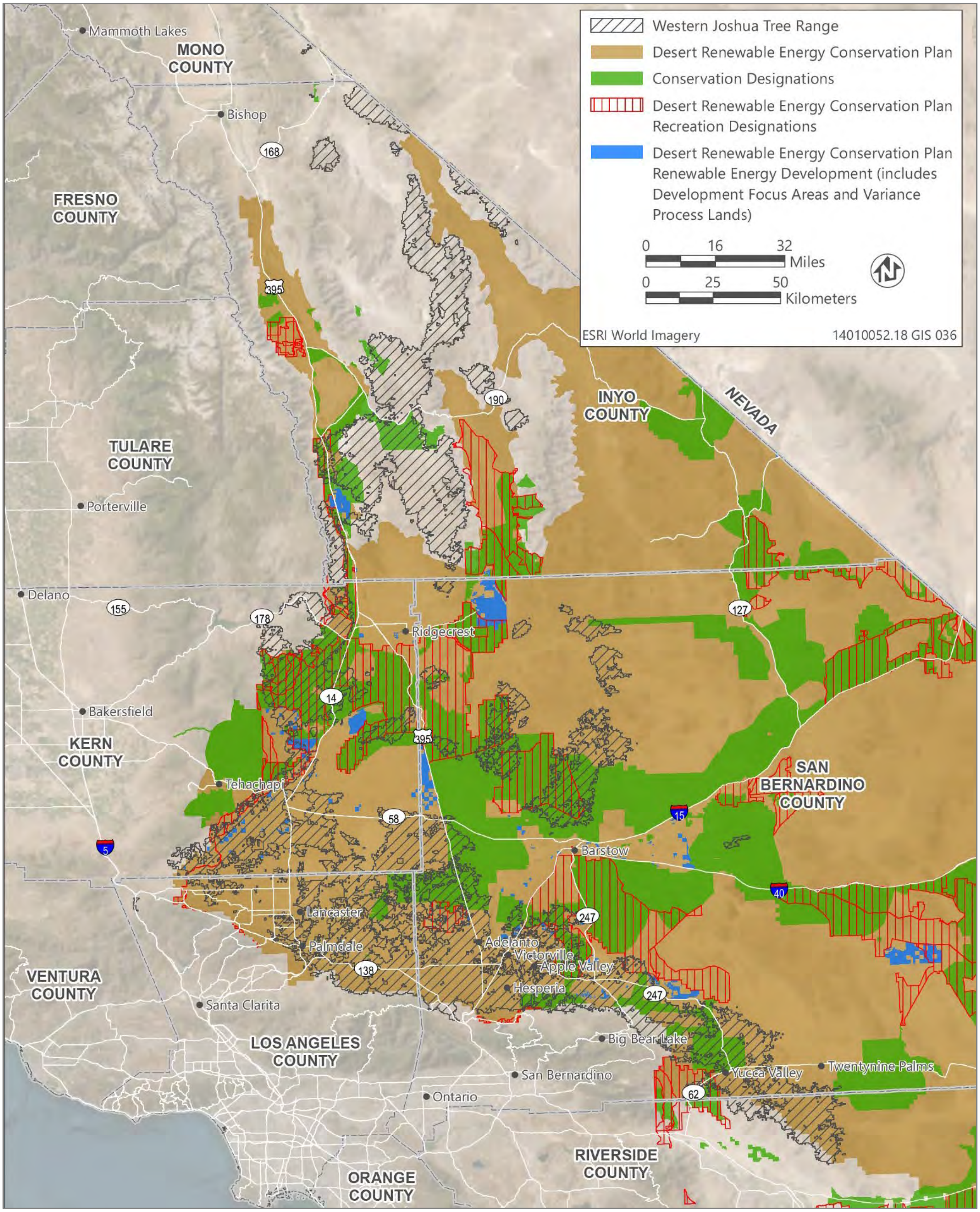
Figure 2-7 California Desert Conservation Area and Desert Renewable Energy Conservation Plan Overlapping the Geographic Focus Area

In September 2016, as part of DRECP, BLM adopted its Land Use Plan Amendment (LUPA) to the CDCA Plan, Bishop Resource Management Plan, and Bakersfield Resource Management Plan (BLM 2016). LUPA amends preexisting land designations, identifying 4.2 million new acres for conservation that are closed to renewable energy development on BLM-managed public lands and 3.5 million acres with recreation designations, which are generally closed to renewable energy development. The land designations under LUPA are shown in Figure 2-8. Under LUPA, approximately 24 percent of western Joshua tree's range in California is designated for conservation, 12 percent is designated for recreation, and 1 percent is designated for renewable energy development.

Approximately 32 square kilometers (12.2 square miles), or roughly one third of areas open for renewable energy development in DRECP, are within western Joshua tree's range and classified as ecologically core or ecologically intact (Randall et al. 2010; Parker et al. 2018). Areas for renewable energy development are referred to as Development Focus Areas and Variance Process Lands in DRECP. Development Focus Areas are areas with substantial energy generation potential, access to existing or planned transmission, and low resource conflicts. Variance Process Lands are areas where renewable energy development may be considered, but are subject to a variance process with specific permitting requirements. Ecologically core refers to lands with high landscape integrity that support conservation targets and are located in areas where protection is critical for the long-term conservation of the ecoregion's biological diversity (Randall et al. 2010). Ecologically intact lands have high landscape integrity or support conservation targets and require protection to continue to support ecological processes and provide connectivity (Randall et al. 2010).

To minimize impacts from development, LUPA includes the following objective that guides the protection of western Joshua tree on BLM-managed lands:

- **Objective 1.4:** Conserve unique landscape features, important landforms, and rare or unique vegetation types identified within the BLM Decision Area [i.e., BLM-managed surface lands and federal mineral estate lands within the DRECP planning area], including:
    - Desert riparian and wetland resources in the planning area, including riparian habitat (including microphyll woodlands), desert playas, and seeps/springs;
    - Areas of dense Joshua tree woodland;
    - Areas with unique geological activity and/or paleontological interest;
    - Rare vegetation alliances.



Source: Conservation Biology Institute 2024; adapted by Ascent in 2024.

Figure 2-8 Land Use Designations under the US Bureau of Land Management Land Use Plan Amendment to the Desert Renewable Energy Conservation Plan

LUPA also identifies conservation and management actions to protect biological resources. LUPA-BIO-1 requires a habitat assessment, which includes identification or delineation of Joshua trees and suitable habitat to inform siting and design considerations for all authorized activities on BLM-managed public lands. LUPA-BIO-SVF-1 requires habitat assessment of special vegetation features, which include Joshua tree woodland, for activity-specific National Environmental Policy Act analysis. LUPA-BIO-SVF-5 requires that impacts on Joshua tree woodlands be avoided to the maximum extent practicable (BLM 2016).

In 2016, BLM commissioned a report that analyzed the 6-year planning process leading to the release of the draft DRECP in 2014 (Bengtson et al. 2016). The report describes the lessons learned and recommendations for future landscape-scale planning processes based on interviews with representatives of government agencies, Native American tribes, consultants, scientists, and other interested parties.

In support of the Conservation Plan, CDFW could enter into a written MOU or other agreement with BLM to minimize renewable energy development in areas that currently support ecologically core or intact habitat for western Joshua tree or in areas that could serve as potential climate refugia for the species on BLM-managed lands. As part of these agreements, CDFW could also provide input on mitigation measures or other conditions of permit approval to reduce impacts on western Joshua tree (e.g., guidelines for relocation, seed collection).

Wildland Fire Management Program

The BLM Wildland Fire Management Program is responsible for fire management, including wildland fire suppression and prescribed fire, for the protection of natural resources on public lands. Because these public lands are intermixed with land owned and managed by other federal, state, and local government entities, BLM collaborates with other fire management agencies and is a member of the National Wildfire Coordinating Group. BLM is working to preserve ecosystems that are not currently affected by invasive plants, while restoring ecological balance in other ecosystems where invasive plants are changing the landscape and increasing wildland fire risk (BLM n.d.). BLM also participates in the interagency Burned Area Emergency Response program to address post-wildland fire recovery. The Conservation Plan presents an opportunity for CDFW to collaborate on best management practices related to western Joshua tree and its habitat for fire crews and fire resource advisors in initial wildland fire response.

Covington Flats in Joshua Tree National Park under smoke from the Apple Fire.

Source: National Park Service.

US DEPARTMENT OF DEFENSE

Approximately 2,321 square kilometers (896.3 square miles), or 18 percent, of western Joshua tree's range in California is within lands managed by DOD. Military installations within the geographic focus area are shown on Figure 2-9.

DOD's mission does not specifically include management of lands for the benefit of natural resources, but the Sikes Act (16 U.S.C. § 670 et seq.) directs DOD to cooperate with USFWS and state fish and wildlife agencies to carry out a program for the conservation and rehabilitation of natural resources on military installations.

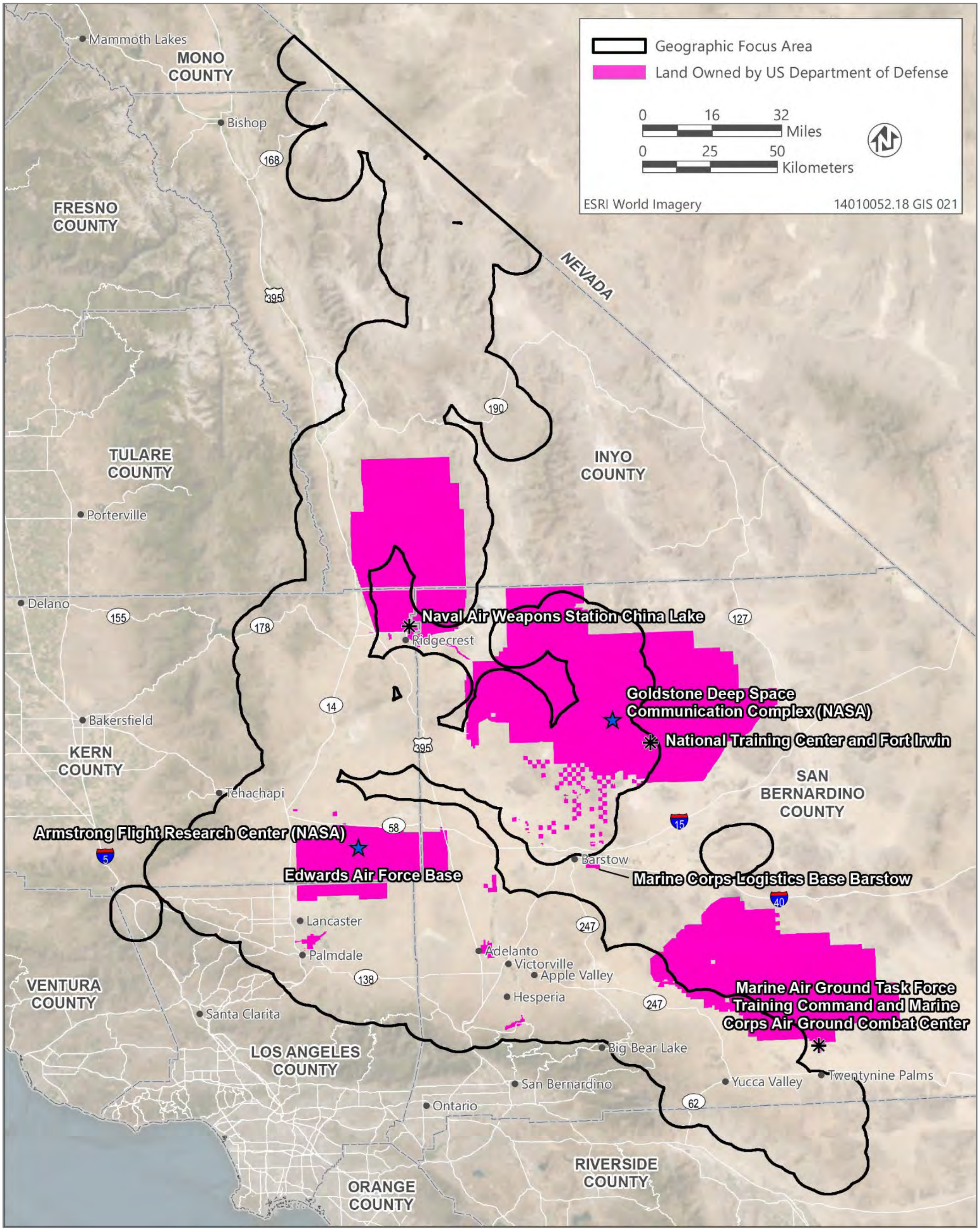
The Sikes Act requires DOD to develop and implement Integrated Natural Resources Management Plans (INRMPs) to guide the management of natural resources on military lands. INRMPs use an ecosystem-based approach and balance conservation and mission activities to ensure "no net loss" from testing, training, and operational activities (DOD 2023). INRMPs are valid for a period of 5 years and must be reviewed by USFWS, the relevant state agency, and the military installation.

INRMPs present an opportunity for CDFW to coordinate with military installations on management goals and actions that support the conservation of western Joshua tree on military lands. These plans could further serve as the foundation for a written MOU or other agreement between CDFW and DOD regarding the conservation of western Joshua tree. The INRMPs for the military installations within the geographic focus area that relate to the conservation of western Joshua tree are described in the following sections.

Mojave Desert Installations

Edwards Air Force Base

The US Air Force adopted a 2020-2025 INRMP for the Edwards Air Force Base to support natural resources management in accordance with the Sikes Act (412 CEG/CEVA 2020). The INRMP identifies 52,719 acres of Joshua tree woodland within the Edwards Air Force Base. Overall, the US Air Force's primary management goals for desert woodlands are to "conserve these limited natural resources for [the benefit of] threatened and endangered species and other wildlife and to maintain the integrity of the desert ecosystem. For western Joshua trees specifically, the Environmental Management Directorate of the US Air Force encourages conserving the species wherever feasible. The INRMP references the Air Force Flight Test Center's 1994 *Edwards Air Force Base Revegetation Plan* (Air Force Flight Test Center 1994, cited in 412 CEG/CEVA 2020), which recommends planting Joshua trees to maintain the diversity of natural habitats on base. The US Air Force conducts western Joshua tree restoration efforts at the base in accordance with the recommendations in the *Edwards Air Force Base Revegetation Plan*.



Source: CAL FIRE 2024; adapted by Ascent in 2024.

Figure 2-9 US Department of Defense Lands Overlapping the Geographic Focus Area

The INRMP also states that the US Air Force implements avoidance and minimization measures to reduce individual fatalities of western Joshua tree and disturbance of its habitat (412 CEG/CEVA 2020). Edwards Air Force Base previously identified all western Joshua trees over 3 meters (approximately 10 feet) in height using photogrammetry, light detection, and ranging data and has reported that populations on the base are stable to increasing (412 CEG/CEVA 2017, cited in 412 CEG/CEVA 2020).

Edwards Air Force Base is collaborating with the USFWS Joshua Tree Biological Working Group to develop standardized western Joshua tree monitoring procedures. Because of the substantial acreage of Joshua tree woodland on the base and the US Air Force's management goals for the species, a written MOU or other agreement between Edwards Air Force Base and CDFW could be beneficial to western Joshua tree conservation.

Western Joshua tree at Edwards Air Force Base.
Source: US Geological Survey.

Marine Air Ground Task Force Training Command, Marine Corps Air Ground Combat Center

The INRMP for the Marine Air Ground Task Force Training Command and Marine Corps Air Ground Combat Center (Combat Center) located in Twentynine Palms provides a strategy for natural resource management on the installation (MAGTFTC MCAGCC 2024). The INRMP states that yucca woodlands (identified as "Joshua Trees and/or Mojave Yucca" in the INRMP) are in the southwestern and northwestern portions of the Combat Center and cover 0.4 percent of the installation. The Combat Center has not established formal protections for western Joshua tree but incorporates measures to avoid and minimize impacts. These protections include inventorying all known western Joshua trees on the installation, maintaining a 1-kilometer (approximately 0.6-mile) no-train buffer at the base boundary that reduces potential for indirect impacts, and establishing restricted areas around portions of the population. During subsequent updates of the INRMP, CDFW has the opportunity to collaborate with the Combat Center on establishing formal protections for western Joshua tree and developing management goals and actions to support conservation of the species on the installation.

National Training Center and Fort Irwin

The INRMP for the National Training Center and Fort Irwin provides a strategy for natural resource management at the facilities. The INRMP notes that Joshua tree is a species of special concern and has a limited distribution and density on the National Training Center and Fort Irwin. The INRMP states that if removal of Joshua trees is necessary, trees must be relocated to sites with the same orientation and similar characteristics as their original sites to reduce the risk of tree mortality (National Training Center and Fort Irwin 2006).

Naval Air Weapons Station China Lake

The INRMP for the Naval Air Weapons Station China Lake provides a strategy for natural resource management at the station. The INRMP for Naval Air Weapons Station China Lake does not list western Joshua tree as a sensitive species but discusses the sensitivity of the species to fire and mentions transplantation of western Joshua tree as a component of revegetation or landscaping (US Navy n.d.).

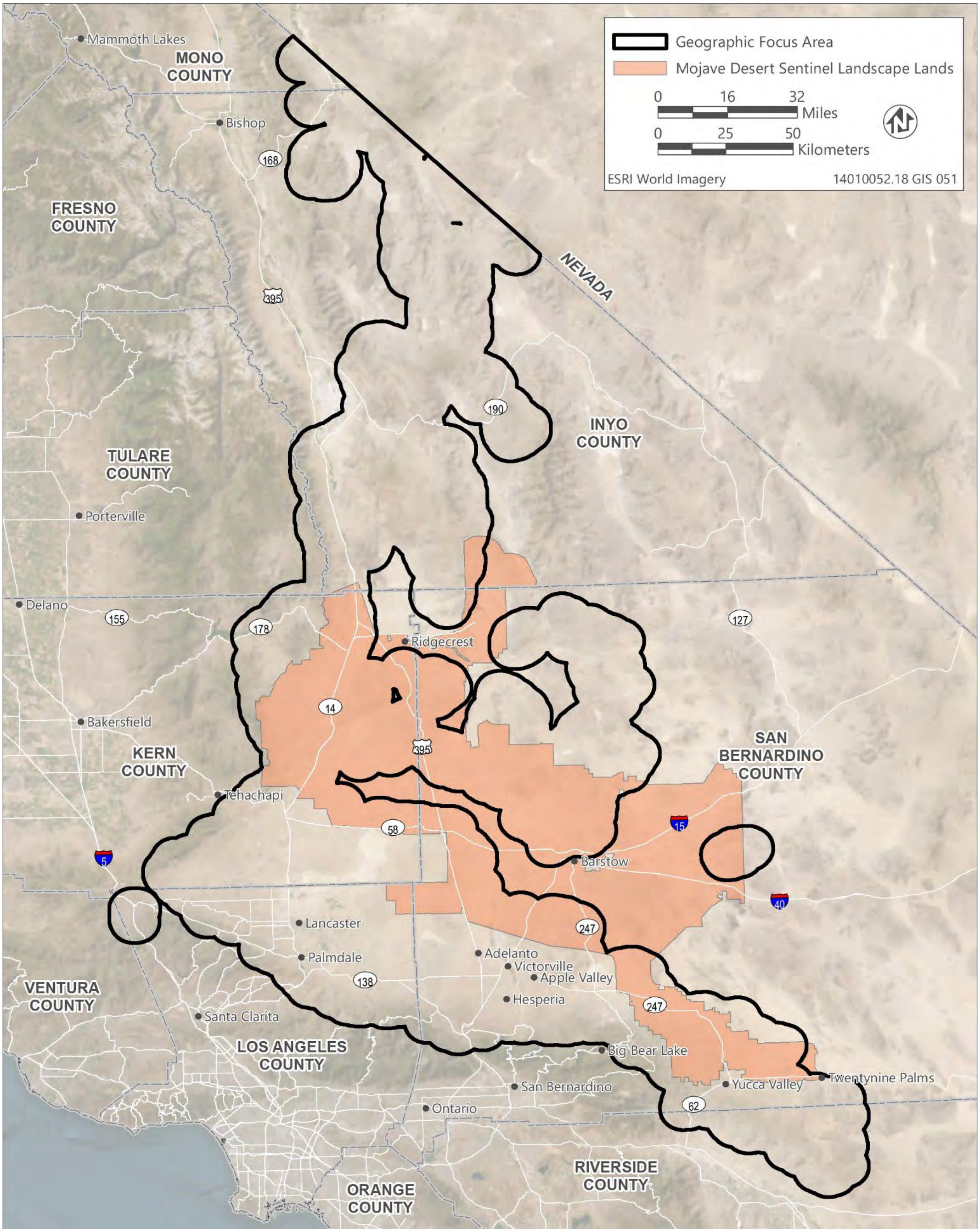
Department of Defense Wildland Fire Management Plans

DOD uses Wildland Fire Management Plans to guide the application of prescribed fire and the response to and recovery from wildland fire incidents on military installations. Each installation manages wildland fires according to its mission, location, community, and the natural resources, ecosystems, and species that are present. Wildland fire planning is integrated with installation INRMPs so that ecological processes, impacts, and benefits are evaluated (ESOH and ASD EI&E 2022). Because wildland fires occur across jurisdictions, an interagency approach to wildland fire planning, prevention, response, and recovery is necessary. DOD is a member of the National Wildfire Coordinating Group, which includes other federal, tribal, state, and local partners.

Sentinel Landscapes Partnership

The Sentinel Landscapes Partnership is a coalition of federal agencies, state and local governments, and NGOs that work with private landowners to advance sustainable land management practices around military installations and ranges. The partnership was founded by the US Department of Agriculture, DOD, and the Department of the Interior. To fulfill the partnership's mission of conserving natural resources, the Sentinel Landscapes Partnership connects private landowners with voluntary state and federal assistance programs that provide funding for conservation easements, among other things.

The Mojave Desert Sentinel Landscape (MDSL) was designated on May 15, 2024 (Clark 2024), which will allow a coalition of state, federal, tribal, and local partners to address encroachment threats, resource concerns, and climate resilience priorities. The MDSL area is 3,539,077 acres, encompassing 2,074,754 acres of federal land (59 percent of the western Joshua tree range in California), 124,870 acres of state land (4 percent of the species' California range), and 1,337,821 acres of private land (38 percent of the species' California range). MDSL lands include the mountain foothills, sand washes, playas, and desert mountains of the Mojave Desert and Sierra Nevada (Figure 2-10).



Source: Data provided by CDFW in 2024; adapted by Ascent in 2024.

Figure 2-10 Mojave Desert Sentinel Landscape Lands Overlapping the Geographic Focus Area

Western Joshua trees are found on all five DOD installations in the Mojave Desert, described in the previous section. In the MDSL proposal, western Joshua tree is identified as one of the more than 40 threatened, endangered, or sensitive species targeted for conservation. The proposal identifies the potential to work collaboratively with entities such as CDFW to support the following goals, which are relevant to the Conservation Plan:

- Facilitate connectivity to increase species and climate resilience.
- Provide community outreach in tandem with habitat improvements to increase the success of restoration and proactive conservation activities that support climate resiliency.
- Reduce and mitigate impacts from unauthorized off-highway vehicle (OHV) use, which compromises vegetation, soil integrity, and habitat.
- Reclaim and rehabilitate priority habitats by supporting protection, restoration, wildlife restoration, and rehabilitation of up to 50,000 acres of the MDSL.
- Develop sustainable seed propagation and climate resilient seed growing cooperatives.

The proposal also identifies the potential to leverage state funding programs to implement protection, restoration, and rehabilitation activities. CDFW has the opportunity to provide input on shared goals, establish regional priorities, and leverage funding for implementation of projects that support western Joshua tree conservation within MDSL lands.

National Aeronautics and Space Administration Facilities

The National Aeronautics and Space Administration (NASA) operates two facilities within the geographic focus area—the Armstrong Flight Research Center, which is located within Edwards Air Force Base, and the Goldstone Deep Space Communication Complex, which is associated with the US Army Fort Irwin National Training Center (Figure 2-9). Western Joshua trees are present at both facilities. NASA has not adopted specific management plans addressing conservation of the species; however, NASA strives to protect ESA-listed species and to limit adverse effects on state-specific and local species of concern in accordance with applicable federal and state laws and regulations. NASA also strives to be proactive in species management, helping to protect the ecological integrity of critical habitat and promote populations of endangered and threatened species (NASA 2024). For example, NASA installed a new antenna at the Gladstone Deep Space Communications Complex in 2020. As part of the project, NASA developed a mitigation plan that involved installing perimeter exclusion fences around some western Joshua trees and transplanting trees that could not be avoided (Wilder Ecological Consulting n.d.). If CDFW enters into a written MOU or other agreement for management of western Joshua tree within Edwards Air Force Base and the US Army Fort Irwin National Training Center, NASA could also be a party to the agreement.

NATIONAL PARK SERVICE

Approximately 1,934 square kilometers (746.5 square miles), or 15 percent, of western Joshua tree's range in California, are distributed within lands managed by NPS. Joshua Tree National Park and Death Valley National Park, which are located within California and administered by NPS, have native populations of western Joshua tree (Figure 2-11). Mojave National Preserve, which is also administered by NPS, is outside the current range of western Joshua tree, but supports populations of eastern Joshua tree. The preserve is shown on Figure 2-11 for reference to discussions in Section 5.2, "Management Actions Necessary to Conserve Western Joshua Tree."

Natural resources on lands managed by NPS generally receive a high level of protection, including some active management, although some of these resources may be adversely affected by recreational use, development and maintenance of related infrastructure, wildland fire, and invasive species. As detailed in the following sections, NPS is implementing management practices to conserve western Joshua tree within Joshua Tree National Park, and the Agency began to implement management practices to conserve eastern Joshua tree within Mojave National Preserve following the 2020 Dome Fire.

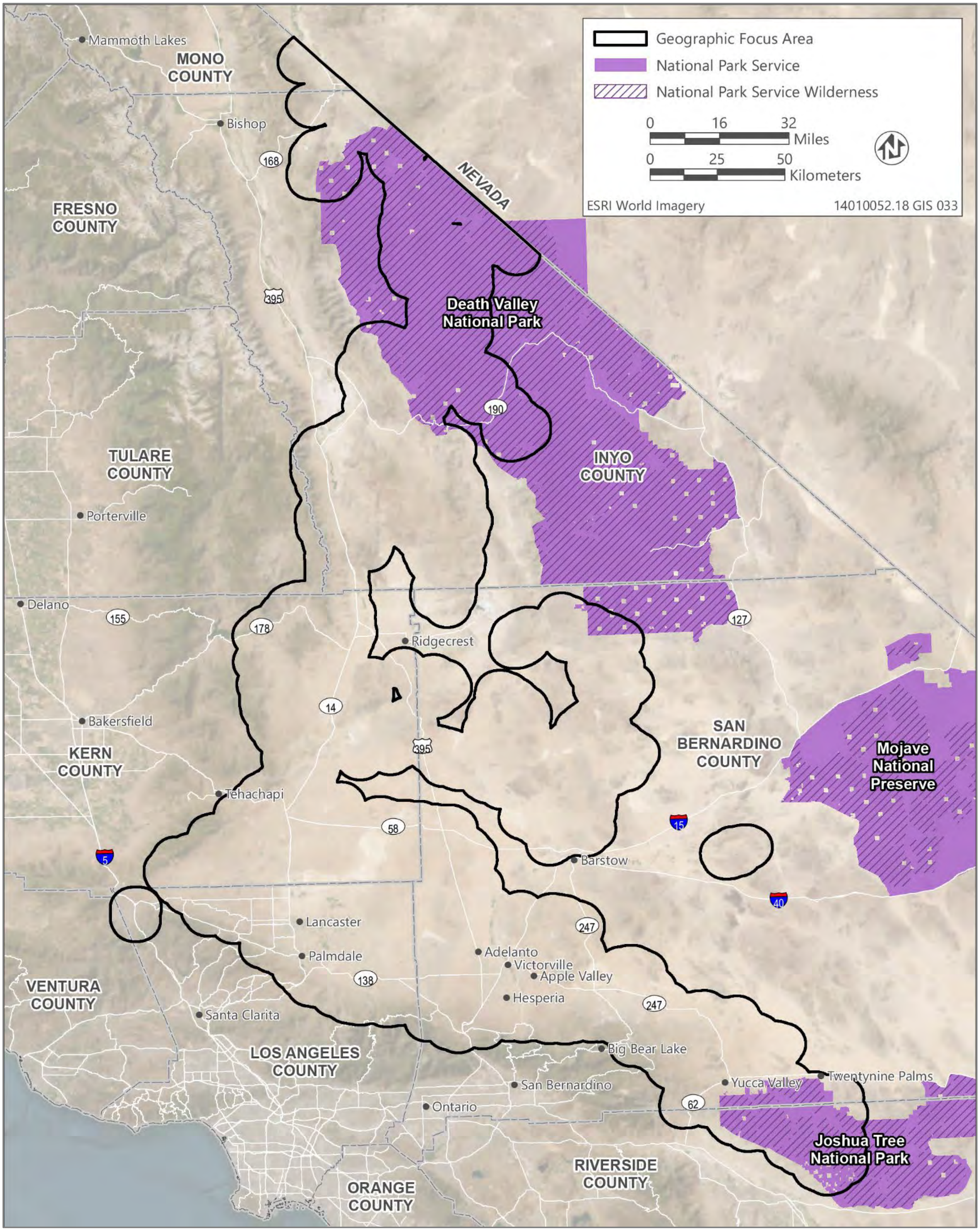
NPS's experience with Joshua tree conservation has fundamental influence on the Conservation Plan, particularly where it can inform CDFW protocols for the successful relocation of western Joshua trees. A summary of NPS's input on the Conservation Plan to date is provided in Chapter 6.

The Conservation Plan will provide an opportunity for CDFW and NPS to engage in cooperatively coordinated conservation actions. As discussed above, the Conservation Plan could support the development of a written MOU or other agreement and may also influence the development of new NPS management policies or updates to existing policies.

The following two systemwide and park-specific management plans and practices that are relevant to the conservation of western Joshua tree are discussed in the following sections.

National Park Service Management Policies 2006

NPS adopted *Management Policies 2006*, which serves as the primary guide for management of the National Park System. *Management Policies 2006* does not contain specific policies for western Joshua tree or other individual species. Rather, it sets forth general principles for the management of biological resources, including principles for the management and restoration of native plants and animals, management of threatened and endangered plants and animals, maintenance of altered plant communities, harvest of plants and animals by the public, and NPS actions that remove native plants and animals (NPS 2006).



Source: NPS 2024a; adapted by Ascent in 2024.

Figure 2-11 National Park Service Lands Overlapping the Geographic Focus Area

National Park Service Fire Management

To fulfill its mission, NPS manages wildland fire to protect the public, park communities, and infrastructure; conserve natural and cultural resources; and maintain and restore natural ecosystems and processes. NPS also participates in the interagency Burned Area Emergency Response program to address post-wildland fire recovery. Because NPS manages wildland fire in consideration of natural resources and ecosystem processes, NPS fire management principles and strategic guidelines are expected to have a positive influence on conservation outcomes for western Joshua tree.

Wildland fire at Joshua Tree National Park.
Source: National Park Service.

Director's Order #18 contains the basic principles and strategic guidelines governing the management of wildland fire by NPS. Under Director's Order #18, each national park with burnable vegetation must have an approved fire management plan. The current fire management plan for Joshua Tree National Park provides for full suppression of all fires, including those naturally caused, until more research is collected on fire behavior and fire effects in the park and across the Mojave Desert. Park biologists are monitoring the long-term consequences of fire in desert ecosystems, as well as the effectiveness of treatments designed to hasten ecosystem recovery, to inform future fire management policies (NPS 2024b).

Death Valley National Park has a policy to suppress wildland fires and implement all fire management actions using methods, equipment, and tactics that cause the least impact to natural and cultural resources. The park also has a policy to develop fire management strategies based on science including field observations of fire effects and post-burn monitoring of selected sites (NPS 2021a).

Joshua Tree National Park

Superintendent's Compendium

The Superintendent's Compendium is a compilation of designations, closures, permit requirements, and other restrictions made by the superintendent. The compendium applies to all people within the boundaries of federally owned or designated public use lands within Joshua Tree National Park. It specifically prohibits possessing, destroying, injuring, defacing, removing, digging, or disturbing plants, including climbing, sitting on, or standing on live

Joshua trees or using them as anchors for hammocks or slacklines (Code of Federal Regulations, tit. 35, § 2.1, subd. (a)(1)) (NPS 2022).

Foundation Document

Most units of the National Park System have a foundation document that provides basic guidance for planning and management decisions. Each foundation document contains significance statements, which express why a park's resources and values are important enough to merit designation as a unit of the National Park System. One of the significance statements for Joshua Tree National Park is that the park "preserves a world-renowned, undisturbed population of [western] Joshua trees…, an integral component of the Mojave Desert ecosystem." Accordingly, the Foundation Document for Joshua Tree National Park designates Joshua tree as a fundamental resource and value, warranting its primary consideration during park planning and management activities (NPS 2017a). Joshua Tree National Park is actively engaged in conservation efforts and restoration activities in support of this foundation statement (CDFW 2022).

Joshua Tree National Park General Management Plan

Public Law 95-625, enacted on November 10, 1978, requires NPS to prepare a general management plan to provide for the preservation and public enjoyment of each area of the National Park System (54 U.S.C. § 100502). In 1995, NPS adopted a new general management plan for the administration of Joshua Tree National Monument, which subsequently became a national park in 1994. The General Management Plan provides for the management, use, and development of Joshua Tree National Park. The General Management Plan primarily applies to the developed areas of the park (NPS 1995).

The General Management Plan identifies Joshua tree as a species of special concern because the species is a major part of the park experience. The General Management Plan acknowledges that Joshua trees are likely to be affected by construction of roads, parking areas, and buildings throughout the park. The General Management Plan states NPS will make special efforts to reduce impacts on Joshua trees, including by implementing design criteria to avoid large trees, planting new trees, and salvaging and replanting trees during construction (NPS 1995).

Backcountry and Wilderness Management Plan

On October 31, 1994, the California Desert Protection Act (Public Law 103-433) added 234,000 acres to the Joshua Tree National Monument and changed its status from national monument to national park (16 U.S.C. § 410, subd. aaa-22). This land remains largely undeveloped and primarily comprises backcountry and wilderness areas. As an amendment to the General Management Plan, Joshua Tree National Park adopted the Backcountry and Wilderness Management Plan to address the management of these lands. The purpose of the

Backcountry and Wilderness Management Plan is to minimize disturbance to resources, ensure their preservation, and offer the public a wide variety of recreational opportunities. The plan identifies the following nine actions that affect the quality of the human environment: designation of a trail system; designation of unpaved roads in lands added to the park in 1994; designation of management prescriptions for recreational climbing; designation of locations where roadside auto camping may or may not be permitted; analysis of major artificial water sources installed for wildlife; adoption of areas limited to day use only or closed to public access; establishment of group size limits for overnight stays; implementation of the Department of the Interior's Desert Tortoise Recovery Plan; and analysis of proposed additions to wilderness (NPS 2000).

Joshua tree is identified in the Backcountry and Wilderness Management Plan as a species of special interest to NPS. Although the Backcountry and Wilderness Management Plan does not identify specific protections for western Joshua tree, management actions contained in the plan were designed to minimize impacts to natural resources and avoid the removal of large plants, such as Joshua trees (NPS 2000).

Source: Dave Hursey, National Park Service.

Resource Stewardship Strategy Summary

An NPS Resource Stewardship Strategy Summary is a strategic plan intended to help park managers achieve and maintain desired resource conditions over time. The Resource Stewardship Strategy Summary for Joshua Tree National Park, released in January 2021, includes a summary of key issues, stressors, and threats affecting park resources, brief descriptions of the park's priority resources and their components, stewardship goals for priority resources, and stewardship activities determined to be high priorities for the next 3 to 5 years (NPS 2021b).

The Resource Stewardship Strategy Summary discusses the threat of climate change on the mortality of Joshua trees and the elimination of suitable habitat for the species. The document identifies a long-term goal of sustaining Joshua tree populations within their potential range under climate change. Short-term goals of the document include controlling wildland fires and removing invasive plant species within Johusa tree climate change refugia, directing visitor activity to areas outside of climate change refugia to minimize trampling of young trees, and restoring degraded refugia for Joshua trees, especially in burned areas. High-priority stewardship activities are also identified in support of these goals. The document also identifies a long-term goal to better understand the trends in Joshua tree distribution, resilience to environmental change, and the effects of other stressors on Joshua trees (NPS 2021b).

Death Valley National Park

Foundation Document

The Foundation Document for Death Valley National Park provides basic guidance for planning and management decisions within the park. The park's endemic species (i.e., a species whose geographic range or distribution is confined to a single given area) and biodiversity are identified in the Foundation Document as fundamental resources and values for which NPS intends to focus planning and management efforts. The Foundation Document does not identify specific protections for western Joshua tree but outlines several opportunities to address threats to the park's endemic species and biodiversity that may aid in the conservation of the species. These opportunities include controlling visitation to critical habitat areas, conducting additional research to guide management decisions, collaborating to ensure adequate resource protection, engaging in cooperative management with the Timbisha Shoshone Tribe to refine resource management activities, and managing fire regimes (NPS 2017b).

Death Valley National Park General Management Plan

The General Management Plan for Death Valley National Park provides an overall management strategy for the park over a 10 to 15-year period. The General Management Plan does not specifically discuss western Joshua tree, but it includes management objectives to perpetuate plant and animal life for their essential roles in the natural ecosystem and to perpetuate rare and endangered plants and animals and species endemic to Death Valley National Park. The General Management Plan states that NPS will seek to manipulate natural landscapes and plants only when necessary to achieve approved management objectives (NPS 2021a).

Backcountry and Wilderness Management Plan

NPS does not identify western Joshua tree as a species of special interest in the Backcountry and Wilderness Management Plan for Death Valley National Park, but it includes goals that may aid in the conservation of the species. These goals include: preserving natural resources; minimizing conflicts between users and sensitive resources; refraining from the deliberate manipulation or management of wilderness resources except as necessary; promoting the natural quality of wilderness character through the thoughtful restoration and/or maintenance of natural processes and features; preserving ecological values of wilderness; and preserving the intangible aspects of wilderness, including ongoing traditional cultural uses by the Timbisha Shoshone Tribe (NPS 2012).

Mojave National Preserve

As noted above, Mojave National Preserve is outside the current range of western Joshua tree but supports a large population of eastern Joshua tree. In September 2020, the Dome Fire burned over 43,000 acres in Mojave National Preserve, including over an estimated one million eastern Joshua trees (Smith et al. 2023). The perimeter of the Dome Fire overlaps a modelled eastern Joshua tree climate refugium where favorable conditions are expected to persist during future warming (Smith et al. 2023).

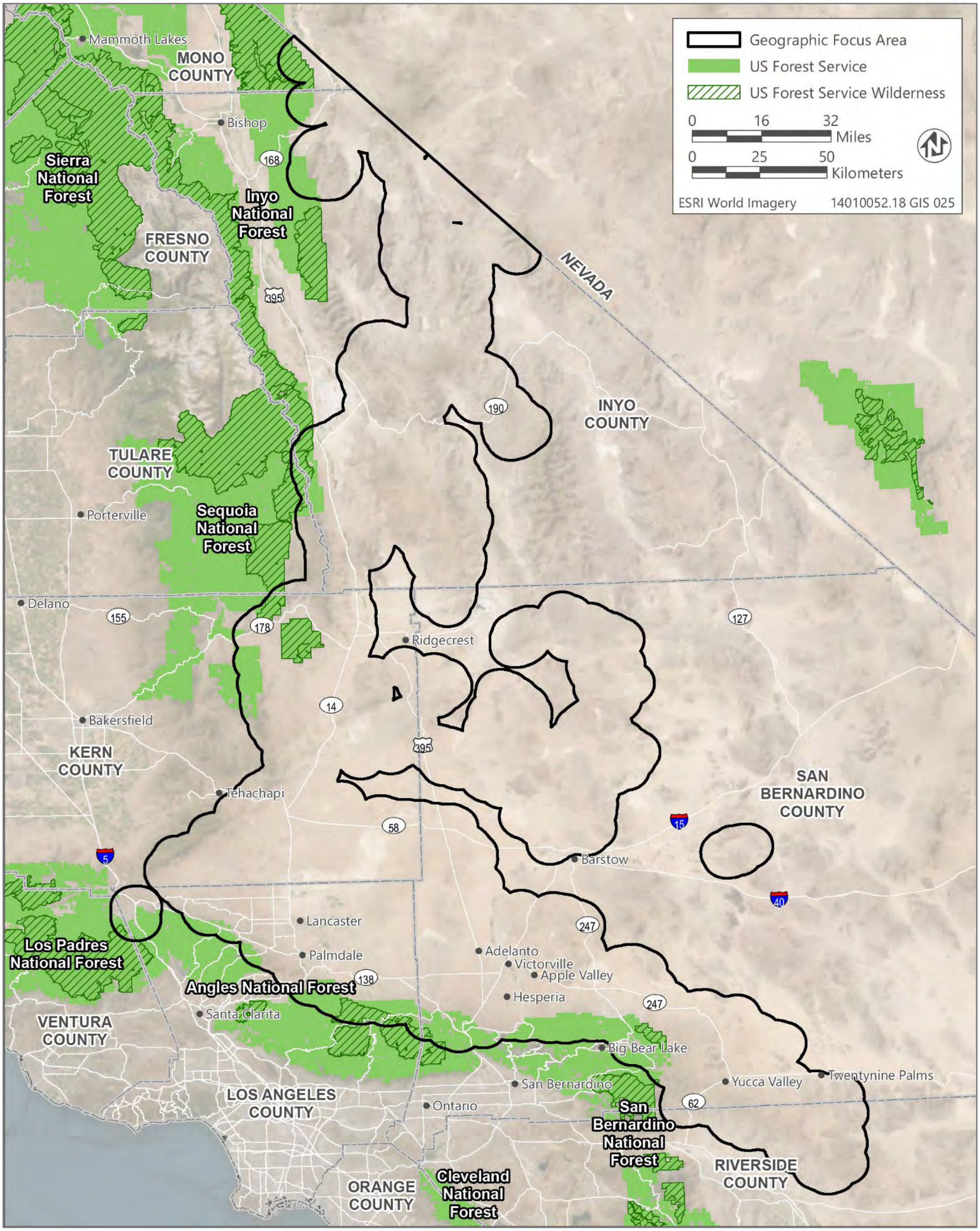
In response to past grazing impacts and the loss of eastern Joshua trees in the Dome Fire and the species' poor seed dispersal characteristics, Mojave National Preserve staff prepared the Dome Fire Restoration Plan in May 2021 (Kaiser 2021). The plan outlines restoration, monitoring, management, and maintenance strategies to restore eastern Joshua tree within the predicted climate refugium. These activities include planting and watering trees and applying herbicide to control invasive annual grasses. As part of the Dome Fire Restoration Plan, Mojave National Preserve staff are collecting data on survival rates associated with various treatments, including the use of cages to exclude herbivores and planting under shrubs to simulate nurse plants. Although the monitoring data from this restoration project apply to eastern Joshua tree, the resulting data can provide important information related to postfire recovery and survivability and successful restoration strategies for western Joshua tree.

Eastern Joshua trees burned in the Dome Fire in Mojave National Preserve.

Source: Drew Kaiser, California Department of Fish and Wildlife.

US FOREST SERVICE

Approximately 245 square kilometers (94.6 square miles), or 2 percent, of western Joshua tree's range in California, is distributed within lands managed by USFS. USFS manages several national forests and wilderness areas within the geographic focus area, which are shown on Figure 2-12. The national forests and wilderness areas in western Joshua tree's range in California are described in Table 2-3.



Source: USFS 2024; adapted by Ascent in 2024.

Figure 2-12 US Forest Service Lands Overlapping the Geographic Focus Area

Table 2-3 US Forest Service Lands in Western Joshua Tree Range in California

National Forest or Wilderness Area	County	National Forest or Wilderness Area in Square Kilometers (sq mi)	Range in Square Kilometers (sq mi), Percent of Range (%)	Description
San Bernardino National Forest	San Bernardino	3,284.3 (1,268.1)	127.1 (1.0), 49.1	The National Forest contains mixed conifer forests and oak woodlands, pinyon juniper stands, and chaparral and semidesert areas, which include western Joshua trees.
Bighorn Mountain Wilderness Area[1]	San Bernardino	155.2 (59.9)	44.2 (17.1), 0.3 [2]	The wilderness area is a transition zone between the western Joshua tree and other yucca–covered desert floor and stands of Jeffrey pine in the higher elevations.
Kiavah Wilderness Area	Kern	357.3 (138.0)	28.8 (11.1), 0.2	The wilderness area is at a transition zone between the Sierra Nevada mountain range and the Mojave Desert, with vegetation that includes creosote bush, western Joshua tree, burro bush, and shadscale growing near pinyon pine, juniper, canyon oak, and foothill pine.
Sequoia National Forest	Tulare, Kern, Fresno	4,451.5 (1,718.7)	1.9 (0.7), <0.1	The National Forest contains mixed forests of ponderosa pine (*Pinus ponderosa*), incense cedar (*Calocedrus decurrens*), white fir (*Abies concolor*), sugar pine (*Pinus lambertiana*), and scattered groves of giant sequoia (*Sequoiadendron giganteum*) in the low- to mid-montane elevations. Jeffrey pines are scattered on dry granitic slopes, and pure stands of red fir forest and lodgepole pine forest are found in the upper montane zone. Western Joshua trees are found in the southernmost and easternmost portions of the National Forest.
Angeles National Forest	Los Angeles, San Bernardino, Ventura	2,630.5 (1,015.6)	1.3 (0.5), <0.1	The National Forest is predominately covered with dense chaparral, which changes to slopes covered in pine (*Pinus* spp.) and fir (*Abies* spp.) in the higher elevations. Western Joshua trees are present at lower elevations.
Inyo National Forest	Inyo, Mono, Tulare, Fresno, Madera	8,093.7 (3,125.0)	1.3 (0.5), <0.1	The National Forest contains arid shrublands, conifer forests, and mountain meadows. Western Joshua trees are present in the desert scrub on the lower slopes of the eastern Sierra Nevada Mountains in the southern part of the National Forest.
White Mountains Wilderness[1]	Mono	934.7 (360.9)	0.8 (0.3), <0.1 [2]	The wilderness area contains one of the largest and highest desert mountain ranges. The wilderness area is known for its high-elevation bristlecone pine forest, but western Joshua trees have been observed in the desert portions.

National Forest or Wilderness Area	County	National Forest or Wilderness Area in Square Kilometers (sq mi)	Range in Square Kilometers (sq mi), Percent of Range (%)	Description
San Gorgonio Wilderness[1]	San Bernardino, Riverside	390.9 (150.9)	0.1 (<0.1), <0.1	This wilderness area is in a landscape that transitions between desert, coastal, and mountain environments, including different types of vegetation representative of each elevation. Western Joshua trees are present in the USFS-managed part of the wilderness area.

Notes: sq mi = square miles.

[1] This wilderness area is managed jointly by BLM and USFS.

[2] The western Joshua tree range in the wilderness area represents only the area of land managed by USFS.

Sources: Esque et al. 2023; USFS 2024; compiled by Ascent in 2024.

US Forest Service Land Management Plans

The land management plans for the Angeles and San Bernardino National Forests, which specifically reference western Joshua tree, are described in the following sections.

Angeles National Forest Land Management Plan

The Angeles National Forest Land Management Plan describes USFS's strategic direction for managing the land and resources within the Angeles National Forest over the next 10 to 15 years. As identified in the Angeles National Forest Land Management Plan, the Mojave Front Country within the Angeles National Forest contains western Joshua trees at lower elevations. The Angeles National Forest Land Management Plan states that one of the desired conditions for this area is to maintain a natural-appearing landscape, which includes preserving distinct desert views of Joshua trees. The Land Management Plan does not include specific protections for western Joshua tree but includes vegetation management standards and other design criteria required under the Code of Federal Regulations title 36, part 219 that may aid in the protection of the species (USFS 2005a).

San Bernardino National Forest Land Management Plan

The San Bernardino National Forest Land Management Plan describes USFS's strategic direction for managing the land and resources within the San Bernardino National Forest over the next 10 to 15 years. Within the San Bernardino National Forest, western Joshua trees are found in the high desert landscape in the eastern portion of the Big Bear backcountry, at lower elevations within the Desert Rim and the Mojave Front Country, and in the Bighorn Mountain Wilderness.

The San Bernardino National Forest Land Management Plan states that one of the desired conditions for these areas is to preserve valued landscape attributes, such as Joshua tree stands. Within the Mojave Front Country, another desired condition is to manage Joshua tree woodlands to provide fire protection for adjacent urban communities, compatible dispersed recreation use, high quality wildlife habitat, and protection for plant communities from type conversion by frequent burning. The San Bernardino National Forest Land Management Plan does not include specific protections for western Joshua tree but includes vegetation management standards and other design criteria required under Code of Federal Regulations title 36, part 219 that may aid in the protection of the species (USFS 2005b).

US Forest Service Fire Management

USFS manages wildland fire on National Forest System lands and also partners with Tribes and federal, state, and local governments as part of the National Wildfire Coordinating Group. USFS suppresses fires that threaten people and communities but also uses prescribed fire to benefit natural resources and prevent the buildup of flammable vegetation. USFS also participates in the interagency Burned Area Emergency Response program and implements rehabilitation and restoration activities to repair natural resources damaged by wildland fires. These activities include planting trees, reestablishing native species, restoring habitats, and removing invasive plants.

Source: Bob Wick, Bureau of Land Management.

NATURAL RESOURCES CONSERVATION SERVICE

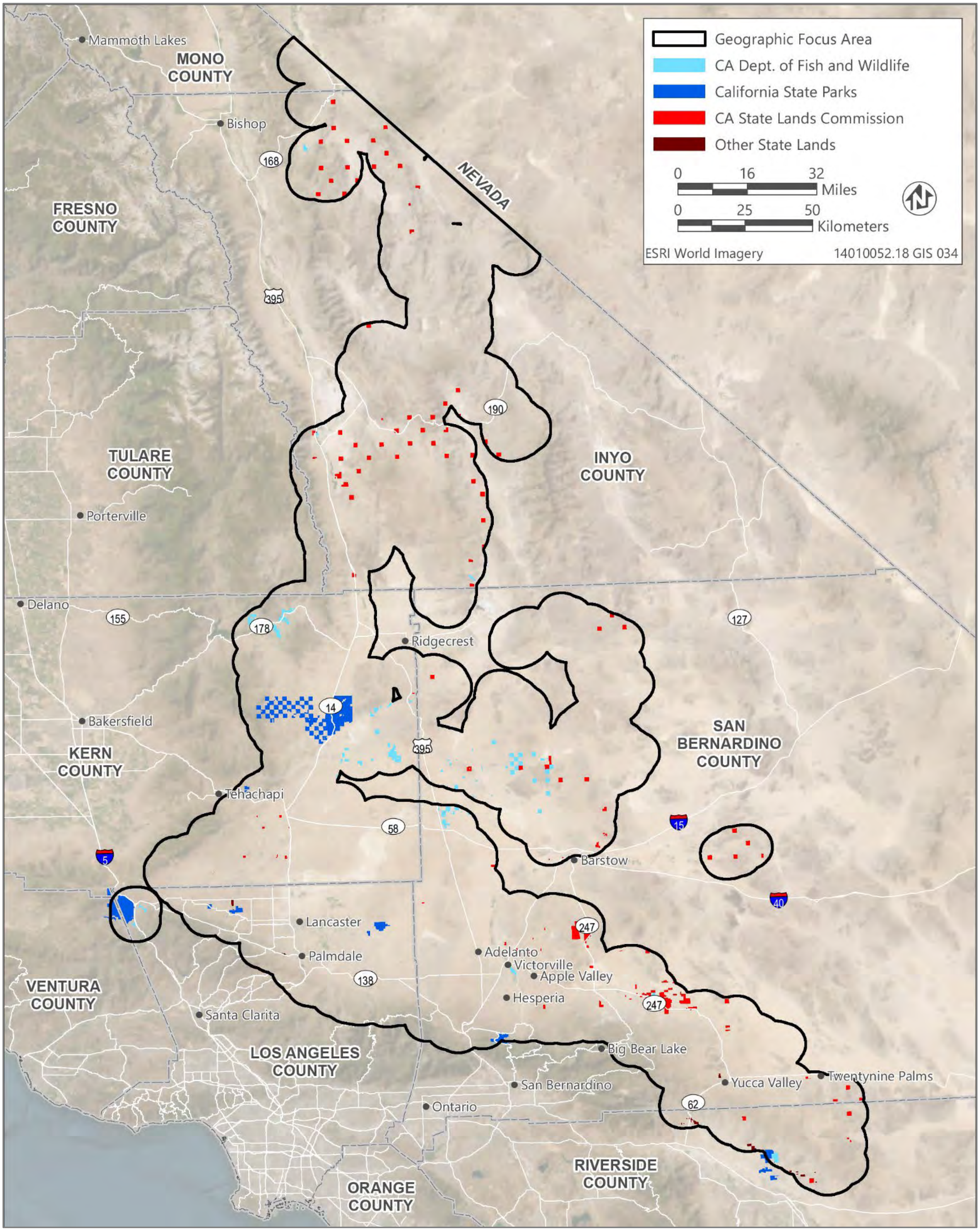
Approximately 0.3 square kilometer (74.1 acres), or less than 0.1 percent, of western Joshua tree's range in California, is distributed within lands managed by the Natural Resources Conservation Service (NRCS). This land is part of a conservation easement established under the Wetland Reserve Easements program, which was established to help private and tribal landowners protect, restore, and enhance wetlands that have been previously degraded due to agricultural uses. NRCS has the right to develop and implement a Wetland Reserve Plan of Operations for land enrolled in wetland reserve easements. These plans detail practices to help restore, protect, and enhance wetland functions and values.

2.3.4 State of California Land Management

State agencies manage approximately 2 percent of land within western Joshua tree's range in California. State Lands within the geographic focus area, including lands managed by CDFW, CSP, and CSLC, are shown on Figure 2-13. Lands identified as "Other State Lands" on Figure 2-13 consist of lands owned by the California Department of Water Resources, University of California, California Wildlife Conservation Board, Coachella Valley Conservation Commission, Coachella Valley Mountains Conservancy, and Desert and Mountain Conservation Authority. Natural resources on state-managed lands generally receive a high level of protection, including some active management and research for the benefit of natural resources (CDFW 2022).

CALIFORNIA STATE PARKS

CSP manages the California State Park System. The State Park System is divided into 21 districts. The Central Valley, Great Basin, Inland Empire, and Sierra Districts overlap with the geographic focus area. Lands owned by CSP within the geographic focus area are shown on Figure 2-13, and the distribution of western Joshua tree's range in California within State Parks is listed in Table 2-4. Approximately 149 square kilometers (57.4 square miles), which is about 1 percent of western Joshua tree's range in California, overlaps with the California State Park System.



Source: CAL FIRE 2024; adapted by Ascent in 2024.

Figure 2-13 State Lands Overlapping the Geographic Focus Area

Table 2-4 California State Parks in Western Joshua Tree Range in California

Park	District	County	Park Area in Square Kilometers (sq mi)	Range in Square Kilometers (sq mi), Percent of Range (%)	Description
Onyx Ranch State Vehicular Recreation Area	Great Basin	Kern	105.2 (40.6)	82.1 (31.7), 0.6	The setting consists of rugged Mojave Desert terrain. Recreational opportunities include trails for OHV use and campgrounds. This recreation area has the largest contiguous stands of western Joshua trees in the California State Parks System.
Red Rock Canyon State Park	Great Basin	Kern	109.3 (42.2)	50.7 (19.6), 0.4	The setting consists of a desert landscape with cliffs, buttes, and rock formations. Recreation opportunities include developed campsites, day use areas, hiking and equestrian trails, and primitive roads for OHV recreation. Western Joshua trees are currently present at the park.
Saddleback Butte State Park	Great Basin	Los Angeles	12.0 (4.6)	11.7 (4.5), 0.1	The setting consists of a granite mountaintop surrounded by high desert landscape, including native Joshua tree woodlands. Recreation opportunities include day-use picnic areas, campground facilities, and equestrian trails. Western Joshua trees are currently present at the park.
Arthur B. Ripley Desert Woodland State Park	Great Basin	Los Angeles	2.3 (0.9)	2.3 (0.9), <0.1	The setting consists of a Joshua tree and juniper woodland stand. Recreation opportunities include picnic areas and hiking trails. Western Joshua trees are currently present at the park.
Antelope Valley Indian Museum State Historic Park	Great Basin	Los Angeles	0.6 (0.2)	1.6 (0.6), <0.1	The setting consists of desert parkland on the south side of Piute Butte in the Mojave Desert and sits against a backdrop of western Joshua trees and towering rock formations. Western Joshua trees are currently present at the park.
Hungry Valley State Vehicular Recreation Area	Great Basin	Los Angeles	76.9 (29.7)	0.3 (0.1), <0.1	The setting consists of hills and valleys, grassland, coastal sage scrub, and oak woodland. Recreational opportunities include trails for OHV use and campgrounds. Western Joshua trees are currently present at the recreation area.

Notes: OHV = off-highway vehicle; sq mi = square miles.

Sources: Esque et al. 2023; CSP 2024a; compiled by Ascent in 2024.

California State Parks Department Operations Manual

The “Natural Resources” chapter of the CSP Department Operations Manual (CSP 2004) contains many policies that can apply to management of western Joshua trees. The following are examples of two high-level, general policies; however, more detailed guidance can be found in the “Plant Management” section, DOM 0310-0310.9.

- **DOM 0310.1.1: Plant Management Policy.** It is the policy of the Department to acquire, preserve, and interpret outstanding examples of native California species; and to acquire, perpetuate, and interpret natural plant communities, associations, natural processes (e.g., succession), and examples of rare, endangered, endemic, or otherwise sensitive native California plants. This will be done in concert with other agencies and organizations.
- **DOM 0313.2.1: Wildfire Management.** The Department's goal is to prevent all unplanned human-caused fires on its lands. Given that some unplanned fires will occur, both lightning-caused and human-caused, it becomes the Department's responsibility to protect human life, and to minimize damage to park facilities and resources from wildfires and from all suppression activities.

State Park Units Classified as State Parks

The following sections discuss units classified as State Parks that have management goals and policies relevant to western Joshua tree.

Arthur B. Ripley Desert Woodland State Park

In 1995, CSP established the 566-acre Arthur B. Ripley Desert Woodland State Park (Ripley State Park) in Los Angeles County. Although CSP has not adopted a general plan for this park, the agency has undertaken management efforts to protect Joshua tree and juniper woodland, which have nearly disappeared in the Antelope Valley due to factors including farming, housing, and green energy development. The purpose statement of the park is "to preserve and protect an impressive area of Joshua Tree—juniper woodlands and its associated ecosystem, a landscape which was once abundant in the Antelope Valley" (CSP n.d.).

Western Joshua trees in Arthur B. Ripley Desert Woodland State Park. Source: California State Parks.

In August 2020, the Lake Fire burned 55 acres, primarily comprised of western Joshua tree habitat, in the southern extent of Ripley State Park. Beginning in March 2021, CSP implemented a habitat restoration project to address regeneration of western Joshua tree. In a June 2022 status report, CSP reported that Ripley State Park is steadily recovering from the fire. The report describes restoration methods, identifies the survival rate of sprouts, and recommends management actions to track the growth rate of the trees (De Vera 2022). These findings and recommendations may be used to inform management actions in the Conservation Plan related to restoration. CSP is also seeking funding to remove fuels and invasive species and conduct research on the effects of wildland fire on regrowth of western Joshua tree in the park.

Red Rock Canyon State Park

Red Rock Canyon State Park was first established on 3,015 acres in Kern County. Since 1982, the park has grown to about 27,000 acres through subsequent land acquisitions and agreements. The Red Rock Canyon State Park General Plan was approved in January 1982 and most recently updated in 2023. The General Plan identifies 301 acres of Joshua tree woodland and other small stands within the park, noting that Joshua tree woodland is a sensitive natural community of high resource value and in need of protection.

The General Plan also identifies western Joshua tree as a sensitive botanical resource, noting that the park is near the western edge of the species' range in California where the population was modeled as unsustainable (Cole et al. 2011; CSP 2023).

One of the General Plan's stated goals is to restore native plant communities, including by:

- Developing science-based vegetation management objectives for habitat restoration and enhancement.
- Developing management plans in consultation with Tribes to avoid or minimize human impacts on native plant communities.
- Partnering with neighboring landowners to restore and preserve desert plant communities on a landscape scale.

Another goal of the General Plan (CSP 2023) is to protect and conserve sensitive plant species, including by:

- Implementing protection methods (e.g., habitat preservation, seed banking, restoration/enhancement, and visitor education).
- Developing and implementing protocols for locating and monitoring sensitive plant populations.
- Monitoring known populations of sensitive species over time.
- Developing sensitive species management plans.
- Planning and implementing conservation actions in collaboration with other agencies.
- Avoiding or minimizing human activities that disrupt natural ecological systems.
- Implementing management activities that improve ecological systems, such as controlling invasive species and restoring habitat.

Saddleback Butte State Park

Saddleback Butte State Park encompasses 2,955 acres in Los Angeles County. Although CSP has not adopted a general plan for this park, the park was originally named Joshua Trees State Park and was established for the purpose of protecting Joshua tree woodlands.

The purpose statement of the park is "to make available for day use an unspoiled area of desert terrain and to preserve a representative stand of [western] Joshua Trees and associated desert flora typical of this portion of the Mojave Desert" (CSP n.d.).

State Park Units Classified as State Vehicular Recreation Areas

The following sections describe management plans relevant to western Joshua tree conservation that apply to State Vehicular Recreation Areas (SVRAs).

Wildlife Habitat Protection Plans

Public Resources Code section 5090.32, subdivision (g) requires the Off-Highway Vehicle Division of CSP to prepare Wildlife Habitat Protection Plans (WHPPs) for lands in SVRAs within the State Parks System. Each SVRA has an existing WHPP that was developed in the 1990s and updated in 2010. Many of these plans are currently being updated in accordance with changes to the Public Resources Code (CSP 2021). After completion of these updates, WHPPs will be updated every 5 years at a minimum. Some of the updated WHPPs were approved between 2022 and 2024, while other WHPPs are still in development or pending public review and approval. In accordance with the Public Resources Code, each WHPP must include objectives for updated WHPPs to identify rare or endangered plant and animal species and their supporting habitat for sensitive area consideration; incorporate objectives that target the protection, conservation, and improvement of natural resources within SVRAs; and develop and incorporate annual monitoring programs to assess whether WHPP objectives are being met. The types of management actions that may influence western Joshua tree conservation include actions to conserve and restore soils, prevent authorized trail development in areas with existing natural communities, and restore habitat. During subsequent updates of WHPPs, CDFW will have the opportunity to collaborate with CSP on management actions to be implemented at Hungry Valley and Onyx Ranch SVRAs in support of western Joshua tree conservation.

Soil Conservation Plans

Each SVRA is required to develop a soil conservation plan that must be reviewed every 5 years and updated as needed. Soil conservation plans must demonstrate how an SVRA complies with CSP's 2020 Soil Conservation Standard by implementing an adaptive management framework that consists of performing assessments of OHV roads, trails, and facilities, implementing maintenance actions, and monitoring the outcome of the actions taken. Under the 2020 Soil Conservation Standard, SVRAs must manage OHV facilities for sustainable long-term use, meaning soil loss must not exceed restorability (CSP 2020). During subsequent updates of soil conservation plans, CDFW will have the opportunity to collaborate with CSP on soil management actions to be implemented at Hungry Valley and Onyx Ranch SVRAs in support of western Joshua tree conservation.

Hungry Valley State Vehicular Recreation Area

Hungry Valley SVRA encompasses 19,000 acres in Los Angeles County. Providing opportunities for OHV recreation is a top priority of Hungry Valley SVRA, but the General Plan, which is currently being updated, also recognizes the recreation area's natural resources. The General Plan does not specifically discuss western Joshua tree but includes policies to protect rare, endangered, and threatened plants. CSP is currently developing a soil conservation plan for Hungry Valley SVRA, which includes measures to minimize and repair soil erosion in the recreation area. CSP is also implementing a wildlife habitat protection plan for Hungry Valley SVRA, which allows motorized vehicle use in a manner that balances natural resource protection. The plan identifies western Joshua tree as a candidate for listing under CESA and identifies Joshua tree woodland as habitat for other wildlife species in the recreation area (CSP 2024b).

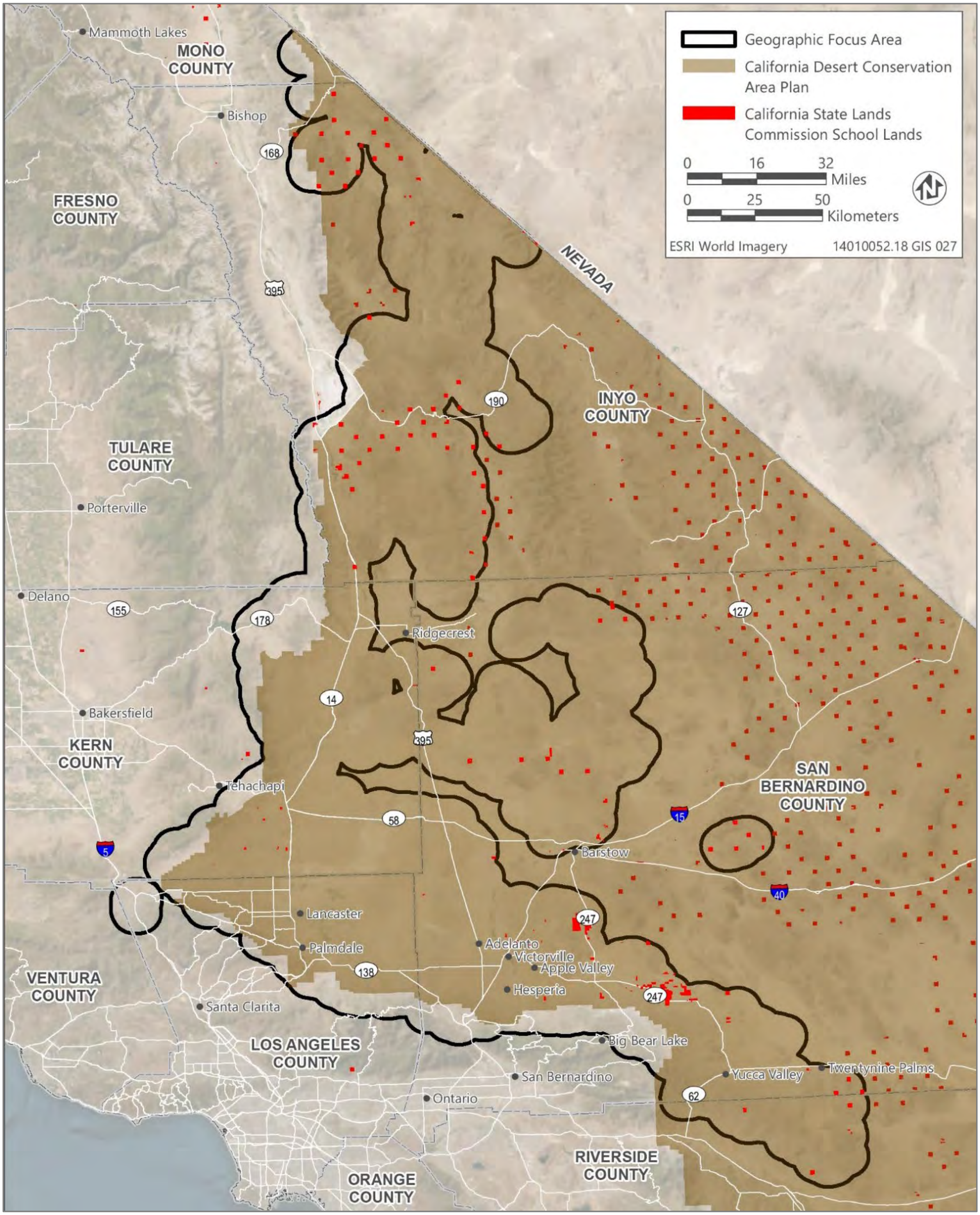
Onyx Ranch State Vehicular Recreation Area

Onyx Ranch SVRA encompasses over 26,000 acres in eastern Kern County. A general plan has not yet been adopted for this SVRA. CSP is currently developing a soil conservation plan and a wildlife habitat protection plan for Onyx Ranch SVRA.

CALIFORNIA STATE LANDS COMMISSION

School Lands in the California Desert Conservation Area

The California State Lands Commission (CSLC) has primary responsibility for the surface management of school lands in California. This includes the identification, location, and evaluation of the State's interest in these lands and their leasing and management. School lands are what remains of the nearly 5.5 million acres granted to California by Congress in 1853 to benefit public education (Ch. 145, 10 Stat. 244). Currently, CSLC manages approximately 468,000 acres of school lands held in fee ownership by the State, with many of these lands located in the California desert. The Commission also manages the surface and mineral ownership of hundreds of thousands of acres of school lands (CSLC 2012, n.d.). School lands make up approximately 87 square kilometers (33.6 square miles), or roughly 0.7 percent, of western Joshua tree's range in California. School lands within the geographic focus area are shown in Figure 2-14.



Source: CSLC 2024; adapted by Ascent in 2024.

Figure 2-14 California State Lands Commission School Lands Overlapping the Geographic Focus Area

As discussed above, DRECP was developed by the agencies in the Renewable Energy Action Team to provide effective protection and conservation of desert ecosystems while allowing for the appropriate development of renewable energy projects and promoting outdoor recreation opportunities within CDCA (refer to the “Desert Renewable Energy Conservation Plan” section above).

CSLC is the largest state agency landowner in DRECP, managing approximately 1.5 percent of the DRECP planning area. These lands form a patchwork of small parcels found throughout the DRECP planning area, mostly in San Bernardino County and Eastern Riverside County (BLM 2015).

On October 16, 2008, CSLC adopted the Resolution by the California State Lands Commission Supporting the Environmentally Responsible Development of School Lands Under the Commission’s Jurisdiction for Renewable Energy Related Projects. In this resolution, CSLC resolved that lands within its jurisdiction may be developed only with assurances that California’s unique and sensitive environments will be protected. A written MOU, executed in May 2012 between CSLC and the Department of the Interior, acting through BLM, describes the terms and procedures for land exchanges between these agencies to consolidate school lands into larger parcels suitable for commercial-scale renewable energy projects (CSLC 2008, 2012; BLM 2015).

CSLC may issue leases or permits on State Lands under its jurisdiction, including School Lands, for various types of projects (e.g., utility, highway, grazing, mineral extraction). CSLC generally serves as the lead agency for conducting environmental review under CEQA for the issuance of leases and permits on school lands. As part of the CEQA process, CSLC is required to evaluate the impacts of issuing a lease or permit on special-status species, including western Joshua tree, and to adopt mitigation measures to reduce potentially significant impacts, where feasible. For example, CSLC recently issued a general lease for a new solar energy facility in Kern County. The project was anticipated to affect lands that possess significant environmental values due, in part, to their unique display of Joshua trees. CSLC required preparation of a Joshua Tree Preservation Plan, exclusionary fencing of the western Joshua tree woodland, and annual monitoring of the species (CSLC 2023).

CSLC may also issue leases on State Lands for conservation purposes. CSLC has previously approved long-term leases (i.e., 10–20 years) to CSP and CDFW for conservation. In support of the Conservation Plan, CSLC may award additional long-term leases to CDFW to conserve land that currently supports western Joshua tree or that could serve as potential climate refugia for the species.

California State Lands Commission Significant Lands Inventory

Western Joshua trees at sunset.
Source: National Park Service.

As directed by Public Resources Code section 6370, CSLC published the *Inventory of Unconveyed State School Lands & Tide & Submerged Lands Possessing Significant Environmental* Values, also referred to as the "Significant Lands Inventory" (CSLC 1975). The report identifies lands possessing significant environmental values and the criteria by which those determinations were made, along with any recommended actions necessary for permanent protection of such identified lands. Whether land is necessary for the continued existence of a rare or endangered plant is one of several criteria for identifying lands that possess significant environmental values. Parcels that possess significant environmental values are then classified into the following categories:

- Class A: Restricted Use. Areas where public use should be minimized to preserve the integrity of the natural environment as a whole.
- Class B: Limited Use. Areas in which one or more closely related dominant, significant environmental values is present. Limited use compatible with and non-consumptive of such values may be permitted.
- Class C: Multiple Use. Areas currently in multiple use which are less susceptible to environmental degradation than are Classes A and B, but nevertheless do possess significant environmental values.

CSLC adopted regulations to assure the protection of the significant environmental values of identified lands (Cal. Code Regs., tit. 2, § 2951 et seq.). The regulations state that CSLC will not allow sale, lease, or other use of significant environmental land without (a) finding that adequate provisions have been made for the permanent protection of the significantly environmental characteristics or (b) finding that granting of the application will have no significant effect upon environmental characteristics.

CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE

Sensitive Natural Communities

CDFW maintains a list of natural communities throughout California, which are assigned a state rank based on their rarity. Sensitive natural communities refer to natural communities with rarity ranks of S1 (critically imperiled), S2 (imperiled), or S3 (vulnerable). Joshua tree woodland (*Yucca brevifolia* Woodland Alliance) is identified as a CDFW sensitive natural community. The State rank for Joshua tree woodland is S3 (vulnerable) due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation from California (CDFW 2023).

CEQA is the primary mechanism through which sensitive natural communities receive protection. CEQA requires public agencies to evaluate impacts to sensitive natural communities from projects they review, and to adopt measures to mitigate significant impacts. The Native Plant Protection Act, CESA, and ESA may also afford protections to natural communities that support rare species or are defined by the dominance or presence of such species by prohibiting unauthorized take of those species. In addition, sensitive natural communities may be protected by local regional plans, regulations, or ordinances (CDFW n.d.).

State Wildlife Action Plan

In 2005, Congress mandated that each state must develop a State Wildlife Action Plan (SWAP) every 10 years. SWAPs are designed to identify species of greatest conservation need. California's SWAP examines the health of wildlife and prescribes actions to conserve wildlife and vital habitats before they become rarer and more costly to protect. The plan also promotes wildlife conservation while furthering responsible development and addressing the needs of a growing human population. Although the focus of the SWAP is on wildlife conservation, the plan acknowledges that Joshua tree is an endemic species adapted to specialized desert habitats. Joshua trees are a focal habitat type associated with conservation targets in the desert region.

The SWAP includes conservation strategies for wildlife species that would also benefit western Joshua tree, including strategies to advocate, increase political awareness, and acquire funding for conservation of desert habitat; develop HCPs, NCCPs, and management plans to minimize impacts of development; and conserve lands through land acquisitions, easements, and leases (CDFW 2015). CDFW circulated a draft 2025 SWAP for public review on March 10, 2025. The final 2025 SWAP is anticipated to be completed by CDFW in October 2025.

California Department of Fish and Wildlife Lands Program

CDFW manages more than 1.1 million acres of land spanning more than 700 properties statewide. These lands comprise ecological reserves, wildlife areas, undesignated lands, public access areas, fish hatcheries, and miscellaneous lands. Of these, approximately 700,000 acres are owned in fee title, and approximately 483,000 acres are administered through written MOUs, leases, easements, or management agreements under the CDFW Lands Program (CNRA 2023). The CDFW Lands Program's mission is to ensure that California's lands are managed and maintained to provide optimal benefits for fish, wildlife, and plants by:

- Developing uniform, statewide policies and planning guidance relative to the acquisition, protection, restoration, enhancement, and management of lands.
- Providing statewide policy and programmatic coordination with conservation groups and local, state, and federal resource agencies to conserve privately owned lands.
- Developing uniform guidelines and regulations for public use and land management plans that focus on the needs of fish, wildlife, and plants.
- Providing budgetary and technical assistance to regional land managers.
- Fostering public use, knowledge, and enjoyment of lands.

CDFW lands within the geographic focus area are shown on Figure 2-13. Approximately 34 square kilometers (13.1 square miles), or 0.3 percent, of western Joshua tree's range in California is distributed within CDFW lands. The ecological reserves within western Joshua tree's range in California, which together comprise approximately 28 square kilometers (10.8 square miles), or 0.2 percent, are listed in Table 2-5. CDFW has not adopted land management plans for these ecological reserves. Approximately 5 square kilometers (1.9 square miles), or less than 0.1 percent, of CDFW land within western Joshua tree's range in California are held under conservation easements. Other CDFW lands within western Joshua tree's range in California include a mitigation property, a regional park, a fish hatchery, and public river access. Combined, these areas make up less than 0.4 square kilometer (98.8 acres), or less than 0.1 percent, of western Joshua tree's range in California.

Table 2-5 Ecological Reserves in Western Joshua Tree Range in California

Ecological Reserve	County	Ecological Reserve Area in Square Kilometers (sq mi)	Range in Square Kilometers (sq mi), Percent of Range (%)	Description
West Mojave Ecological Reserve	San Bernardino	72.8 (28.1)	18.8 (7.3), 0.1	This reserve was acquired for the purpose of preserving a representative portion of the West Mojave Desert, protecting desert tortoise (*Gopherus agassizii*) and Mojave ground squirrel (*Xerospermophilus mohavensis*) habitat, and protecting it from the damaging influences of OHV use and sheep grazing. The dominant vegetation in the reserve is white bur-sage (*Ambrosia dumosa*). Creosote bush is also abundant but not as evenly distributed.
Canebrake Ecological Reserve	Kern	29.1 (11.2)	5.0 (1.9), <0.1	The Reserve contains valley foothill riparian, valley foothill hardwood-conifer/blue oak-foothill pine, sagebrush, western Joshua tree, riverine, lacustrine, fresh emergent wetland, wet meadow, pasture, and cropland.
Fremont Valley Ecological Reserve	Kern	16.6 (6.4)	4.2 (1.6), <0.1	The Reserve was acquired for the purpose of protecting desert tortoise habitat. The reserve consists of typical northwest Mojave Desert terrain, and the natural vegetation community is primarily creosote bush scrub.
King Clone Ecological Reserve	San Bernardino	2.0 (0.8)	0.5 (0.2), <0.1	This reserve was acquired for the purpose of protecting ancient creosote rings in the Mojave Desert. The Reserve consists of a predominantly flat, level area with creosote bush scrub.

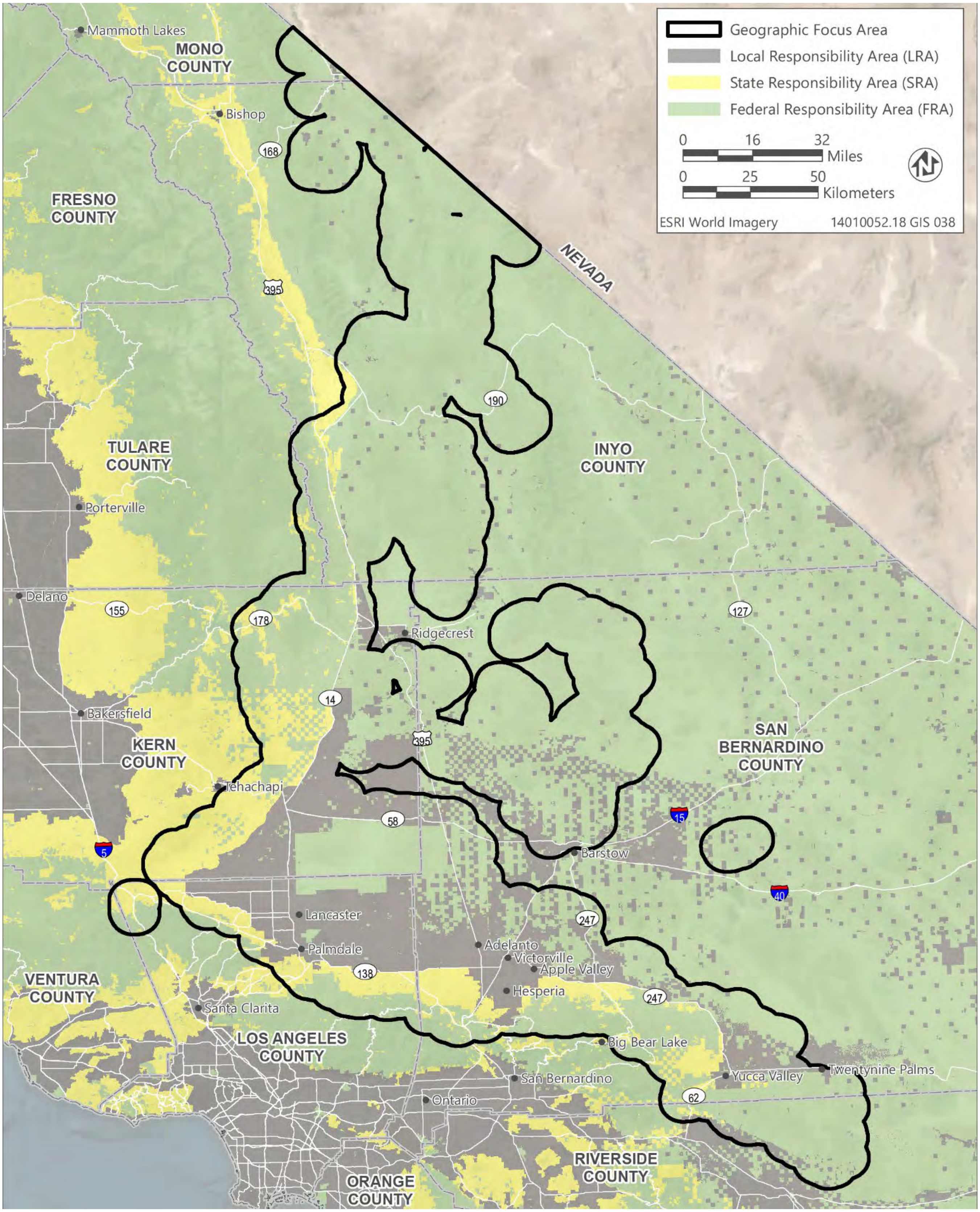
Notes: OHV = off-highway vehicle; sq mi = square miles.

Sources: Esque et al. 2023; CAL FIRE 2024; CSP 2024a; GreenInfo Network 2024; data provided by CDFW in 2024; compiled by Ascent in 2024.

CALIFORNIA DEPARTMENT OF FORESTRY AND FIRE PROTECTION

The California Department of Forestry and Fire Protection (CAL FIRE) is responsible for wildland fire prevention, risk reduction, and response on behalf of the State across lands not covered by local fire districts or by federal agencies (i.e., the State Responsibility Area) and in certain local jurisdictions through intergovernmental contracts. The CAL FIRE State Responsibility Area is shown in Figure 2-15.

Approximately 14 percent of the western Joshua tree range in California is within the State Responsibility Area. In the State Responsibility Area, CAL FIRE's fire suppression objective is to provide aggressive initial attack on all wildland fire to minimize resource loss.



Source: CAL FIRE 2023; adapted by Ascent in 2024.

Figure 2-15 Federal, State, and Local Responsibility Areas for Fire Response Overlapping the Geographic Focus Area

CAL FIRE also supports and encourages fuel treatment before an incident occurs to reduce wildland fire risk, including the use of prescribed fire as a management tool on forest and rangelands, as well as for wildlife habitat improvement, watershed protection, reforestation, and range and livestock management. Further discussion regarding fire protection, natural resource management, and fire prevention methods within western Joshua tree's range in California and climate refugia, including fire suppression and fuel treatments, is found in Sections 5.2.2, "Land Conservation and Management," and 5.2.4, "Research to Inform Long-Term Conservation."

CALIFORNIA WILDLIFE CONSERVATION BOARD

The California Desert Conservation Act (Fish & G. Code, § 1450 et seq.) became effective on January 1, 2022, and established a California Desert Conservation Program under the administration of the Wildlife Conservation Board. The purpose and goal of the California Desert Conservation Program include the following:

- Protect, preserve, and restore the natural, cultural, and physical resources of the "portions of the Mojave and Colorado Deserts region," as defined in Fish and Game Code section 1452, subdivision (f), in California through the acquisition, restoration, and management of lands.
- Promote the protection and restoration of the biological diversity of the region.
- Provide for resilience in the region to climate change.
- Protect and improve air quality and water resources within the region.
- Undertake efforts to enhance public use and enjoyment of lands owned by the public.

Federal and state agencies, local public agencies, tribes, and NGOs with tax exempt status under United States Code title 26, section 501, subdivision (c)(3) are eligible to apply for grant funding under the program for acquisition, restoration, and management projects (Fish & G. Code, §§ 1452, subd. (d) & 1456, subd. (c)). Although the California Desert Conservation Program does not specifically target the conservation of any individual species, the program could contribute to the conservation or restoration of western Joshua tree habitat in California (WCB n.d.).

2.4 TRIBAL CO-MANAGEMENT

This section describes laws and policies that provide for CDFW communication, consultation, and co-management with Tribes. WJTCA provides requirements regarding western Joshua tree co-management with Tribes in Fish and Game Code section 1927.6, subdivisions (a) and (b), listed below.

- CDFW shall develop and implement a western Joshua tree conservation plan in collaboration with the Commission, governmental agencies, Tribes, and the public (Fish & G. Code, § 1927.6, subd. (a)).
- When developing the conservation plan, CDFW shall consult with Tribes, include co-management principles in the plan, provide for the relocation of western Joshua trees to tribal lands upon a request from a Tribe, and ensure Traditional Ecological Knowledge is incorporated into the plan (Fish & G. Code, § 1927.6, subd. (b)).
- This section shall not preclude CDFW from entering into memorandum of understanding with Tribes to provide for the taking and possession of western Joshua trees for tribal cultural purposes, or as otherwise required by applicable law (Fish & G. Code, § 1927.2, subd. (h); see Section 6.4, "Tribal Co-Management").

Tribal lands referenced in Fish and Game Code section 1927.6, subdivision (b) above include all of the following: (1) lands meeting the definition of "Indian country" in United States Code, title 18, section 1151 held in trust by the United States for the benefit of either Tribes (rancherias/reservations) or tribal members (individual allotments usually within rancherias/reservations); (2) fee lands held by Tribes (land purchased and owned by a Tribe typically outside of rancherias/reservations); or (3) fee lands held by tribal-led NGOs (e.g., NALC) or NGOs formed by non-federally recognized Tribes to act on a Tribe's behalf as an entity to hold land.

Source: Ryan Hall.

2.4.1 State Tribal Communication and Consultation Policy

State agencies and Tribes engage in consultation regarding policies, processes, programs, and projects that have the potential to affect tribal interests. Executive Order (EO) B-10-11, issued by Governor Edmond G. Brown, Jr., on September 19, 2011, states that it is the policy of the administration that every state agency and department subject to executive control shall encourage communication and consultation with Tribes. EO B-10-11 reaffirms the right for Tribes to exercise sovereign authority over their members and territory, recognizes that the State and Tribes are better able to adopt and implement mutually beneficial policies when they cooperate and engage in meaningful consultation, and identifies the State's commitment to strengthening and sustaining effective government-to-government relationships between the State and the Tribes. EO B-10-11 also created the Office of the Tribal Advisor, which, among other things, is directed to facilitate communication and consultations between Tribes and state agencies. Pursuant to EO B-10-11, California Natural Resources Agency (CNRA), CDFW, and the Commission developed the following policies:

- CNRA adopted its Tribal Consultation Policy on November 20, 2012 (CNRA 2012). The Tribal Consultation Policy directs CNRA departments to conduct outreach to Tribes and designate a tribal liaison to serve as the central point of contact for Tribes. CNRA is currently updating its Tribal Consultation Policy to reflect additional consultation requirements established by news laws and executive orders that have been enacted subsequent to 2012. This updated Tribal Consultation Policy will become the new framework for all CNRA departments, which may develop supplemental policies specific to their authorities.
- CDFW adopted its Tribal Communication and Consultation Policy on October 2, 2014 (CDFW 2014). The Policy establishes guiding principles and directs CDFW to appoint a tribal liaison. CDFW is committed to consulting with Tribes about issues surrounding California's fish, wildlife, and plant resources, assessing the potential effects of CDFW activities on tribal interests, and providing Tribes with meaningful opportunities to participate in decision-making processes that have the potential to affect tribal interests.
- The Commission adopted its Tribal Consultation Policy on June 10, 2015, to effectively work with Tribes to sustainably manage natural resources of mutual interest. Several years of an iterative and collaborative processes to develop a shared vision between tribal entities and the Commission resulted in the following vision statement and definition of co-management (Commission 2017, 2020):
    - "The vision of Tribes, the California Fish and Game Commission, and the California Department of Fish and Wildlife is to engage in a collaborative effort between sovereigns to jointly achieve and implement mutually agreed upon and compatible governance and management objectives to ensure the health and sustainable use of fish and wildlife."
    - Co-management is defined as "a collaborative effort established through an agreement in which two or more sovereigns mutually negotiate, define, and allocate amongst themselves the sharing of management functions and responsibilities for a given territory, area or set of natural resources."

EO N-15-19, issued by Governor Gavin Newsom on June 18, 2019, acknowledges and apologizes on behalf of the State for the prejudicial policies and maltreatment of Tribes and commends California Native Americans for stewarding and protecting lands within California. This EO also reaffirms and incorporates by reference the principles of government-to-government engagement established by EO B-10-11.

Young western Joshua tree.
Source: National Park Service.

EO N-82-20, signed by Governor Gavin Newsom on October 7, 2020, creates a California Biodiversity Collaborative and sets a goal of conserving at least 30 percent of the State's land and coastal waters by 2030 to combat the biodiversity and climate crises. This EO acknowledges that California Native Americans have stewarded and managed the lands within California and that addressing the biodiversity and climate crises requires partnerships and collaboration with Tribes.

Section 1.3.2, "California Native American Tribes," and Appendix C, "Tribal Input Summary Memo," of the Conservation Plan include a summary of CDFW's tribal outreach and consultation efforts to-date during development of this Conservation Plan.

2.4.2 Statement of Administration Policy: Native American Ancestral Lands

In September 2020, Governor Newsom issued a Statement of Administration Policy stating that it is the policy of the administration to "seek opportunities to support California Native American tribes' co-management of and access to natural lands that are within a California Native American tribe's ancestral land and under the ownership or control of the State of California." The purposes of this policy are to partner with Tribes to facilitate tribal access to, use of, and co-management of state-owned or state-controlled natural lands and to work cooperatively with Tribes that are interested in acquiring natural lands in excess of state needs to:

- Support tribal self-determination and self-government.
- Facilitate the access of Tribes to sacred sites and cultural resources.
- Improve the ability of Tribes to engage in traditional and sustenance gathering, hunting, and fishing.

- Partner with Tribes on land management and stewardship utilizing Traditional Ecological Knowledge.
- Reduce fractionation of tribal lands.
- Provide opportunities for education, community development, economic diversification, and investment in public health, investment in information technology and infrastructure, renewable energy, water conservation, and cultural preservation or awareness.

Examples of actions that could be taken in accordance with this policy are:

- Entering into a written MOU or other written agreements, or adopting policies and practices to allow for access to or co-management of natural lands under the ownership or control of the State with Tribes with ancestral lands located in such areas.
- Coordinating with local governments to zone natural land in excess of state needs in a way conducive to tribal access and use.
- Granting funding to assist Tribes with procurement, protection, or management of natural lands located within their ancestral territories, subject to available resources.
- When natural lands under the ownership or control of the State are in excess of state needs, working cooperatively within existing statutory and regulatory frameworks with Tribes that have ancestral territory within those lands and are interested in acquiring them, including by prioritizing tribal purchase or transfer of land.

2.4.3 Assembly Bill 1284: Tribal Co-Governance and Co-Management

Enacted in September 2024, Assembly Bill 1284 allows for the co-governance and co-management of tribal ancestral lands and waters in California. The bill encourages the CNRA and its departments, conservancies, and commissions to enter into co-governance and co-management agreements with federally recognized Tribes. In addition, the bill authorizes the California Natural Resources Secretary or a delegate to enter into agreements with federally recognized Tribes for the purposes of shared responsibility, decision-making, and collaboration in resource management and conservation within a Tribe’s ancestral lands and waters, and requires the Secretary or a delegate to be the signatory for the State for these agreements. The bill also authorizes the Secretary or a delegate, within 90 days of a federally recognized Tribe’s request, to begin government-to-government negotiations on co-governance and co-management agreements with the Tribe.

2.4.4 Senate Bill 310: Cultural Burning

Enacted in September 2024, Senate Bill 310 authorizes the California Natural Resources Secretary, in consultation with its departments, commissions, boards, conservancies, and other entities, to enter into written agreements with federally recognized Tribes in support of tribal sovereignty with respect to cultural burning in their ancestral territories. In deference to tribal sovereignty, the Secretary may agree in a written agreement that compliance with specified state permitting or regulatory requirements is not required for cultural burning. The bill also authorizes local air districts to enter into written agreements with federally recognized Tribes in support of tribal sovereignty with respect to cultural burning in their ancestral territories.

2.4.5 Tribal Stewardship Strategy Toolkit

The CNRA is developing a Tribal Stewardship Strategy Toolkit that will provide policies and resources to advance shared goals of Tribes and the State for improved tribal access and co-management of public places and natural resources and the return of ancestral lands to tribal ownership. Example projects already undertaken by departments within CNRA include entering into memorandums of understanding to open state lands for tribal ceremonies, gathering, and use; returning land to Tribes; and providing funds to Tribes to support their wildland fire resilience and forestry management priorities (CNRA 2024).

2.4.6 The Advisory Council on Historic Preservation

The Advisory Council on Historic Preservation has adopted a policy statement on indigenous knowledge and historic preservation, which was requested to be included in the Conservation Plan by tribal members who contributed to the Conservation Plan (FIICPI, pers. comm., 2024). The Advisory Council on Historic Preservation provides foundational commitments that are important for guiding development of co-management principles with Native Americans who inhabit land in the United States (ACHP 2024). CDFW developed initial foundational commitments based on recommendations from tribal members in Action TCM 1, which are described in Section 5.2.3, “Tribal Co-Management,” and in Appendix G, “Foundational Commitments by CDFW for Developing Western Joshua Tree Conservation Plan Co-Management Principles with California Native American Tribes.”

2.4.7 Joshua Tree National Park Co-Management Agreement

In November 2022, the Twenty-Nine Palms Band of Mission Indians entered into a co-management agreement with Joshua Tree National Park that allows for continued cooperation between the two entities and outlines a path toward shared stewardship of park resources. Through this agreement, the Twenty-Nine Palms Band of Mission Indians and Joshua

Tree National Park identified critical areas for collaboration, which include trail development, emergency mutual aid, joint planning on educational and interpretive activities, and other programs (NPS 2023). This co-management agreement can serve as an example for future co-management agreements between CDFW and Tribes.

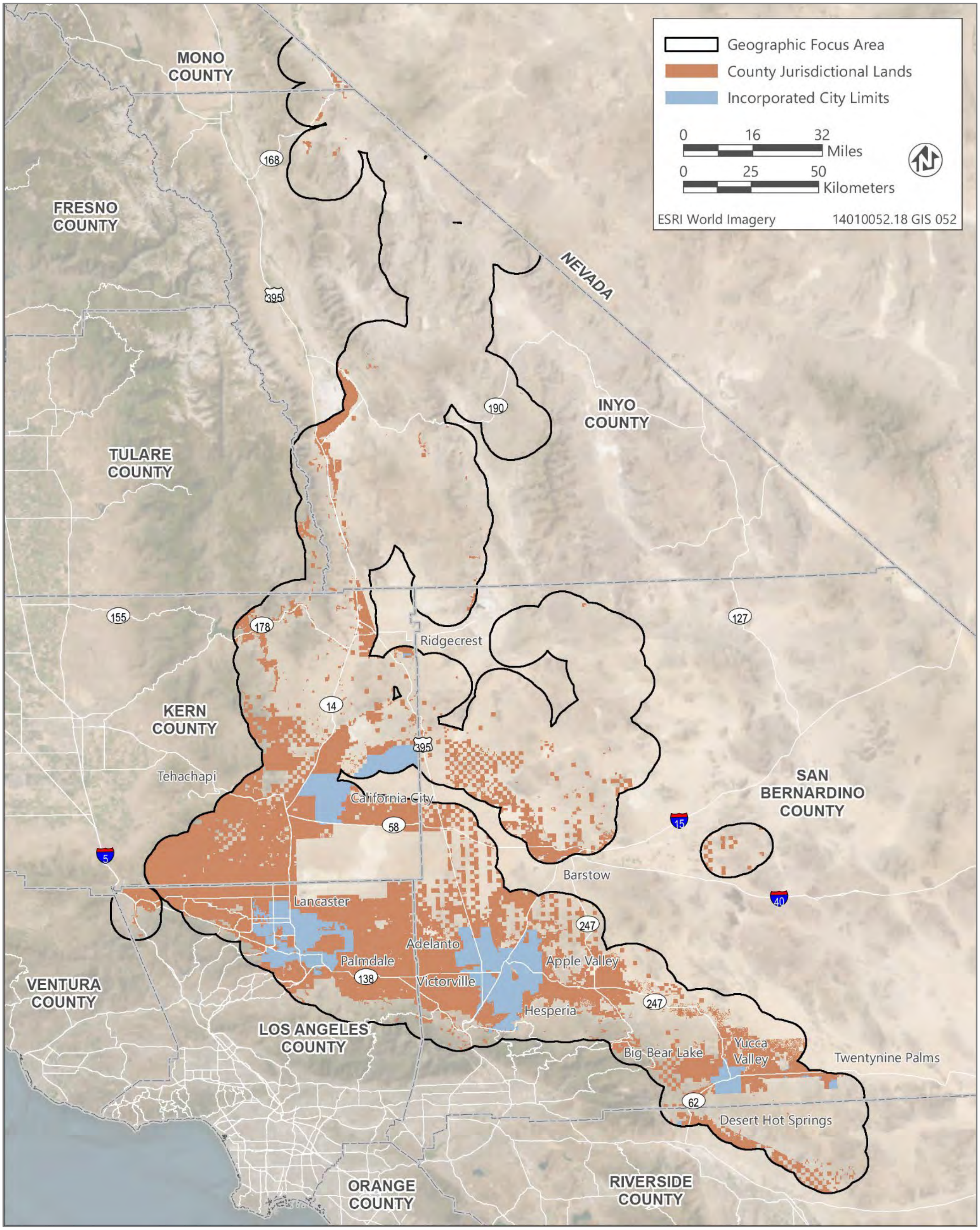
2.5 LOCAL GOVERNMENT

2.5.1 County and City Plans, Policies, and Ordinances

Approximately 37.8 percent of western Joshua tree's range in California is within areas of land use control and authority of local agencies (i.e., county and city jurisdictions). This category includes county- and city-owned lands, some of which are protected parks, preserves, and sanctuaries. Table 2-6 lists the counties and cities that have western Joshua trees in their jurisdiction and identifies the area and percentage of the species' range in California within each jurisdiction. For each county listed, the area and percentage of western Joshua tree's range in California is limited to unincorporated areas within the county and excludes federal and state lands. The counties and cities within the geographic focus area are shown on Figure 2-16. Figure 2-16 does not include federal and state lands, which are included in Figure 2-4 in Section 2.3.3 and Figure 2-13 in Section 2.3.4.

Mojave yuccas in front of a western Joshua tree.

Source: National Park Service.



Source: Data provided by CDFW in 2024; adapted by Ascent in 2024.

Figure 2-16 County and City Jurisdictional Land within the Geographic Focus Area

Table 2-6 City and County Jurisdictions in Western Joshua Tree Range in California

Jurisdiction	Range in Square Kilometers (sq mi)	Percent of Range (%)
San Bernardino County	1,741 (672.2)	13
Kern County	1,011 (390.3)	8
Los Angeles County	989 (381.9)	8
City of Hesperia	144 (55.6)	1.1
City of Adelanto	120 (46.3)	0.9
City of Victorville	119 (45.9)	0.9
City of Palmdale	117 (45.2)	0.9
Town of Apple Valley	98 (37.8)	0.7
Inyo County	53 (20.5)	0.4
Town of Yucca Valley	93 (35.9)	0.7
City of California City	70 (27.0)	0.5
City of Lancaster	56 (21.6)	0.4
Riverside County	4 (1.5)	<0.1
Mono County	<1 (<0.4)	<0.1

Notes: sq mi = square miles.

Sources: Esque et al. 2023 ;data provided by CDFW in 2024; compiled by Ascent in 2024.

Article XI of the California Constitution sets forth the powers of local governments. Local agencies govern land use planning within their jurisdictions, including by adopting ordinances, zoning regulations, and general plans. Although state laws and regulations protecting biological resources preempt those of local governments, local agencies can adopt ordinances, regulations, and policies that describe how the agency will implement state requirements, support the State's objectives, and reinforce the State's priorities at the local level. Local agencies have the ability to adopt more stringent ordinances and regulations, provided they do not conflict with state laws. Local agencies also have the ability to make changes to their ordinances, regulations, and policies in response to changing conditions and regulatory environments.

Many counties and cities within western Joshua tree's range in California have adopted policies in their general plans that align with state and federal laws governing the protection of biological resources. Such policies include designating Joshua tree woodland as a sensitive natural community, designating sensitive areas where development must be carefully planned or where development is discouraged or prohibited, coordinating with land management agencies to protect biological resources, protecting special-status species, acquiring mitigation lands and preserving those lands as open space, and educating the public about natural resources. Many general plans also include policies that provide a framework for the local agency to coordinate with CDFW to implement the requirements of CESA at the local level.

Many counties and cities within western Joshua tree's range in California have also adopted ordinances that regulate tree maintenance and removal, with some ordinances providing specific requirements applicable to western Joshua tree. As applied to western Joshua tree, some of these local ordinances are currently preempted by WJTCA and CESA, given the protections afforded by these statutes, and will continue to be preempted if the species is listed under CESA. However, WJTCA allows local agencies to adopt measures that provide additional protections beyond those required under the act (Fish & G. Code, § 1927.11).

WJTCA allows CDFW to enter into an agreement with any county or city to delegate the ability to authorize, by permit, the taking of a western Joshua tree associated with developing single-family residences, multifamily residences, accessory structures, and public works projects, provided certain conditions are met (Fish & G. Code, § 1927.3). Fish and Game Code section 1927.3, subdivision (c)(3) specifies limits on the number of individual western Joshua trees that a project may take pursuant to a permit issued under a county or city's delegated authority, depending on the project type, and requires CDFW's concurrence that certain projects have avoided and minimized the take of western Joshua trees to the maximum extent practicable. To receive this limited delegation of authority, a county or city must adopt an ordinance requiring the satisfaction of all requirements in Fish and Game Code section 1927.3 as a condition of approval for any take permit issued under such authority (Fish & G. Code, § 1927.3, subd. (c)(1)). In addition, counties and cities are responsible for ensuring that permittees satisfy those requirements (Fish & G. Code, § 1927.3, subd. (c)(2)). Fish and Game Code section 1927.3, subdivision (c)(4) also directs counties and cities to collect fees for permits issued and to remit the fees to CDFW.

CDFW may also enter into an agreement with any county or city to delegate the ability to authorize, by permit, the removal or trimming of dead western Joshua trees or the trimming of live western Joshua trees that pose a risk to structures or public health and safety, provided certain conditions are met (Fish & G. Code, § 1927.4, subd. (b)). To receive this limited delegation of authority, counties and cities must ensure the requirements of Fish and Game Code section 1927.4, subdivision (a) are met and must comply with specific reporting requirements (Fish & G. Code, § 1927.4, subd. (b)).

The Conservation Plan can also provide a framework for CDFW to enter into a written MOU or other agreement with counties and cities to designate protected areas for western Joshua tree. For example, Inyo County designates large contiguous areas in the County known for containing sensitive natural communities or supporting special-status species as environmental resource areas. Policy BIO-1.4 in the *Inyo County General Plan* (Inyo County 2001) discourages development in environmental resource areas unless adverse effects to sensitive resources can be mitigated to a less-than-significant level. The *Inyo County General Plan* recognizes Joshua tree woodland as sensitive natural community that occurs within the County. Similarly, Los

Angeles County officially designates areas with irreplaceable biological resources as significant ecological areas. Although western Joshua tree receives protection under the County's significant ecological areas ordinance, this ordinance is currently preempted by WJTCA. There is potential for CDFW to work with Inyo and Los Angeles Counties to designate western Joshua tree habitat, including climate refugia, as environmental resource areas and significant ecological areas, respectively. In addition, there is potential for CDFW to work with other counties and cities to designate western Joshua tree habitat, including climate refugia, within their respective jurisdictions. A written MOU or other agreement could also include programs to protect western Joshua tree, such as "adopt-a-tree" programs by which the public can participate in restoration and stewardship activities (Section 5.3.5, "Education and Awareness").

Approximately 25 percent of the western Joshua tree range in California is within the Local Responsibility Area for fire response (Figure 2-15). County and city fire departments and local fire districts have primary responsibility for preventing and suppressing fires in the Local Responsibility Area. Local fire departments generally serve developed areas and are primarily concerned with protecting the communities they serve. However, there are opportunities for CDFW to collaborate with local fire departments on fire management strategies that benefit western Joshua tree on private land.

2.5.2 Utilities and Special Districts

Approximately 0.2 percent of the western Joshua tree's range in California is within lands owned by the public utilities and special districts described below.

- Mountains Recreation and Conservation Authority is an open space district dedicated to the acquisition, preservation, and protection of open space wildlife habitat, and urban, mountain, and river parkland that is easily accessible to the public.
- Apple Valley Recreation and Park District provides recreation in the Town of Apple Valley.
- Hesperia Recreation and Park District provides parks and recreation facilities to the residents of the City of Hesperia and portions of the unincorporated areas of Oak Hills, Summit Valley, and Phelan.
- Antelope Valley Union High School District provides public education in the cities of Palmdale and Lancaster.

A long-lived western Joshua tree.
Source: National Park Service.

- Joshua Tree Park and Recreation District provides recreation for the residents of the unincorporated areas of Joshua Tree and neighboring communities of the Morongo Basin.
- Lancaster Cemetery District operates a cemetery that serves residents of the Antelope Valley.
- Littlerock Creek Irrigation District is a public water utility that provides water for agricultural use for the surrounding areas of Littlerock.
- Morongo Valley Community Services District is a community service district for parks, streetlights, and fire protection in Morongo Valley.
- Palmdale Water District is a public water utility that provides water within the City of Palmdale's planning area.
- Phelan Piñon Hills Community Services District provides water, parks and recreation, solid waste, and street lighting services in the desert foothills of the eastern San Gabriel Mountains in unincorporated San Bernardino County.
- Los Angeles Department of Water and Power is a municipal utility that provides water and electricity within the City of Los Angeles and several adjacent cities and communities in southwestern Los Angeles County.

In addition to the list above, there are many non-landowning special districts responsible for implementing public infrastructure projects within service areas that overlap the western Joshua tree range. Although not a comprehensive list, some of these special districts are Mojave Water Agency, Bighorn-Desert View Water Agency, Hi-Desert Water District, Joshua Basin Water District, Twentynine Palms Water District, Mission Springs Water District, and San Gorgonio Pass Water Agency. Many of the public infrastructure projects carried out by these special districts are state-mandated and/or related to public safety. Public agencies and publicly or investor-owned utilities were previously exempt from obtaining permits under the California Desert Native Plants Act for removal of western Joshua tree when acting in obligation to provide public service (Cal. Food & Agri. Code, § 80117). However, these utilities and special districts are now required to seek take authorization for removal of western Joshua tree under either CESA or WJTCA while western Joshua tree is a candidate species under CESA.

2.6 NONGOVERNMENTAL ORGANIZATIONS

Approximately 0.8 percent of the western Joshua tree's range in California is within lands owned or held in easements by the NGOs, which are described below.

- The Wilderness Land Trust is an NGO whose mission is to acquire and transfer private lands to public ownership to complete designated and proposed wilderness areas or directly protect wilderness values.

- The Transition Habitat Conservancy is a land trust whose mission is to protect transition zones and wildlife corridor ecosystems and their scenic, agricultural, and cultural resource values in the West Mojave Desert.
- The Wildlands Conservancy is an NGO whose mission is to preserve lands and provide programs for public recreation.
- The National Audubon Society is an NGO whose mission is to conserve and restore natural ecosystems, focusing on birds, other wildlife, and their habitats.
- The Mojave Desert Land Trust is an NGO that acquires and permanently protects ecologically significant land throughout the California desert, with a focus on parcels within national parks and preserves, wilderness areas, areas of critical environmental concern, and wildlife corridors.
- The Boys and Girls Club of America is an NGO that provides programs and services for young people, including after-school programs, summer camps, sports and recreation programs, academic enrichment programs, and character development programs.
- The Sequoia Riverlands Trust is an NGO that conserves natural and agricultural lands of the Southern Sierra Nevada and San Joaquin Valley.
- The Tejon Ranch Conservancy is an NGO that works to preserve, enhance, and restore the native biodiversity and ecosystem values of the Tejon Ranch and Tehachapi Range.
- The Wildlife Heritage Foundation is a statewide, nongovernmental land trust that is currently preserving over 100,000 acres of ecologically significant land and water resources.
- The Native American Land Conservancy is an NGO that acquires, preserves, and protects off-reservation sacred sites in California's ancestral territories. Western Joshua trees are present on Coyote Hole and the Bob Rabbit wildlife corridor, which are owned and managed by the Native American Land Conservancy.
- The Antelope Valley Conservancy is an NGO whose mission is the acquisition and stewardship of native habitats, watershed resources, and lands that offer community value.

These NGOs offer important planning influences because they were established primarily to protect land or provide recreation opportunities and conservation activities. The Conservation Plan presents an opportunity for CDFW to work with these nongovernmental conservancies and trusts to acquire land for conservation or implement additional protective measures on existing conservation lands for the benefit of western Joshua tree. Such measures could potentially also be applied to conservation easements on lands NGOs manage as easement holders.

3 TRADITIONAL VALUES AND USES OF WESTERN JOSHUA TREE BY CALIFORNIA NATIVE AMERICAN TRIBES

> *"TEK is an accumulating body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (human and non-human) with one another and with the environment."*
> *-Rinkevich et al. 2011*

This chapter provides an overview of California Native American tribes' (Tribes) traditional uses of Joshua trees (i.e., western Joshua tree and/or eastern Joshua tree [*Yucca jaegeriana*]), as well as traditional values and collective experience and knowledge, known as Traditional Ecological Knowledge (TEK), related to Joshua trees. TEK has been defined in many different ways as part of federal or state policy making, often based on consultation with Native American tribes. USFWS describes TEK as "evolving knowledge acquired by Native and local peoples over hundreds or thousands of years through direct contact with the environment. . . TEK is an accumulating body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (human and non-human) with one another and with the environment. TEK encompasses the world view of Native people which includes ecology, spirituality, human and animal relationships, and more" (Rinkevich et al. 2011). TEK is collectively shared and transmitted and can take several forms, including stories, songs, folklore, proverbs, cultural values, beliefs, rituals, community laws, local language, and agricultural practices, including the development of plant species and animal breeds (Secretariat of the Convention of Biological Diversity 2021). TEK may embody aspects of spirituality, ceremonies, health, vitality, human and wildlife relationships, ecology, and more. It also guides habitat and plant management that complements non-native scientific understanding of agriculture, fisheries, health, horticulture, forestry, cultural identity, and more (Rinkevich et al. 2011). While the origin of TEK is from previous generations, its application now is a part of contemporary landscape management science.

The sources used to inform the chapter include information gathered from tribal engagement and consultation with individual California Native American tribes during the preparation of the Conservation Plan, as described in Section 1.3.2, “California Native American Tribes.” Information referenced in this chapter that was received from a Tribe has been approved by the providing Tribe for public disclosure. Additional sources used to inform the chapter include available secondary materials related to California Native American tribes and their uses of Joshua tree. The secondary materials that help inform this chapter are not exhaustive sources in the published literature, and they may not necessarily provide a complete representation of California Native American tribes and their use of Joshua tree. Only published literature, references, and materials that are currently and publicly available were consulted as secondary sources. Tribal names and ethnographic/linguistic Native American groups are denoted as they were used in each article and may not coincide with, or be representative of, modern Tribe names. If a Tribe or Tribes present new information or alternative representations of the information they would like included in this chapter, CDFW will work to incorporate the information into future updates of the Conservation Plan.

Source: Native American Land Conservancy.

Most published literature about California Native American tribes’ use of Joshua tree does not distinguish between eastern Joshua tree and western Joshua tree because the taxonomic distinction of the two species occurred only recently. For purposes of this chapter, the general term “Joshua tree” is therefore used. In addition, the more generalized “yucca” naming convention is found mostly in early historical and anthropological references, where discussion of “yucca” included Joshua tree, as well as a broader group of shrub-like yucca plant species, such as banana yucca (*Yucca baccata*), chaparral yucca (*Hesperoyucca whipplei*, which was previously *Yucca whipplei*), and Mojave yucca (*Yucca schidigera*). Thus, this chapter uses the term “yucca” or “yucca species” when information is not known to be specific to Joshua tree.

As stated in Section 1.3.2, the collaborative engagement process with California Native American tribes is ongoing and will evolve over time. The information in this chapter will be updated with additional tribal consultation and input shared and approved by Tribes in future versions of the Conservation Plan. California Native American tribes that requested to review a preliminary draft of the Conservation Plan prior to CDFW submittal to the Commission were provided the opportunity. Tribes may provide comments on that preliminary draft and may also provide comments on the publicly released draft Conservation Plan through the review process outlined on the Commission's website. Tribal input will continue to be welcomed at any time by CDFW during Conservation Plan implementation (which is called for in Management Action TCM 1, "Establish Co-Management Principles" in Section 5.2.3, "Tribal Co-Management"), and for incorporation into future Conservation Plan updates.

3.1 CALIFORNIA NATIVE AMERICAN TRIBES COLLABORATING ON THE CONSERVATION PLAN

CDFW notified and invited input from 170 federally and non-federally recognized tribal contacts and representatives during preparation of the draft Conservation Plan. The following Tribes have met with or provided information to CDFW or Native American Land Conservancy (NALC), some of which is incorporated into the Conservation Plan. As additional California Native American tribes provide contributions to the Conservation Plan, they will be added to the following list in future Conservation Plan updates.

- Agua Caliente Band of Cahuilla Indians (ACBCI)
- Agua Caliente Tribe of Cupeño Indians (ACTCI)
- Cahuilla Band of Indians (Chahuilla)
- Fernandeño Tataviam Band of Mission Indians (FTBMI)
- Fort Independence Indian Community of Paiute Indians (FIICPI)
- Fort Yuma Quechan Indian Tribe (FYQIT)
- Kern Valley Indian Community (KVIC)
- Kwaaymii Laguna Band of Indians
- Lone Pine Paiute-Shoshone Tribe (LPPSR)
- San Manuel Band of Mission Indians (SMBMI)
- Tübatulabals of Kern Valley (Tübatulabals)
- Tule River Indian Tribe

3.2 TRIBAL VALUES RELATED TO, AND USES OF, JOSHUA TREE

This section is based on information contributed by California Native American tribes in meetings held during the development of the Conservation Plan and published literature. Descriptions of values and uses provided by secondary materials are sometimes referenced in the past tense because they originate from previously documented sources that interpret or describe Native American values and uses. Tribes have verified and approved the use of secondary material cited in this section during meetings with CDFW and NALC for the Conservation Plan, and additional source material may be identified by Tribes in the future.

Joshua tree is called many names by California Native American tribes that have interacted with the plant (Collins et al. 2022). Yucca species, such as Joshua tree, have been documented for their use in traditional materials and for culinary and medical purposes in the Mojave Desert and throughout the rest of Joshua tree's range in California (Collins et al. 2022). In addition, silhouette images of Joshua trees carry cultural significance in some traditional stories (FTBMI, pers. comm., 2024), have significant historical value as part of the traditional cultural landscape, and serve as witnesses to the pre-colonial contact age (FIICPI, pers. comm., 2024).

An ethnobotanical study by Stoffle et al. (1990) analyzed holistic conservation theory and plant-specific interviews with representatives from Western Shoshone, Southern Paiute, and Owens Valley Paiute Tribes from the Mojave Desert and Great Basin to develop a ranking system of cultural significance of various plants. Importance given to plants was based on the number of plant elements used by Tribes. Due to the various tribal uses of Joshua tree for its seeds, flowers, roots, and fibers, Joshua tree ranked high in overall cultural importance across the represented Tribes in the study within Joshua tree's range in California (Stoffle et al. 1990). Similarly, Tribes in Los Angeles and in the southeastern desert region identified Joshua tree woodlands in southern California as culturally important, where Joshua trees were used for basketry material, culinary purposes, and artistic applications, such as dye for baskets, ceremonial purposes, and tattoo ink (Fortier 2008, 26).

3.2.1 Culinary and Medicinal Uses

Yucca species have been and continue to be an important food source since the earliest traditional cultures of the Southwest. Fruits of Mojave yucca, Joshua tree, and chaparral yucca were gathered for food among the Tribes of southern California, northwestern Arizona, and southern Nevada, (Bell and Castetter 1941, 22 and 63). Although the fruit of Mojave yucca (reported with the older name *Yucca mohavensis* by Bell and Castetter [1941]) could be eaten dry, most people preferred it cooked after drying and made into a drink (Bell and Castetter 1941, 18). Particularly important to the Chemehuevi, Cahuilla, and Serrano culturally affiliated Tribes' diets, "various species of yucca fruits, mescal, and seeds were collected by the women of the Tribe" (Stickel et al. 1980, 98; Braun and Gates 2013, 63 and 71). Basket lids were sealed with greasewood (*Adenostoma fasiculata*) gum for storage of seeds, which allowed them to be kept indefinitely (Braun and Gates 2013, 63). Food stores were frequently cached in caves or rock crevices; these "caches were important for the Chemehuevi when they maintained a more nomadic existence because they allowed the Chemehuevi the freedom to venture to other areas without having to be concerned with their food supply when they returned" (Braun and Gates 2013, 63). Processed edible parts of Joshua tree would be kept for long periods in storage areas (FTBMI, pers. comm., 2024).

Many parts of yucca and agave plants are used for culinary purposes, such as the yucca plant's flower buds, fruits, roots, bulbs, seeds, and stems (Bean and Saubel 1972; Eckhardt and Hatley 1982; Stoffel et al. 2022). The plants are a year-round staple, producing several types of traditional foods for Native Americans of the Mojave Desert, Great Basin, and Colorado Plateau (Stoffle et al. 2022, 23). Collecting parts of the yucca plant is purposefully timed to obtain nutritional value and optimize the quality of yucca material while contributing to the long-term productivity of the plant (Anderson 2005, 265). For example, Anderson reports that "the young flower stalks of [chaparral yucca]… and basal portions of the plants, with leaves removed," were harvested in late spring and "eaten after being roasted in a pit oven with hot stones" (Anderson 2005, 268).

California Native American tribes have noted that the preparation of Joshua tree to be consumed is a major social event (Stoffle et al. 2022, 24). The Fernandeño Tataviam Band of Mission Indians shared that yucca provided the most reliable and plentiful source of energy available to their ancestors; the root and stalk would be cooked slowly prior to being consumed (FTBMI, pers. comm., 2024). The seeds contributed important nutritional value, being especially high in fiber, oil, and sugar (Webber 1953). Seeds were finely ground and either eaten raw or cooked in the form of mush by Tribes in Southern California (Palmer 1878, 647). Immature seed pods were also used as food in early spring and were boiled down or cooked in roasting pits (Louderback et al. 2013). The seed pods of yucca and agave species have been observed in roasting pits dating back at least 4,000 years throughout the Southwest (Price et al. 2009, 18; Louderback et al. 2013, 285). Many sources state that gathering the flowers of Joshua tree and blossoms of other yucca species occurs in early spring (Bean and Saubel 1972; Stickel et al. 1980, 89; Eckhardt and Hatley 1982, 37; Tübatulabals, pers. comm., 2024). Joshua tree flowers and blossoms are eaten fresh or pickled (Tübatulabals, pers. comm., 2024). Flower buds that are cooked are similar in flavor to artichokes (Anderson 2005, 245). Fortier (2008) wrote that sugar from the flowers of Joshua tree has been used as an addition to the ground seeds of four-wing saltbush (*Atriplex canescens*) to create a pinole (roasted corn or maize) drink. In addition, yucca moth larvae, which develop within the fruits of yucca plants, are considered to be a special culinary treat (Stoffle et al. 2022, 23).

Published literature provides limited insight into the medicinal properties and uses of yucca species; however, medicinal TEK is an area of cultural tradition that is strongly associated with oral storytelling and generational knowledge transfer through hands-on education from elders to youth. Information regarding the uses of yucca species for healing purposes will be incorporated into the Conservation Plan in the future, to the extent available. Secondary sources noted that the root of the Joshua tree, "especially the red part," has a medicinal effect similar to greasewood as an antiviral and anti-inflammatory (Stickel et al. 1980, 223). Garcia and Adams Jr. (2009) note that chaparral yucca was used as a medication for skin irritations among the Kumeyaay Tribe.

3.2.2 Material Uses


Dried Joshua tree leaves with woven baskets in background. Source: Native American Land Conservancy.

Material uses of Joshua tree and other yucca species have been and continue to be essential for many functions of the California Native American tribes that inhabit and trade within or near Joshua tree habitat. Yucca species have been documented as being used for pole binding, cordage for building structures, carrying straps, and soap (Barrows 1900, 36–37, 47; Braun and Gates 2013, 135), with the leaves in particular being used for binding and cordage (Hedges 1967, 47–48; Wilken 2012, 136), and dried trunks being used to make sandals (Wilken 2012, 136–137). Yucca cord is often two-strand and twisted in a right spiral, with the fur strips being twisted about the cord base in a left-to-right spiral (Bell and Castetter 1941, 43). Seasonal variation in environmental conditions influence what parts of the Joshua tree might be better suited for gathering according to the type of textiles created from the plant (Anderson 2005, 130). Native Americans of the Mojave Desert pounded leaves of Joshua trees and other yucca and agave plants to expose fibers, which after drying were made into cordage (Stoffle et al. 2022, 23). The spines were used as needles for sewing, tattooing, and separating fibers when making baskets, and as awls when a handle was added (Stoffle et al. 2022, 23). Joshua tree fibers form a natural, elastic textile (Bean and Saubel 1972) used for rope, basket making, sandals, hairbrushes, paint brushes, bowstrings, and netting (Churchill et al. 1879; Barrows 1900, 47; Bean and Saubel 1972). Younger Joshua trees have more elastic fibers than older trees and were preferred for some material construction (Diguet and Poisson 1896).

The roots of Joshua tree are harvested for dyes and basket weaving purposes (FYQIT, pers. comm., 2024; Tübatulabals, pers. comm., 2024). The long roots were frequently used by Southern California desert Tribes, including the Kawaiisu, Kitanemuk, Owens Valley Paiute, Tübatulabals of Kern Valley, and Timbisha Shoshone (formerly known as the Panamint Shoshone) for making coiled baskets and utensils (Coville 1892, 358; Voegelin 1938, 30; Bell and Castetter 1941, 35; Zigmond 1978, 201; McDaniel et al. 2012, xvi, 2-8 through 2-9; Anderson 2018). The Joshua tree roots were removed selectively and collected in batches to allow rest periods for the plants and to not deplete the Joshua trees in a localized area (Anderson 2005, 191). The Tübatulabals of Kern Valley advise that roots should not be dug up in sections longer than 18 inches (Tübatulabals, pers. comm., 2024). The red color of the root of Joshua trees is what makes them desirable for basket weaving and creating patterns, such as lightning bolts for the Kitanemuk basket makers (Anderson 2005, 43). The roots have been documented to create black, brown, light yellow, and red dyes, depending on the season they are harvested (Steward 1933, 271; Voegelin 1938, 30; Murphey 1959). The Paiute preferred roots of yucca from plants above 4,000 feet in elevation because the roots had better color than those from lower elevations (Anderson 2005, 53). Among the Kawaiisu and Tübatulabal, the roots were used in making coiled baskets and basket caps, and the fibers were used for making sandals (Voegelin 1938, 30; Zigmond 1978, 201; McDaniel et al. 2012, xvi, 2-8 through 2-9). Parts of the Joshua tree could also be used to make grass skirts and shoes (FYQIT, pers. comm., 2024). The Kawaiisu additionally used Joshua tree when making twined and burden baskets (Zigmond 1981, 201).

Woven baskets with intricate patterns are made with Joshua tree leaves and roots. A bundle of roots on the right side is the source of the dark colors to make the patterns in the baskets.

Source: Native American Land Conservancy.

3.3 TRADITIONAL ECOLOGICAL KNOWLEDGE FOR CONSERVATION

Reestablishing and healing severed relationships with the earth through activities, such as gathering, crafting, and using products from nature, are important cornerstones to continue to keep California Native American relations with nature alive, rich, and sustainable (Anderson 2005, 338). TEK is a direct connection between Native Americans and the environment that is important for conservation of nature. Spiritual connections and belief systems guide Native American landscape management throughout California, and consultation now affords the ability for Tribes to articulate aspects of TEK that include spiritual elements that may be new to private landowners, local, state, and federal agencies (FIICPI, pers. comm., 2024). As such, it is critical that landowners and agencies take time to consider these new aspects of environmental protection and incorporate them into their plans, policies, and guidance (FIICPI, pers. comm., 2024). Native Americans continue to have highly participatory relationships with nature, which may be intertwined within their Creation Story. Payahuunadü, the Land of Flowing Water, is considered a living church and the Chuk-ke-shuv-ve-wḗ-tah's (Oak Creek or Fort Independence Indian Reservation's) Creation Story includes ancestral lands, and their caring for, that extend beyond the artificial boundaries of their reservation (FIICPI, pers. comm., 2024). Practicing TEK, which is an ongoing cumulative body of knowledge, practices, and beliefs passed on through generations by Native Americans, is one way to heal these severed relationships with the earth and to achieve the Conservation Plan's vision for western Joshua tree.

As described in published literature and current tribal input, Joshua tree remains highly valued for its cultural significance. Landscape-level management was the driving force behind the continued livelihood of most Native Americans in Southwestern California, including in the Mojave Desert and Joshua tree woodland habitat (Anderson 2005, 160–165; Stoffel et al. 2022, 23). Tribes hold landscape-level management that extends beyond the boundaries of reservations and holistic views of culture and biology as key to managing a species (Stoffle et al. 2022; FIICPI, pers. comm., 2024; KVIC, pers. comm., 2024). The Tübatulabals of Kern Valley have highlighted the importance of protecting other native species in Joshua tree's range in California to properly care for the ecosystem (Tübatulabals, pers. comm., 2024). Fort Independence Indian Community of Paiute Indians stress the importance of engaging with all Tribes that have Joshua trees as part of their traditional cultural landscape to better understand how to manage and treat the trees in their cultural ways (FIICPI, pers. comm., 2024). Tribes are working with CDFW to identify actions that benefit multiple ecologically related species. For example, yucca moth and yucca have a mutualistic, ecological relationship and are dependent on each other for reproduction and long-term survival (see Section 4.2, "Wildlife Values and Ecological Function of Western Joshua Trees," for more details).

Tribal members help dig a hole for a demonstration of a western Joshua tree transplanting.
Source: Native American Land Conservancy.

Native American landscape-level management bolsters plant and wildlife populations through actions that encourage the growth of culturally important plant species, which includes Joshua tree and yucca species (Zigmond 1981; Anderson 2005, 191 and 338). Harvesting the tender, immature flower stalks of yucca species before flowering may have stimulated vegetative reproduction through a hormonal change in the plants, forcing them to produce "pups"—small plants attached to the parent plant, which would create additional plants in a desirable area (Anderson 2005, 130 and 269). Pruning and cutting plants are strategically done to enhance plant growth as well (Anderson 2005, 2018). Native Americans have known and understand that among desert plants, propagation is dependent on microhabitats and nurse plants to shelter seedlings, which affect the generation and distribution of Joshua tree plant communities (Brittingham and Walker 2000; Tübatulabals, pers. comm., 2024).

There are limited areas of Joshua tree woodlands, and tribal representatives have remarked on the importance of these areas for ethnobotanical resources (Stoffle et al. 2022, 24). Joshua trees provide key habitat for other wildlife and plant species important to California Native American tribes (Stoffle et al. 2022, 23). In a series of interviews with consulting tribal representatives, one representative noted that wildlife live in the Joshua tree woodland; therefore, any disturbance could lead to the destruction of the habitat, and thus, many wildlife would die or leave the valley (Stoffle et al. 2022, 24).

Native Americans have skillfully gathered plants over long periods in different habitats without depleting plant populations to the point of extinction (Anderson et al. 1997, 33). The Fort Independence Indian Community of Paiute Indians indicate they wouldn't take western Joshua tree unless it was critical and beneficial for our people overall (FIICPI, pers. comm., 2024). A representative from the Tribe further explained that living in excess is a threat to the land and specifically the western Joshua tree species and does not align with the Tribe's values to take only what is needed from the land (FIICPI, pers. comm., 2024). According to *Tending the Wild* author, M. Kat Anderson, "Removing key elements from nature means the possibility of ecological degradation. . . . Removing elements from natural systems with thoughtfulness and respect, one [begins to] address the complex interplay between resource production and the conservation of biological diversity. Judiciously harvesting, crafting, and using products from nature continue to be the three cornerstones that keep Indian relationships with nature alive, rich, and sustainable." (Anderson 2005, 338).

Source: Native American Land Conservancy.

Regular Native American application of low-intensity, periodic fire across landscapes in California to manage vegetative communities and stimulate desirable plant growth is well-documented (Blackburn and Anderson 1993; Keeley 2002; Stewart 2002; Vale 2002; Anderson 2018; Roos et al. 2021; Schelenz 2022). The Kern Valley Indian Community and the Agua Caliente Tribe of Cupeño Indians addressed the topic of burning for management of Joshua trees. Both Tribes noted that there was not a tradition of cultural burning for the management of Joshua trees or the Joshua tree woodland community because there had traditionally not been a reason to burn it (ACTCI, pers. comm., 2024; KVIC, pers. comm., 2024). However, both noted that the environment has changed and believe that burning to reduce fuel loads containing invasive species, and therefore reducing fire intensity, is presently needed. The Kern Valley Indian Community has firsthand experience with Joshua trees and wildland fire and note that in their community, where a fire burned in 2016, Joshua trees were killed and no regrowth from the crowns was observed in areas on the flats where the fire burned more intensely. However, the Kern Valley Indian Community observed Joshua trees have been regrowing from the roots on slopes where the fire did not burn as intensely (KVIC, pers. comm., 2024). The Agua Caliente Tribe of Cupeño Indians' Tribal Chair indicated there may be potential for Joshua tree germination in an environment with fire ash and biochar (ACTCI, pers. comm., 2024).

Although California Native American tribes have noted that cultural burning is used less often in the desert than in other plant communities, there are still documented uses of periodic fire being employed by Native Americans in Southern California. For example, among the Kumeyaay of Southern California, yucca and agave seeds were planted immediately before burning a slope, and germination was induced by the heat of fire (Stoffle et al. 2022, 23). These stimulated plants did not provide immediate materials and would take several years to mature to usable size, providing evidence of long-range plant husbandry planning by the Tribes (Stoffle et al. 2022, 23).

Many southwestern plant species are transplanted across the desert by Native Americans to areas of importance to increase the availability for traditional purposes (Anderson 2005, 143 and 160–165; Stoffle et al. 2022, 23). The density observed in Joshua tree woodlands suggests that Joshua trees were stimulated to grow in the desert, especially near culturally important sites (Stoffle et al. 1989, 98; Stoffle et al. 2022, 23). There are documented accounts of Native Americans saving the seeds of agave, yucca, and desert fan palms and planting them in specific locations within the Mojave Desert, demonstrating the integral nature of plant cultivation in Native American cultural systems (Stoffle et al. 1989, 129 and 138; Anderson 2005, 161; Stoffle et al. 2022, 23).

Western Joshua tree being watered after it has been transplanted by tribal members.
Source: Native American Land Conservancy.

Native Americans skillfully gather plants over long periods in different habitats to manage the health of ecosystems while alternatively ensuring key cultural use species are readily available. This requires knowledge of each species' life characteristics (Anderson et al. 1997, 33). Joshua tree is abundantly present and has a wide habitat range in the desert Southwest because of this skillful knowledge and practice. The sustainability of Native American practices allows natural vegetation and human inhabitation of the landscape to coexist. Integration of California Native American tribes' traditional cultural uses and TEK for landscape-level health is crucial for land management strategies pertaining to conservation of western Joshua tree.

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4 SUMMARY OF RESOURCE CONDITIONS

The starting point for assessing western Joshua tree conservation needs and developing management actions is understanding the existing range and distribution, habitat requirements, ecology, population trends, and key stressors and threats to the species. Detailed information on resource conditions related to western Joshua tree is available in CDFW's March 2022 status review of western Joshua tree (CDFW 2022). This chapter summarizes the resource conditions of western Joshua tree from the status review and additional information and analysis not available when the status review was finalized. Information from a summary of western Joshua tree resource conditions prepared by USFWS (2023) is also included.

4.1 WESTERN JOSHUA TREE BIOLOGY AND ECOLOGY

4.1.1 Range and Distribution

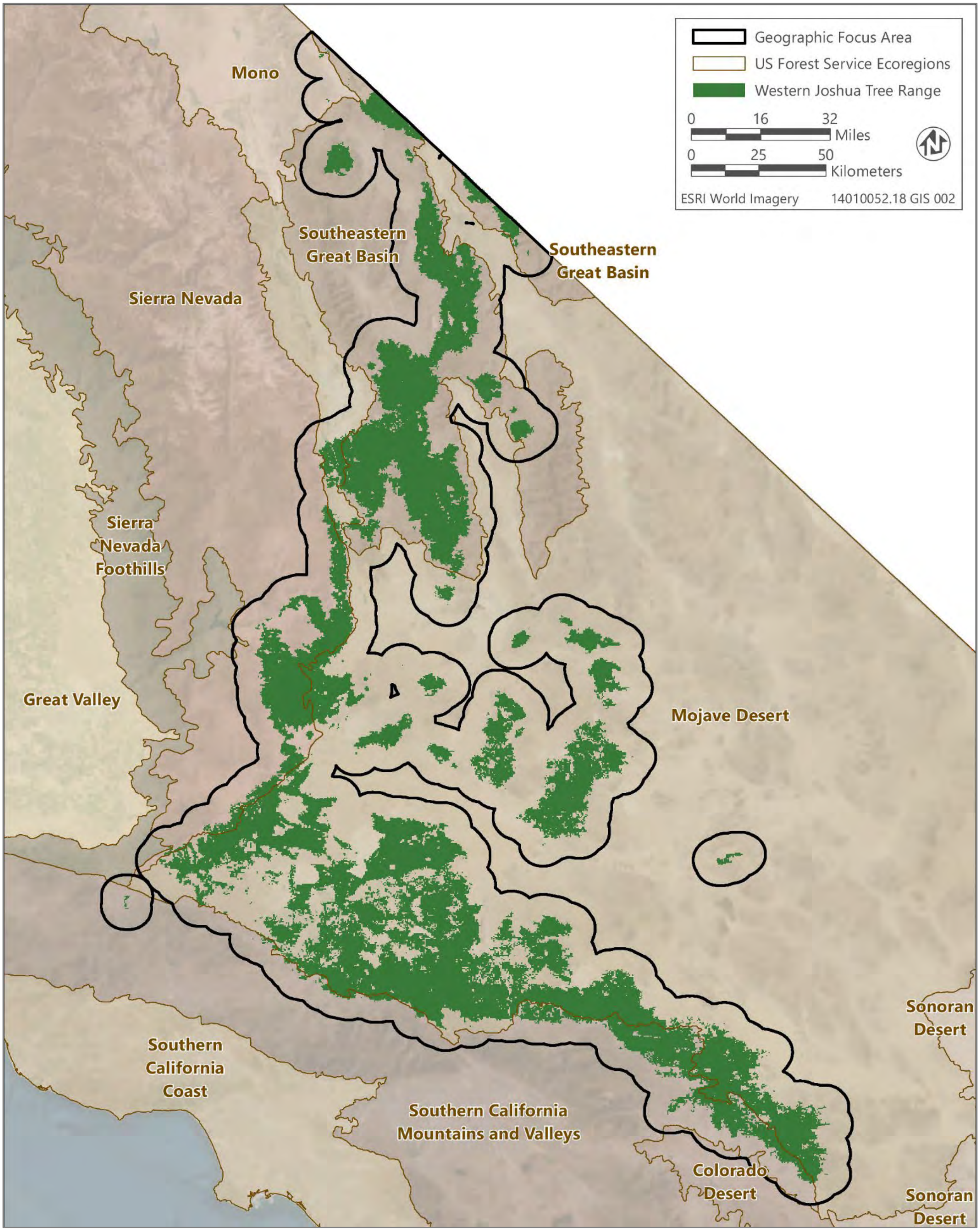
> *"It's the Joshua tree's struggle that gives it its beauty."*
> *— Jeannette Walls, The Glass Castle*

The western Joshua tree range and distribution in California are described in this section in reference to the ecoregions where they occur. Ecoregions are delineated based on biotic factors (i.e., living parts of an ecosystem) and environmental factors that determine the structure and function of ecosystems. Environmental factors include climate, physiography, water, soils, air, hydrology, and natural communities (ECOMAP 1993).

Western Joshua tree is present in discontinuous populations, mainly within the western Mojave Desert and extending north and east into the southwestern Great Basin across various ecoregions. The southern portion of the range extends south into the Southern California Mountains and Valleys ecoregion (Figure 4-1). The western portion of the range extends into the Sierra Nevada ecoregion and into a limited portion of the Sierra Nevada Foothills ecoregion. Western Joshua tree is often noted to be abundant in ecological and sometimes elevational transition zones along the border of the Mojave Desert ecoregion. The southern extent of the species is east of Indio Hills, California, near Rockhouse Canyon and north of Fargo Canyon, and the western extent is an isolated population in Los Angeles County at the junction of Orwin Way Road and Quail Canyon Motocross Road near Caswell (Esque et al. 2023). The northern and eastern extents of the range are located just south of Tonopah, Nevada (Esque et al. 2023), and Tikaboo Valley, Nevada (Rowlands 1978; Smith et al. 2021), respectively, which are not represented in Figure 4-1 because only the California portion of the range is shown. The northern extent of the species in California is likely in the southeastern corner of Mono County, between Wildhorse Creek and Furnace Creek, which are north of Deep Springs, California, and south of Dyer, Nevada (Esque et al. 2023).

The Conservation Plan addresses the known portion of the western Joshua tree range in California within Riverside, San Bernardino, Los Angeles, Kern, Inyo, and Mono counties, and the small portions of the geographic focus area in Tulare and Ventura counties (Figure 4-1). Substantial stands of western Joshua tree have been reported at elevations ranging from approximately 750 to 2,100 meters (2,460 to 6,890 feet) above sea level (Rowlands 1978). The data used for the mapping developed by Esque et al. (2023) (Figure 4-1) show western Joshua tree present at approximately 585 meters (1,919 feet) up to approximately 2,675 meters (8,776 feet). The range of western Joshua tree in California has been estimated to encompass a total area of approximately 13,088 square kilometers (5,053 square miles) across six ecoregions (Table 4-1) (Esque et al. 2023).

Western Joshua tree has a sprawling, diffuse pattern of distribution, particularly compared to eastern Joshua tree (*Yucca jaegeriana*) (Figure 1-1 in Chapter 1, “Introduction”) (Esque et al. 2023). High densities of western Joshua tree are present along the southern end of the species’ range, separated by large gaps where the species is absent, particularly in the southwestern portion of the range. These conspicuous gaps in the species’ distribution are likely a result of urban development, fire, and other cumulative disturbances (Esque et al. 2023). In California, most of the western Joshua tree range is within the Mojave Desert ecoregion and the Southeastern Great Basin ecoregion (Table 4-1; Figure 4-1). Most high elevation portions of the western Joshua tree range in California are in the Southeastern Great Basin ecoregion. Some high elevation portions of the species range in California are also in the Sierra Nevada and Southern California Mountains and Valleys ecoregions.



Sources: Esque et al. 2023; USFS 2024; adapted by Ascent in 2024.

Figure 4-1 California Ecoregions and Range of Western Joshua Tree in California

Table 4-1 Western Joshua Tree Range in California by Ecoregion and Elevation

Ecoregion	Elevation Class[1]	Area in Square Kilometers (sq mi)	Percent of Range
Mojave Desert	low elevation	6,024.3 (2,326.0)	46.0
	middle-low elevation	1,809.2 (698.5)	13.8
	middle-high elevation	1.8 (0.7)	<0.1
	Mojave Desert total	**7,835.2 (3,025.2)**	**59.9**
Southeastern Great Basin	low elevation	10.4 (4.0)	0.1
	middle-low elevation	1,265.8 (488.7)	9.7
	middle-high elevation	1,712.5 (661.2)	13.1
	high elevation	209.6 (80.9)	1.6
	Southeastern Great Basin total	**3,198.4 (1,234.9)**	**24.4**
Sierra Nevada	low elevation	164.1 (63.4)	1.3
	middle-low elevation	826.1 (319.0)	6.3
	middle-high elevation	153.4 (59.2)	1.2
	high elevation	0.3 (0.1)	<0.1
	Sierra Nevada total	**1,143.9 (441.7)**	**8.7**
Southern California Mountains and Valleys	low elevation	85.3 (32.9)	0.7
	middle-low elevation	581.0 (224.3)	4.4
	middle-high elevation	232.1 (89.6)	1.8
	high elevation	7.3 (2.8)	0.1
	Southern California Mountains and Valleys total	**905.8 (349.7)**	**6.9**
Mono	middle-high elevation	2.8 (1.1)	<0.1
	Mono total	**2.8 (1.1)**	**<0.1**
Sierra Nevada Foothills	middle-low elevation	0.7 (0.3)	<0.1
	Sierra Nevada Foothills total	**0.7 (0.3)**	**<0.1**
Total		**13,086.8**	**100.0**

Notes: m = meters; sq mi = square miles.

[1] The elevational range of western Joshua tree was divided into four equal range classes: low elevation: 585–1,105.9 meters (1,919–3,628 feet); middle-low elevation: 1,106–1,625.9 meters (3,629–5,334 feet); middle-high elevation: 1,626–2,145.9 meters (5,335–7,040 feet); high elevation: 2,146–2,675.9 meters (7,041–8,780 feet).

Source: Esque et al. 2023; USFS 2024; compiled by Ascent in 2024.

GENETIC VARIATION

Genetic variation within a species can allow it to adapt to environmental change. Adaptive genetic variation directly affects a species' ability to respond to environmental factors, such as heat stress and drought, highlighting the importance of conserving adaptive genetic variation within species ecotypes (i.e., subgroups of a species that are genetically distinct), compared to conserving overall genetic variation within the species (Smith et al. 2023). A substantial amount of scientific attention has been directed toward understanding the coevolution of western Joshua tree, eastern Joshua tree, and their obligate pollinating moths. Much of this attention is focused on a small area in Tikaboo Valley, Nevada, where the two species of Joshua tree co-occur and hybridization has been observed. Western Joshua tree and eastern Joshua tree have a moderate degree of genetic differentiation and diverged approximately 100,000 to 200,000 years ago, which is considered a relatively recent divergence (Smith et al. 2021). The work by Smith et al. (2021) supports the conclusion that Joshua trees fall into two distinct groups that correspond with western Joshua tree and eastern Joshua tree. Smith et al. (2021) indicate there is genetic diversity among populations of western Joshua tree, particularly among populations in the southern and western extent of its range, possibly driven by adaptations to different climates. The study identified three genetically distinct groups of western Joshua tree across five populations that were sampled within the range in California, which are all located in the Mojave Desert ecoregion, although two populations that are in genetically distinct groups are less than 2 miles from the Southern California Mountains and Valleys ecoregion. Smith et al. (2023) suggested these genetically distinct populations may respond differently to climate change, in which case, identifying and protecting populations that are better adapted to future climate conditions could potentially improve conservation of the species. Further genetic analysis of western Joshua tree is currently in review and will be incorporated into the Conservation Plan in a future update.

4.1.2 Habitat Requirements

Western Joshua trees live in a variety of environments in a wide range of elevations, landforms, soil types, and vegetation communities. Research conducted by Esque et al. (2023), which addressed the entire range of western Joshua tree, showed that climatic variables are typically more accurate predictors of western Joshua tree presence than topography and vegetation; however, topography and vegetation may still be important factors for western Joshua tree survival.

CLIMATE

Western Joshua trees rely on precipitation events to augment soil moisture as a water source. Unlike mature Joshua trees, juvenile Joshua trees and seedlings do not have access to deep groundwater and are unable to store much water in their tissues. Duration of droughts and high precipitation periods are likely important factors in determining where western Joshua tree can successfully reproduce and survive. Where western Joshua trees are found, precipitation is received as rain and less frequently as snow, with most precipitation occurring between

October and April (Hereford et al. 2004). Annual precipitation for western Joshua tree is largely restricted to the winter months because of the species' western position in the Mojave precipitation gradient (Esque et al. 2023). Precipitation across the Mojave Desert region is highly variable from year to year and oscillates between wetter and drier conditions within multiyear and multidecade timescales. The soil moisture requirements of western Joshua tree likely vary depending on factors including life history stage, soil texture, ambient temperatures, local topography, elevation, and the presence and cover of other plants.

Source: Jeb Bjerke, California Department of Fish and Wildlife.

Species distribution modeling efforts by Esque et al. (2023) have revealed the environmental factors with the greatest influence on predicting western Joshua tree presence: mean annual temperature (defined as the average of the monthly temperature averages for the climatic normal period 1980–2010), temperature seasonality (standard deviation [i.e., measure of variation in data] of the monthly mean temperatures), precipitation seasonality (variation in monthly precipitation totals for the normal period 1980–2010), and summer precipitation (average total precipitation received from May through October, based on the climatic normal period 1980–2010). Other predictive factors for western Joshua tree presence, in order of importance, are annual heat/moisture index (mean annual temperature divided by mean annual precipitation), winter minimum temperature (average minimum temperature from December through February based on the climatic normal period 1980–2010), precipitation ratio (ratio of summer to winter precipitation), and mean annual precipitation (average annual precipitation during the climatic normal period 1980–2010).

TOPOGRAPHY AND SOILS

Western Joshua trees are found on a variety of landforms in the Mojave Desert and Great Basin ecoregions, including gentle alluvial fans, bajadas, flats, ridges, mesas, and gentle to moderate slopes, often near the bases of mountains (Huning and Petersen 1973; Thomas et al. 2004; Gucker 2006), although at higher elevations, the species can also be found on steep slopes at lower densities (Esque, pers. comm., 2022, cited in USFWS 2023). The greatest densities of Joshua trees may be found on well-drained sandy to gravelly alluvial fans. Where western Joshua tree is less common, it is likely restricted to areas with sufficient groundwater, such as large sand dunes or groundwater drainages (Charlton and Rundel 2017).

Because water availability limits western Joshua tree survival and reproduction, the soil's water-retention capacity is likely important for the species. Western Joshua trees have been reportedly found more frequently on soils with bimodal textures (i.e., various sized soil particles) with both coarse sands and fine silts that facilitate soil moisture retention (Huning and Petersen 1973; Sawyer et al. 2009). Soil moisture is an important factor for western Joshua tree soil habitat. When not present in sufficient quantities, it can be a limiting factor to western Joshua tree distribution. Joshua tree habitat generally contains old alluvial rocks of igneous rather than sedimentary origin and soils that are coarse sands, very fine silts, gravel, or sandy loams (Rowlands 1978; Sawyer et al. 2009). Western Joshua tree appears unable to grow well in places with insufficient soil moisture available, such as in areas where soils have a high clay content or high volumes of coarse particles (Huning and Petersen 1973; Borchert 2022), or where the depth to bedrock is less than 1 meter (3.3 feet) (Huning and Petersen 1973). Western Joshua tree could grow in areas that collect water due to topography, subsurface bedrock, and soil structure that may otherwise be too hot or too dry, and such areas could provide important refugia for the species in the future. Therefore, water availability in soil is an important abiotic factor (i.e., nonliving part of an ecosystem) for western Joshua tree survival.

In addition, soil biotic factors play a role in intact western Joshua tree habitat, which typically has biological soil crusts (i.e., biocrusts) (Belnap et al. 2001). Biocrusts are soil surface layers that include bacteria, cyanobacteria, algae, mosses, liverworts, fungi, or lichens and can be major components of undisturbed desert ecosystems (Belnap et al. 2001). Biocrusts add diversity to the ecological system, limit soil erosion, increase accumulation of soil organic matter and nutrients, and can either positively or negatively interact with vascular plants (Bowker 2007; Abella et al. 2023).

VEGETATION

Western Joshua tree can occur as the characteristic species of a distinct vegetation community (i.e., a repeated pattern of plants across a landscape), or as an associate species within other tree, shrub, or herbaceously dominated vegetation communities. As described in *A Manual of California Vegetation* (Sawyer et al. 2009), which is California's standard vegetation classification system, Joshua trees are the characteristic species in the Joshua tree woodland alliance, which is defined as a stand of vegetation with greater than or equal to 1 percent cover of Joshua trees evenly distributed across the landscape, with less than 1 percent absolute cover of juniper (*Juniperus* spp.) or pine (*Pinus* spp.) trees. The understory in a Joshua tree woodland is often dominated by shrubs or grasses, and the overstory is dominated by Joshua trees and sometimes other tree species. Joshua tree can also be found in other vegetation communities where it constitutes less than 1 percent of the total overstory cover, including California juniper woodland, foothill pine woodland, and blackbrush scrub alliances.

Source: Anna Cirimele, National Park Service.

To describe the whole western Joshua tree range, a broader classification system of California Wildlife Habitat Relationships System is used in this chapter (CDFW n.d.). This classification system maps terrestrial wildlife habitat based on vegetation characteristics and can be cross-walked with the vegetation communities described in *A Manual of California Vegetation*. The habitats defined in the California Wildlife Habitat Relationships classification system that are within the range of western Joshua tree in California are desert scrub, which covers over half of the western Joshua tree range in California; Joshua tree, which is synonymous with *A Manual of California Vegetation's* Joshua tree woodland alliance; alkali desert scrub; and sagebrush (Table 4-2). Western Joshua tree nurse plants (described in Section 4.1.3) include the dominant plants (i.e., the plants for which the species alliance is named) in creosote bush scrub alliance and blackbrush shrub alliance and the co-dominant species singleleaf pinyon pine (*Pinus monophylla*) of singleleaf pinyon–Utah juniper woodlands alliance. These vegetation alliances are classified within the California Wildlife Habitat Relationships system as desert scrub habitat, sagebrush habitat, and pinyon-juniper habitat, respectively, which are all dominant habitats within the western Joshua tree range in California (Table 4-2). Areas where Joshua tree woodland is mapped likely contain some of the densest stands of Joshua trees. Although the western Joshua tree range in California is mostly within scrub and Joshua tree habitat, western Joshua tree can occur within a variety of vegetation and natural communities; therefore, at the range-wide scale, western Joshua tree does not appear to be associated with a specific vegetation community, which aligns with findings by Esque et al. (2023) conducted at a similar scale. However, topography and vegetation may still be important factors for understanding the full habitat needs of western Joshua tree and planning for its conservation.

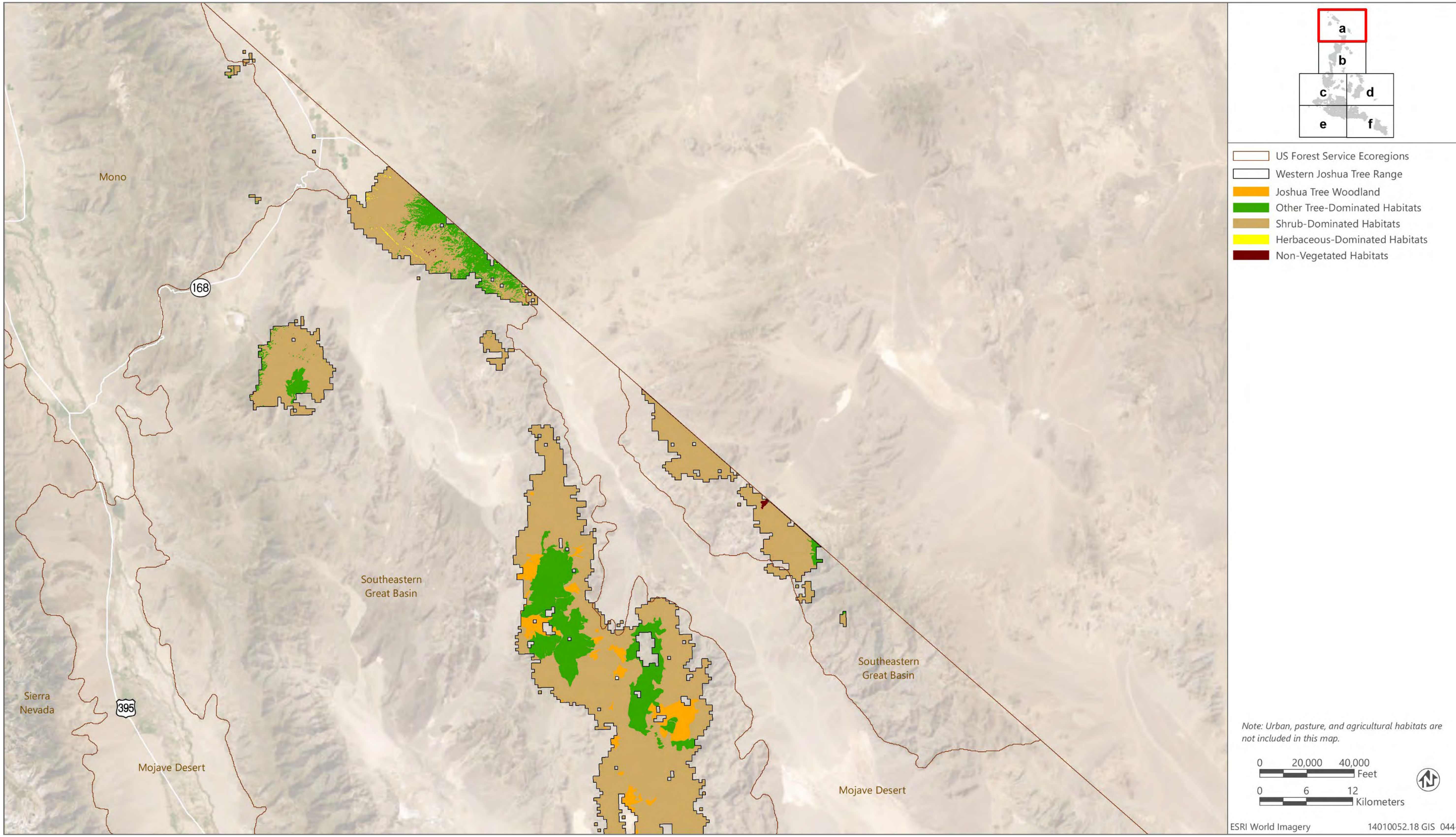
Vegetation within and just outside the western Joshua tree range in California has been mapped at a broad scale in Figures 4-2a through 4-2f.

Table 4-2 Land Cover within the Western Joshua Tree Range in California

Land Cover	Type of Land Cover	Area in Square Kilometers (sq mi)	Percent of Range
Desert scrub	Shrub dominated	7,085.7 (2,735.8)	54.1
Joshua tree	Tree dominated	1,314.5 (507.5)	10.0
Alkali desert scrub	Shrub dominated	1,100.0 (424.7)	8.4
Sagebrush	Shrub dominated	844.5 (326.1)	6.5
Pinyon-juniper	Tree dominated	669.1 (258.3)	5.1
Juniper	Tree dominated	467.7 (180.6)	3.6
Mixed chaparral	Shrub dominated	253.5 (97.9)	1.9
Annual grassland	Herb dominated	245.3 (94.7)	1.9
Barren	Non-vegetated	111.3 (43.0)	0.9
Desert wash	Shrub dominated	109.0 (42.1)	0.8
Desert succulent shrub	Shrub dominated	48.7 (18.8)	0.4
Montane chaparral	Shrub dominated	32.5 (12.5)	0.2
Low sage	Shrub dominated	18.9 (7.3)	0.1
Montane hardwood–conifer	Tree dominated	17.0 (6.6)	0.1
Bitterbrush	Shrub dominated	15.6 (6.0)	0.1
Lake	Aquatic	11.3 (4.4)	0.1
Desert riparian	Tree dominated	7.0 (2.7)	0.1
Montane riparian	Tree dominated	5.2 (2.0)	<0.1
Montane hardwood	Tree dominated	3.9 (1.5)	<0.1
Lodgepole pine	Tree dominated	2.1 (0.8)	<0.1
Riverine	Aquatic	2.1 (0.8)	<0.1
Blue oak–foothill pine	Tree dominated	1.0 (0.4)	<0.1
Valley foothill riparian	Tree dominated	0.8 (0.3)	<0.1
Fresh emergent wetland	Aquatic	0.7 (0.3)	<0.1
Saline emergent wetland	Aquatic	0.7 (0.3)	<0.1

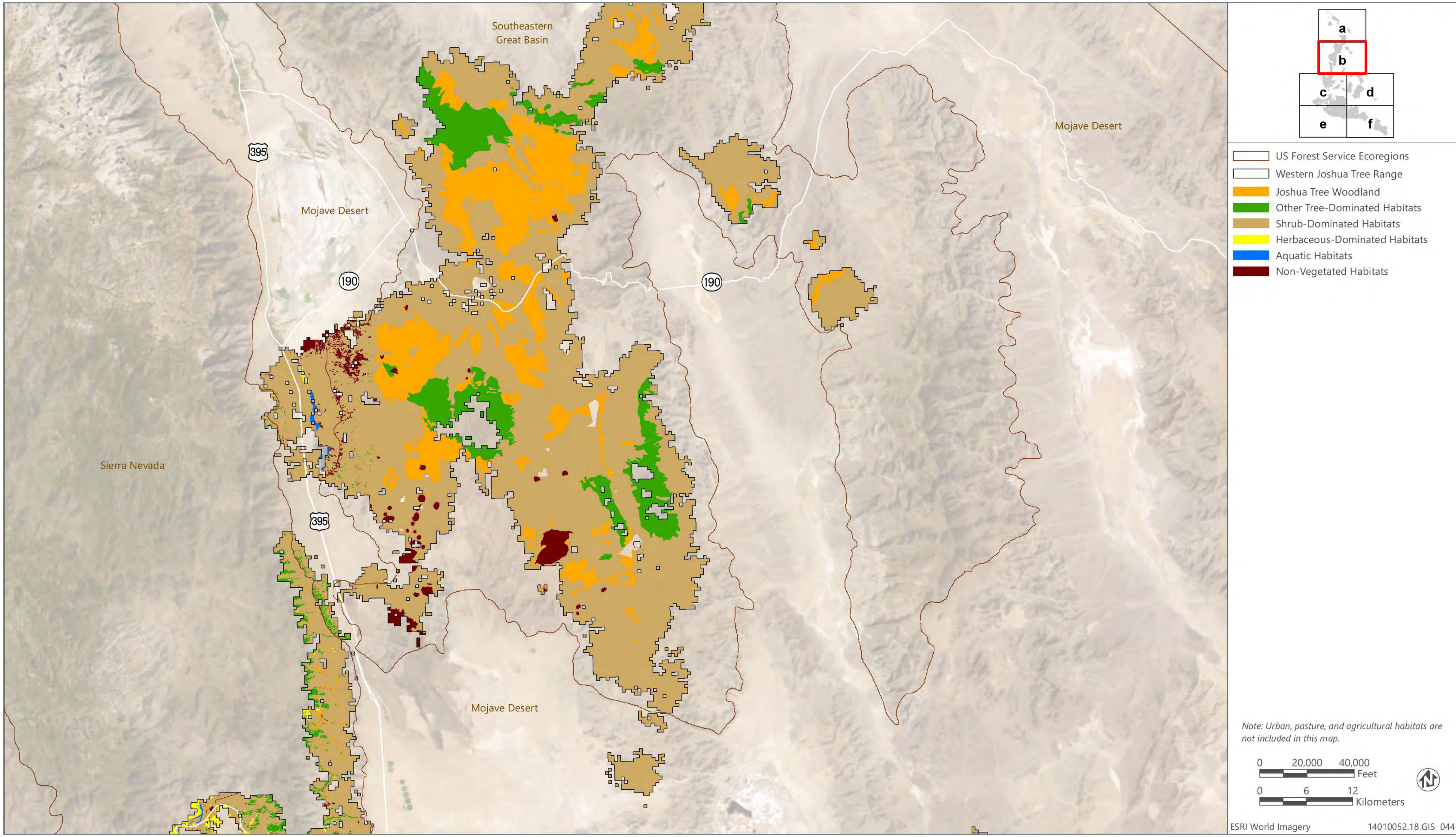
Note: Land cover types of eastside pine, wet meadow, perennial grassland, Jeffrey pine, valley oak woodland, sierran mixed conifer, blue oak woodland, coastal scrub, chamise-redshank chaparral, and ponderosa pine each represent less than 0.005 percent of the western Joshua tree range and were excluded from this table; sq mi = square miles; vegetation data is from CAL FIRE's Fire and Resource Assessment Program (FRAP), which is classified using the California Wildlife Habitat Relationships system. Converted land cover uses are presented separately in this chapter, below.

Sources: CAL FIRE 2022; Esque et al. 2023; compiled by Ascent in 2024.



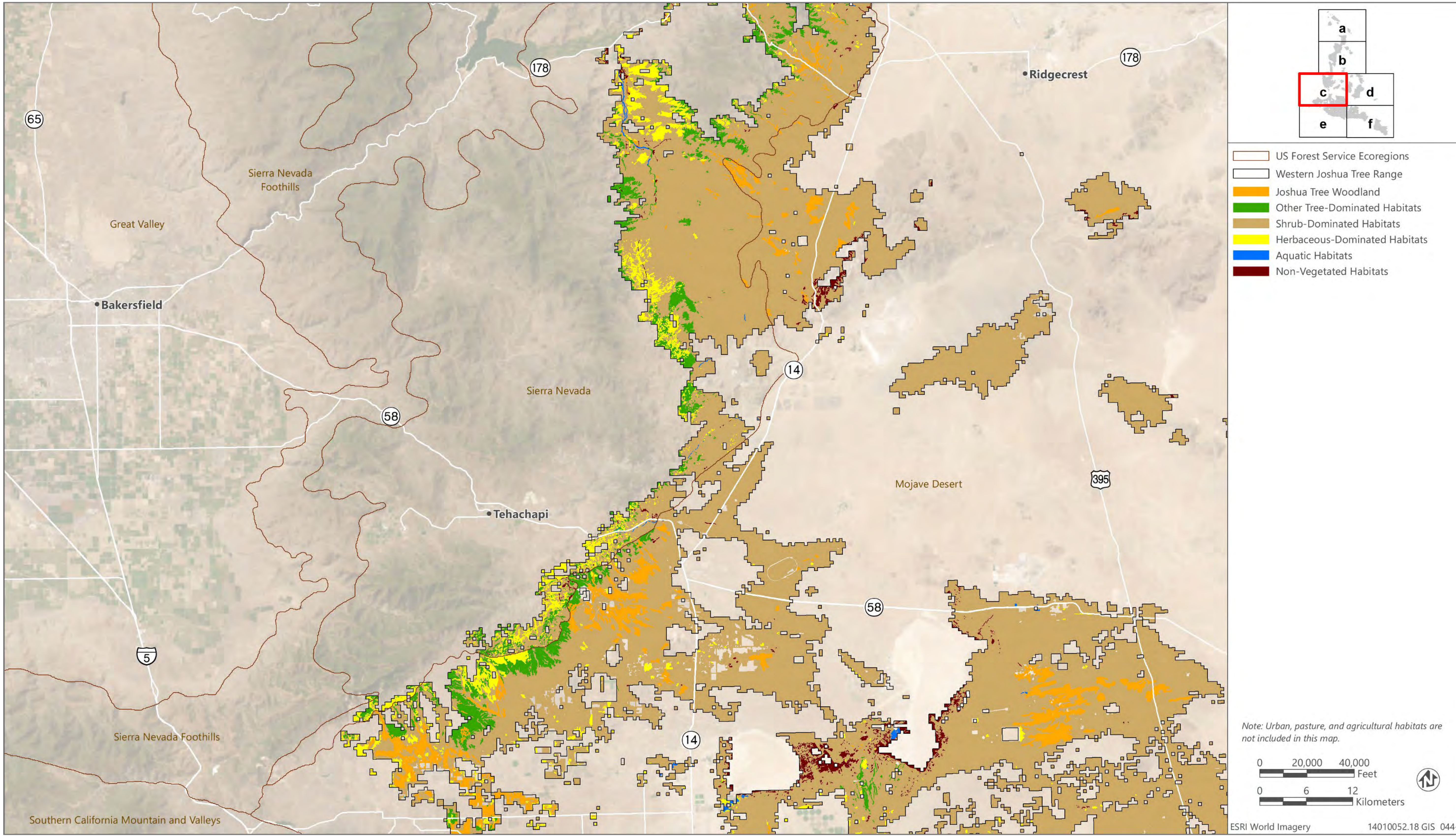
Sources: CAL FIRE 2022; Esque et al. 2023; USFS 2024; adapted by Ascent in 2024.

Figure 4-2a Land Cover within the Western Joshua Tree Range in California



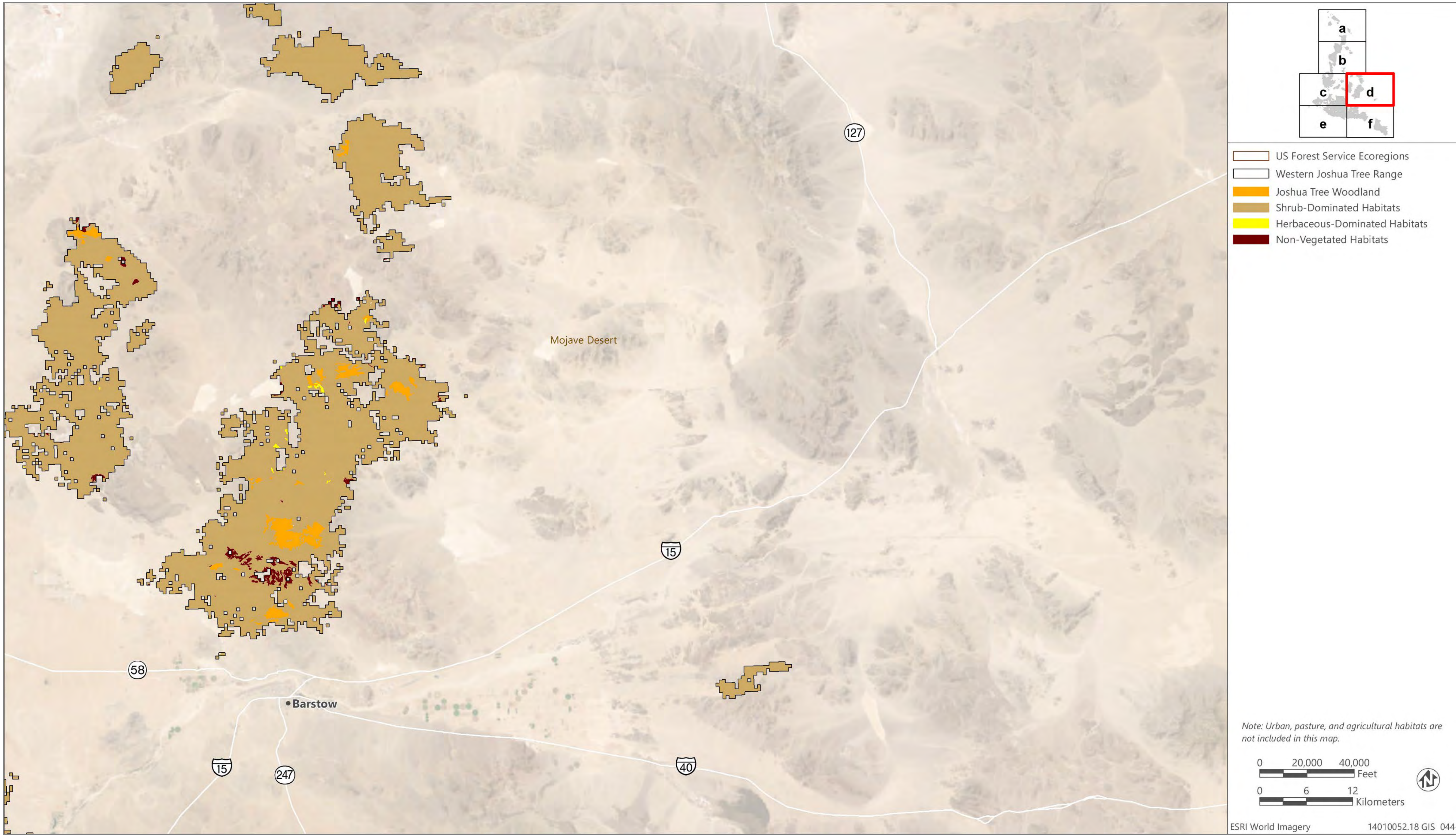
Sources: CAL FIRE 2022; Esque et al. 2023; USFS 2024; adapted by Ascent in 2024.

Figure 4-2b Land Cover within the Western Joshua Tree Range in California



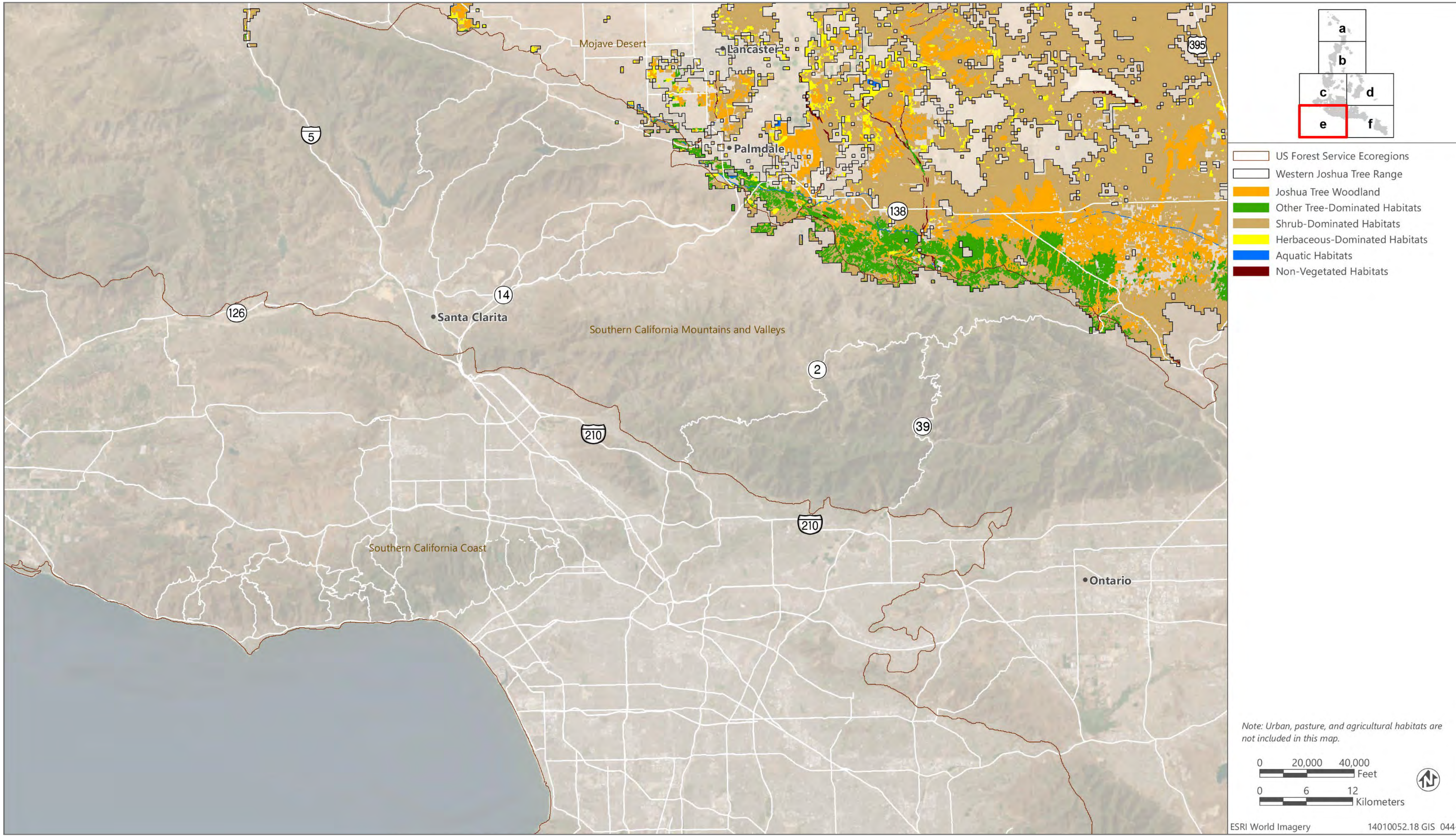
Sources: CAL FIRE 2022; Esque et al. 2023; USFS 2024; adapted by Ascent in 2024.

Figure 4-2c Land Cover within the Western Joshua Tree Range in California



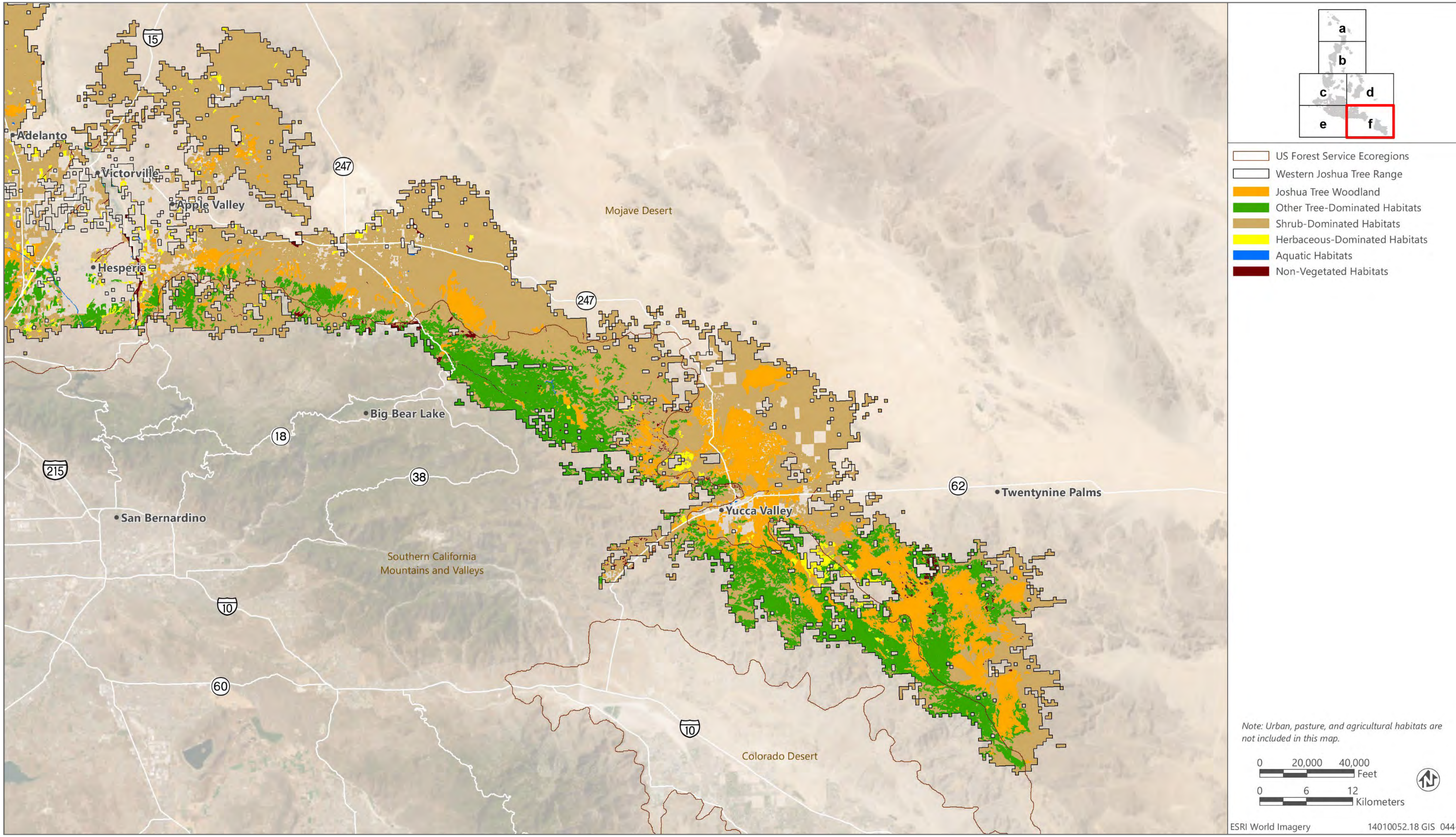
Sources: CAL FIRE 2022; Esque et al. 2023; USFS 2024; adapted by Ascent in 2024.

Figure 4-2d Land Cover within the Western Joshua Tree Range in California



Sources: CAL FIRE 2022; Esque et al. 2023; USFS 2024; adapted by Ascent in 2024.

Figure 4-2e Land Cover within the Western Joshua Tree Range in California



Sources: CAL FIRE 2022; Esque et al. 2023; USFS 2024; adapted by Ascent in 2024.

Figure 4-2f Land Cover within the Western Joshua Tree Range in California

4.1.3 Life History

Both western and eastern Joshua tree species are relatively long-lived and slow-growing species that require a complex combination of environmental factors to successfully grow and reproduce.

FLOWERING

Joshua trees are mature when an individual plant begins to produce flowers, which occurs when the Joshua tree is approximately 50 to 70 years old (Esque et al. 2015) or when the plant is between 1 and 2.5 meters (3.3 and 8.2 feet) in height (Rowlands 1978). Western Joshua tree flowers between January and May, peaking in late February, but the species can flower as early as November (Barve et al. 2020; Brenskelle et al. 2021; Hess and Baldwin 2022). Flowering of western Joshua tree is thought to occur episodically rather than annually, so mature Joshua trees do not flower every year. Flowering of mature individuals at one small site in the town of Yucca Valley, California ranged from 0 to 90 percent in 15 years of monitoring (Yoder et al. 2024).

Source: Diane Etchison.

Research has increased understanding of the conditions needed for flowering (St. Clair and Hoines 2018; Barve et al. 2020; Brenskelle et al. 2021; Yoder et al. 2024). In some years, many western Joshua trees produce large quantities of fruits and seeds synchronously (Kelly and Sork 2002; Borchert and DeFalco 2016; St. Clair and Hoines 2018), which is a reproductive strategy used by western Joshua tree, called “masting” that results in a wide variation in flowering rates from year to year. Seed predators are the primary dispersal mechanism for western Joshua tree seeds. Having a mast seeding reproductive strategy is beneficial because more seeds are produced than seed predators can feasibly consume. Subsequently, surviving seeds have a higher likelihood of successfully establishing and developing into a reproductive adult (Kelly and Sork 2002). These large, synchronous flowering and masting events seem to occur as infrequently as once or twice per decade, and the conditions that produce them are not well understood (Esque et al. 2010; DeFalco and Esque 2014; Borchert and DeFalco 2016). Research conducted by Yoder et al. (2024) found that flowering in Joshua tree is more likely to occur when the growing year leading up to flowering is wetter than the previous growing year, and that previous growing year is drier than the growing year before it (i.e., going from a year to a drier year and then to a wetter year tends to result in flowering). Yoder et al. (2024) defined "growing year" from April of one year through March of the next year. When flowering does occur in a given year, Brenskelle et al. (2021) found that it is likely to occur following cold and dry conditions. In addition, Yoder et al. (2024) found that flowering is more likely to occur when the maximum vapor pressure deficit (i.e., measure of drought stress on the landscape) is lower in the growing year before flowering and the minimum vapor pressure deficit is relatively stable since the previous growing year. These vapor pressure deficits align with lower drought stress leading up to flowering (Yoder et al. 2024). Flowering was also found to more likely occur when the minimum temperature the growing year before flowering was above freezing and when the maximum temperature has been relatively stable since the previous growing year (Yoder et al. 2024). This finding is consistent with observations that suggest Joshua trees flower much more often in locations that are historically warmer (St. Clair and Hoines 2018) and that winter low temperatures limit distribution of flowering (Dole et al. 2003); however, these findings contradict speculation that freezing triggers flowering (Brenskelle et al. 2021; Rodgers 2023). In addition, Yoder et al. (2024) found that the median interval between flowering years has decreased from historical (i.e., early 20th century) levels of flowering every 5 years to every 4 years.

POLLINATION

Yucca moth larva inside Joshua tree fruit.
Source: Anna Cirimele, National Park Service.

Western Joshua tree relies on the yucca moth (*Tegeticula synthetica*) for pollination and is not pollinated by other insects in California or by wind. The relationship between these two species is an obligate pollination mutualism, meaning both species rely on the other for successful sexual reproduction. The yucca moth pollinates western Joshua tree, and western Joshua tree provides food (i.e., western Joshua tree seeds) for the developing moth larvae. Many yucca moth species (*Tegeticula* and *Parategeticula*) are specialized pollinators for *Yucca* species (Smith and Leebens-Mack 2024). Eastern Joshua tree's obligate pollinating yucca moth (*Tegeticula antithetica*) is not known to co-occur with western Joshua tree in California but is capable of pollinating western Joshua tree where they co-occur in Nevada, though significantly fewer larvae survive compared to when the moth oviposits on its preferred host (Smith et al. 2009). Yucca moth species aggregate on the flowers of *Yucca* species and mate within the inflorescence (i.e., group or clusters of flowers on one main stem on a plant) (Smith and Leebens-Mack 2024). *Yucca* species appear to have adapted to yucca moth pollination by having a low pollen-to-ovule ratio, low nectar production, and the ability to abort fruits when they are over exploited (Smith and Leebens-Mack 2024). Although pollination from its yucca moth does impose a cost on the western Joshua tree through the larval consumption of its seeds, both it and its yucca moth pollinator rely on successful seed development for survival.

Yucca moths pollinate Joshua tree by using unique, specialized tentacles to purposefully place pollen into the stigma after egg laying (Smith and Leebens-Mack 2024). This active pollination process in Joshua tree and other *Yucca* species ensures development of seeds for the moth offspring by transferring pollen efficiently, leading to lower pollen-to-ovule ratio (Pellmyr et al. 2020). Yucca moths are also known to lay eggs into the Joshua tree floral ovary, and the growing larvae consume a portion of the fertilized seeds resulting in a tight codependence between each species for survival (Trelease 1893; Pellmyr 2003; Smith and Leebens-Mack 2024). The yucca moths' ovipositor (through which they lay their eggs) length correlates with the style length of the western Joshua tree flower, which allows for successful egg laying in the seed ovules (Smith et al. 2009). Research in the San Bernardino Mountains found approximately 19.5 and 42.8 percent of seeds were damaged by larvae in 2013 and 2014, respectively (Borchert and DeFalco 2016). In yucca plant–yucca moth relationships, typically 5 to 30 percent of the seed crop is consumed, although it can be up to 90 percent (Smith and Leebens-Mack 2024). Although there are costs from larval predation of seeds, western Joshua tree needs its yucca moth for successful sexual reproduction.

For all species of yucca moth, eggs typically hatch in 7 days (Smith and Leebens-Mack 2024). In late summer, the moth larvae fall to the ground from the Joshua tree fruits and enter diapause (i.e., suspended development) (Pellmyr 2003). This stage of diapause can likely last for several years, although the environmental or other cues that trigger metamorphosis into adult moths are not currently known (Pellmyr 2003). The environmental factors that lead to the survival of the yucca moth are not well understood, nor are the components of the natural communities that support both western Joshua tree and the yucca moth. The range of the yucca moth, and therefore the range where western Joshua tree can sexually reproduce, is also not well understood but can be estimated as the range in which pollination and fruiting occurs. Yucca moth presence was recorded in Joshua Tree National Park at study sites from approximately 1,049 to 2,076 meters (3,442 to 6,811 feet) in elevation, but not at the study sites with the lowest (1,004 meters [3,294 feet]) or highest (2,212 meters [7,257 feet]) elevation (Harrower and Gilbert 2018). More research is needed to understand whether the results of this study apply to yucca moth populations elsewhere.

Source: Matt Berger.

Following the yucca moth's pollination of western Joshua tree, fruits containing seeds are produced. The number of fruits and seeds produced by western Joshua trees vary greatly from year to year (Borchert and DeFalco 2016; Wilkening et al. 2020). Borchert (2022) reported approximately 80 seeds in mature western Joshua tree fruits. In research conducted in the San Bernardino Mountains at approximately 1,776 meters (5,827 feet) in elevation, fruits reached full size in late May (Borchert and DeFalco 2016), although timing of the maturing of fruits likely varies at other locations along the elevational gradient of western Joshua tree. Preliminary data show that areas with high fruit production tend to be colder and wetter with uniform precipitation, and sites that differ in the amount of fruit production have significantly different climates (Smith, pers. comm., 2024).

The production of fruits and seeds fluctuates yearly and is dependent upon the number of adults (i.e., defined as flowering Joshua trees) that are present, the presence of yucca moth, and the amount of moisture available while fruits are in development. However, the relative influence of each of these on the abundance and timing of fruit set for Joshua tree has yet to be determined. In one study in Joshua Tree National Park, pollinator abundance, flowering, and seed production were all found to be lowest at the high elevation sites (Harrower and Gilbert 2018). Pollinator abundance was found to be the most limiting factor to viable seed production because seed production is positively correlated with yucca moth presence (Harrower and Gilbert 2018); however, these conclusions may not be generalizable over the entire range of western Joshua tree. For example, the study had a limited sample size, fine-scale variation in seed production, and moth presence within any one site (even at sites in the same climate and elevation zones), which may have captured normal spatial variation in seed production as opposed to variation due to elevation (Smith, pers. comm., 2024). In addition, the study was conducted in a location that represents a small window of climate variation compared to the range of the species (Smith, pers. comm., 2024).

SEED DISPERSAL

Dispersal of Joshua tree seeds is primarily facilitated by other species, so the capacity for the species to expand into unoccupied habitat is dependent on those species. Prehistorically, Joshua tree seeds may have been dispersed long distances by extinct megafauna, including the Shasta ground sloth (*Nothrotheriops shastensis*) and relatives of the elephant (Lenz 2001). However, using genetic data, Smith et al. (2011) found no evidence of a change in the rate of Joshua tree dispersal corresponding with the timing of the extinctions of such herbivores, which would be expected if they were important Joshua tree seed dispersers.

Currently, seeds of western Joshua tree are dispersed by scatter-hoarding rodents (see Section 4.2, below) that either collect seeds from the canopy of western Joshua tree or the ground below and bury the seeds a short distance from the tree (Vander Wall et al. 2006; Waitman et al. 2012; Borchert 2016). Primary dispersal (first caching of seeds) distances of western Joshua tree seeds by seed-caching small rodents of up to 56.6 meters (186 feet) have been observed, with secondary dispersal (re-caching of seeds) distances of up to 32.2 meters (106 feet) (Vander Wall et al. 2006). The average historical migration rate of Joshua tree over the Holocene period has been estimated to be up to 2 meters (6.6 feet) per year (Cole et al. 2011). Research from Esque et al. (2023) indicates small founder trees occur less than 1 kilometer (0.6 mile) from the edge of established Joshua tree stands. Other mechanisms of dispersal for Joshua tree seeds have also been suggested including wind, other mammals, and birds (e.g., California scrub-jay [*Aphelacoma californica*]) (Lenz 2001; Borchert 2016).

SEED GERMINATION

Joshua tree seed germination is dependent on favorable environmental conditions that, when absent, seem to result in low rates of seed viability and germination success. While Joshua tree seed germination occurs readily in controlled laboratory conditions (Wallace and Romney 1972; McCleary 1973; Gucker 2006; Bonner and Karrfalt 2008; Waitman et al. 2012; Birker, pers. comm., 2021), seed germination rates decrease dramatically following dispersal in the wild. To model seed viability in the wild, one study conducted in the range of eastern Joshua tree found that after 1 year in an underground cache, approximately 50 to 68 percent of eastern Joshua tree seeds recovered from the field germinated in the lab (Reynolds et al. 2012). After 3 years and 4 months in an underground cache, less than approximately 1 to 3 percent of eastern Joshua tree seeds were able to germinate (Reynolds et al. 2012), suggesting that at least eastern Joshua tree has limited capacity to maintain seed viability in soil for long periods of time. Seed viability may be longer when protected within fruits compared to when loose in the soil. It is possible that uneaten fruits in the tree canopy function as an aerial seedbank, which likely occurs more frequently in masting years when fruit production is high enough to provide ample food for larvae and seed predators (Borchert and DeFalco 2016). One high desert study found that seeds were ready to germinate in mid-June, approximately 14 days after the Joshua tree fruit reached full size (Borchert and DeFalco 2016).

After dispersal, western Joshua tree seeds appear more likely to germinate following a rain event (Went 1948; Reynolds et al. 2012) and may germinate fastest at approximately 25 degrees Celsius (77 degrees Fahrenheit), as was found in one study for eastern Joshua tree seeds when testing germination in four different temperature conditions (McCleary 1973). Following germination, seedling emergence above the soil from the shoot (i.e., stem and attached organs, such as leaves and flowers) of the plant seems to be greatest in the spring and summer when increased soil moisture and warm soil temperatures co-occur. However, seedlings seem to also emerge at other times of the year, which suggests some potential for adaptation to shifting conditions (Reynolds et al. 2012). Seedling emergence is likely increased when seeds are buried approximately 1 to 3 centimeters (0.4 to 1.2 inches) below the surface (Waitman et al. 2012). Seeds that are left unburied on the soil surface seldom germinate (Waitman et al. 2012). Seed germination and seedling emergence seem to be most successful under nurse plants (e.g., shrubs) compared to out in the open (Vander Wall et al. 2006; Reynolds et al. 2012; Waitman et al. 2012).

RECRUITMENT AND ESTABLISHMENT

As with many plants, western Joshua tree recruitment—the process by which individuals are added to a population, usually by the addition of new individuals from on-site reproduction—can be limited by seed availability and other constraints on seedling establishment (Grubb 1977; Clark et al. 1999; Clark et al. 2007). In some instances, recruitment may refer to clonal offspring, but seedling recruitment, which includes the processes of seed germination, seedling survivorship, and seedling growth, is more common (Eriksson and Ehrlén 2012). Recruitment plays a role in maintaining stable populations if, on average, a reproductive individual is replaced by a successfully recruited offspring (Eriksson and Ehrlén 2012). Seedling establishment of Joshua tree appears to be infrequent because it requires seedling germination and survivorship, and establishment only occurs when the plant begins to photosynthesize (which will allow the plant to grow) (Reynolds et al. 2012). Few Joshua tree seedlings have been observed in the field, particularly at lower elevations (Webber 1953; Wallace and Romney 1972; Comanor and Clark 2000; Esque et al. 2010); however, for younger western Joshua trees, higher survival rates have been observed in western and higher elevation areas (DeFalco et al. 2010; St. Clair and Hoines 2018; Sweet et al. 2019). Sparse seedling observations in some locations may be because of the lower density of Joshua trees or the influence of more recent factors, such as drought, climate change, and invasive species. Sweet et al. (2019) found that higher recruitment of western Joshua tree occurred in areas that had significantly higher annual precipitation, and marginally significantly lower climatic water deficit and maximum temperature of the warmest quarter of the year. Successful seedling establishment likely requires several successive years of sufficiently wet and/or cool conditions (Wallace and Romney 1972; Cole et al. 2011) and growth to a large size (i.e., approximately 25 centimeters [9.8 inches]) before the arrival of a period of drier and/or hotter conditions (Esque et al. 2015).

Source: Jeb Bjerke, California Department of Fish and Wildlife.

Like other desert plants, Joshua trees can survive with limited water by utilizing moisture reserves in intermediate and deep soils and moisture stored in leaves, trunks, and roots (Crosswhite and Crosswhite 1984). Joshua trees of all sizes seem to have relatively low mortality during periods of average to above-average rainfall (nearly zero in many years) (Esque et al. 2015). Time of year may also affect successful seedling establishment, with one study finding that seedlings survived the longest when emergence occurred in September, although 90 percent still experienced mortality (Reynolds et al. 2012).

Presence under a nurse plant (e.g., shrub) appears to be critical for Joshua tree establishment (Waitman et al. 2012; Reynolds et al. 2012; Esque et al. 2015). This is likely because nurse plants provide a microclimate with higher soil moisture, lower soil temperature, less direct sun, a reduction in water loss to the atmosphere, and a reduction in drying effects from wind (Brittingham and Walker 2000; Legras et al. 2010). Nurse plants for western Joshua trees, such as blackbrush (*Coleogyne ramosissima*), creosote bush (*Larrea tridentata*), and other perennial plants, which likely provide favorable conditions for seedling growth and survival (Loik et al. 2000), potentially offer seedlings some protection from small mammal herbivory, as was found for singleleaf pinyon pine, where 69 percent of seedlings in one growing season emerged beneath nurse plants (Vander Wall 1997).

After establishment, western Joshua tree seedlings and very young plants appear to require sufficient soil moisture, periods of cold temperatures for optimal growth, and avoidance of consumption by herbivores to survive (Went 1957; Esque et al. 2015). One study found that young eastern Joshua tree plants produced the greatest average number of leaves when they were exposed to 10 hours of light (McCleary 1973). Another study investigating different metrics affecting Joshua tree growth found that western Joshua tree seedlings grow most successfully at root temperatures near 18 degrees Celsius (64 degrees Fahrenheit), compared to 10 degrees Celsius (50 degrees Fahrenheit) and 35 degrees Celsius (95 degrees Fahrenheit), and without calcium carbonate in the soil (Wallace and Romney 1972). Exposure to low temperatures may be required for optimal growth once Joshua trees have reached approximately 3 years of age (Went 1957).

Presence of arbuscular mycorrhizal fungi (i.e., soil microorganisms that can form mutualistic relationships with most terrestrial plants) in association with western Joshua tree seedling roots generally appears to have positive benefits for nitrogen absorption and plant biomass (Harrower and Gilbert 2021). Some species of arbuscular mycorrhizal fungi from low elevation areas in Joshua Tree National Park have been found to initially have negative impacts on 1- to 3-month-old western Joshua tree seedlings, but these became positive associations once seedlings reached 6 months old (Harrower and Gilbert 2021). A 22-year-long study of fifty-three 5- to 6-year-old individual western Joshua tree plants with an average height of approximately 21.5 centimeters (8.5 inches) found that 10 western Joshua tree plants with an average height of approximately 1 meter (3.3 feet) survived, an approximately 18.9 percent survival rate (Esque et al. 2015).

ASEXUAL REPRODUCTION

Sexual reproduction (i.e., formation of a seed) is advantageous because it promotes genetically diverse offspring and, in turn, evolutionary adaptation (Hoffman and Sgrò 2011; Yang and Kim 2016), and can increase the dispersal ability of plant species (Winkler and Fischer 2002). However, when the absence of yucca moths precludes western Joshua tree sexual reproduction, the plant is also able to reproduce asexually. Asexual reproduction occurs by vegetative propagation from rhizomes (i.e., horizontal underground plant stems), branch sprouts, and basal sprouts, which generally remain attached to the parent plant. This could allow western Joshua tree individuals to survive indefinitely, although this has not been observed and may not be possible due to factors including normal stochastic processes (i.e., random events that can affect community and population dynamics), as well as shifting climate conditions. A young, asexually produced western Joshua tree is connected underground to the parent plant by rhizomes or basal shoots (Simpson 1975). Asexual reproduction can result in clumps of many individual stems emerging from the ground in the same vicinity that can be genetically identical, although, due to random genetic mutations in plant tissue, can sometimes be genetically different (Antolin and Strobeck 1985). Asexual reproduction in Joshua tree tends to increase at the edge of its range, as is the case with other plant species (Silvertown 2008), and has been reported to increase in frequency with increasing elevation (Rowlands 1978) and at lower elevations where there is no sexual reproduction (Harrower and Gilbert 2018). Western Joshua tree often reproduces asexually by resprouting following fire (Vogl 1967; Loik et al. 2000; Gucker 2006; DeFalco et al. 2010; Cornett 2022), and like Joshua tree asexual reproduction, fire is more frequent at higher elevation areas of the Mojave Desert (Brooks et al. 2018).

GROWTH AND AGE

Mature trees can reach heights of approximately 5 to 20 meters (16.4 to 66 feet), although western Joshua trees rarely exceed 10 meters (33 feet) (Cornett 1997). Western Joshua trees often have one main trunk that branches approximately 1 to 3 meters (3.3 to 10 feet) above the ground, and older trees can have extensive branching and a large, rounded tree-like canopy. Western Joshua trees have a monopodial branching pattern (i.e., after branching, one stem remains dominant, even though the branches may appear to be approximately equal in size). Branching of western Joshua tree typically occurs after an inflorescence is produced at the end of a stem or after the growing tissue at the end of a stem is damaged, such as by the yucca weevil or yucca-boring weevil (*Scyphophorus yuccae*) (Simpson 1975).

Because Joshua tree trunks lack growth rings, tree height and annual growth rate assumptions are often used to approximate the age (Gilliland et al. 2006). These age estimates have a high level of uncertainty; however, they are still useful in providing information about the demographic structure of Joshua tree populations. Western Joshua trees that have reached reproductive maturity have high survivorship and are therefore likely to maintain reproductive potential for decades. Although it has been speculated that western Joshua tree may live hundreds or even thousands of years, the actual maximum lifespan of western Joshua tree is unknown (Cornett 2006; Gilliland et al. 2006). Generally, Joshua tree trunk diameters increase over time, although they have also been reported to decrease, perhaps because of drought (Gilliland et al. 2006). Mature Joshua trees may take advantage of infrequent rains by storing near-surface water collected through their extensive network of fibrous roots (Gucker 2006). Roots of eastern Joshua tree have been observed approximately 11 meters (36 feet) away from what appeared to be the aboveground portion of the plant (Bowns 1973). As is the case during western Joshua tree establishment, mycorrhizal associations that form with their roots may contribute to adult western Joshua tree survival (Harrower and Gilbert 2021).

Source: Tom Minczeski.

4.1.4 Population Trends

Population trends may be measured directly, inferred from demographic information, or indirectly inferred from fossil evidence or environmental impacts that have occurred in the past. Population trends can be an important predictor for extinction risk (O'Grady et al. 2004). A sustainable western Joshua tree population would likely have high numbers of young plants, decreasing numbers of older plants, and relatively few old plants. In addition, the average western Joshua tree lifespan must remain longer than the generation length (i.e., time from seedling establishment to reproductive maturity) for populations to remain stable. Using a long-term average growth rate of approximately 0.312 ± 1.96 centimeters per year (Esque et al. 2015), the generation length of western Joshua tree has been estimated to be 50 to 70 years (Esque et al. 2015).

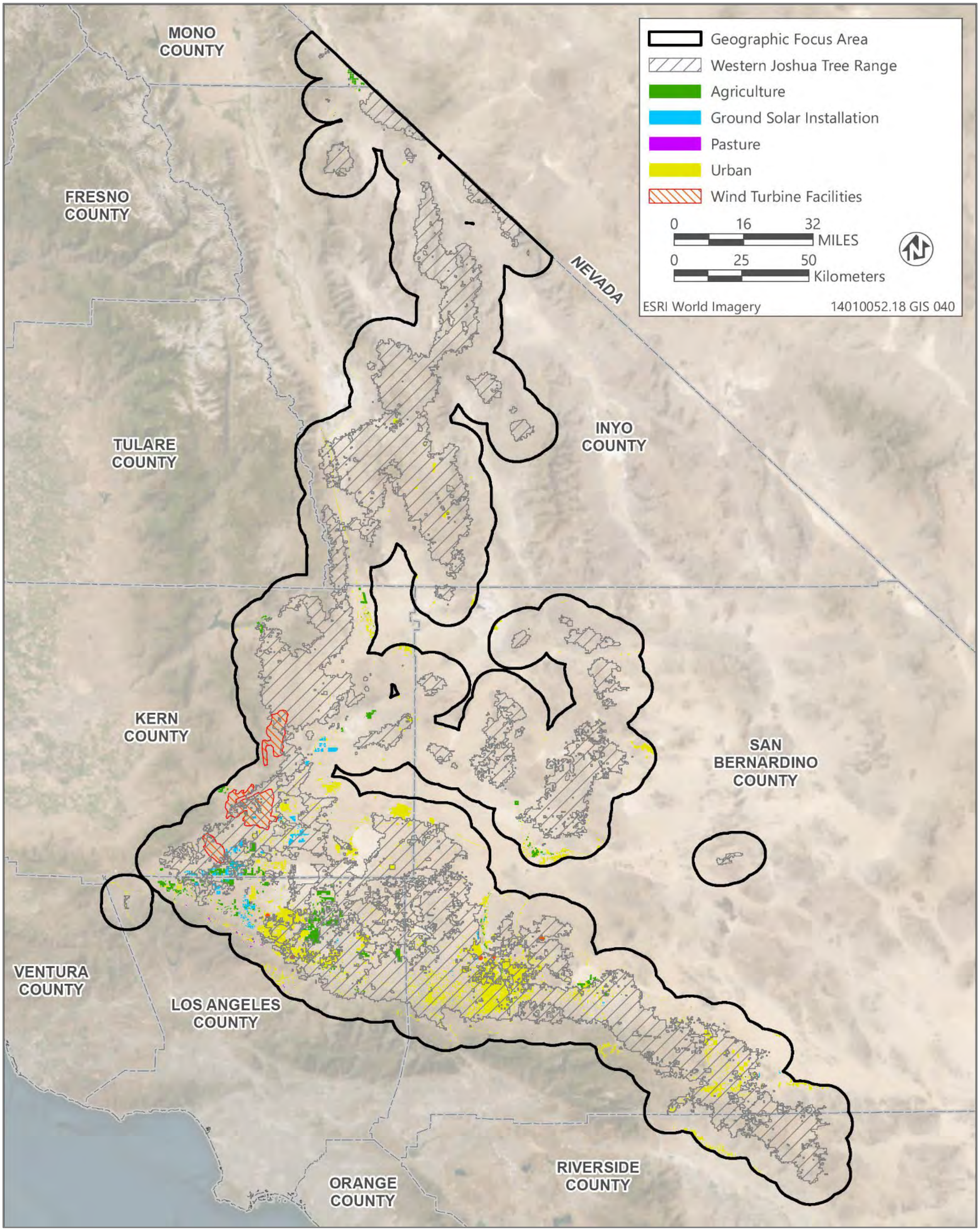
Genetic analyses suggest that approximately 200,000 years ago, western Joshua tree experienced substantial population growth and range expansion from the Mojave Desert southeast into the Sonoran Desert and north-northeast into the Great Basin Desert (Smith et al. 2011). Studies on population trends of Joshua tree over the past 20,000 years are contradictory in their conclusions. Approximately 22,000 to 13,000 years ago, during the Late Pleistocene, the fossil record shows Joshua tree with a larger range compared to today, extending south farther into Southern California, Arizona, and likely into northwestern Mexico (Rowlands 1978; Holmgren et al. 2010; Cole et al. 2011; Smith et al. 2011). A larger range is not synonymous with greater abundance though, and research conducted by Smith et al. (2011) found no indication of significant range or population size reductions at the end of the last glacial period.

Toward the beginning of the Holocene period, approximately 11,700 years ago, fossil evidence indicates the Joshua tree southern range extent contracted northward for approximately 3,700 years until the range reflected the southern extent of today (Cole et al. 2011). This contraction began following an approximately 50-year period where rapid warming occurred, with the minimum winter temperature in the Grand Canyon increasing approximately 4 degrees Celsius (Cole and Arundel 2005) and mean annual sea surface temperature off the coast of Northern California increasing approximately 4 degrees Celsius (Barron et al. 2003). The apparent range contraction of Joshua tree represented in the fossil record starting in the Late Pleistocene suggests that the population of the entire range of Joshua tree has been in decline. However, research conducted by Smith et al. (2011) found no evidence to indicate population declines starting approximately 21,000 years ago, following the last glacial maximum. This suggests that loss of habitat within the southern portion of the Joshua tree range in California, starting in the Late Pleistocene, was potentially offset by habitat expansion in the northern extent of the range (Smith et al. 2011).

Although western Joshua tree has continued to occur within the same general geographical range in California since European settlement of the Mojave Desert, the population size and occupied areas within that geography have declined due to habitat modification and degradation related to land conversion for agriculture and development (Borge 2018; CDFW 2022). Development and other human activities that began with European settlement (see Section 4.3.2) have likely resulted in the greatest decline in the landscape-scale abundance of western Joshua trees in California. Given the limited understanding of western Joshua tree distribution before European occupation and current lack of range-wide population monitoring, this population decline can be estimated by using agricultural land use and development as a proxy to understand habitat loss after European occupation began. Along the southern extent of the western Joshua tree range in California, large portions of western Antelope Valley were cleared for alfalfa production (Borge 2018), which likely resulted in decline of western Joshua tree populations in the area. Large human population centers, particularly in the southern portion of the species range, coincide with large conspicuous areas free of western Joshua tree, including in western Antelope Valley and near the metropolitan areas of Palmdale and Lancaster, which correspond to areas historically cleared for agriculture (Figure 4-3). Agriculture, pasture, and urban data presented in Figure 4-3 were collected from approximately 1990 to 2014 (CAL FIRE 2022). In the past, these areas, as well as the developed areas of Victorville, Hesperia, and Yucca Valley, likely supported substantially more western Joshua trees. Approximately 30 percent of the habitat occupied by western Joshua tree in California may have been modified in the period between European settlement and the present (CDFW 2022).

"In the presence of the Joshua Tree, one cannot help but feel a profound connection to the natural world."
— John Muir

On the local population scale, trends from available direct monitoring of western Joshua tree are not uniform, but several plots have shown declines in abundance, and observations of recruitment have been minimal (Esque et al. 2010; St. Clair and Hoines 2018; Natural Resources Group 2021; WEST 2021; CDFW 2022). According to the information available, local populations of western Joshua tree are currently exhibiting short-term demographic trends ranging from apparent increase or stability to apparent decline, but no uniform range-wide trend is evident. Demographic data on tree height at some locations show signs of drastic short-term declines in recruitment (CDFW 2022), some show a more gradual decline in recruitment (St. Clair and Hoines 2018), and others appear to be experiencing stable short-term recruitment levels at various locations throughout the species' range (Esque et al. 2010; CDFW 2022).



Sources: Hoen et al. 2018; CAL FIRE 2022; Esque et al. 2023; Fujita et al. 2023; adapted by Ascent in 2024.

Figure 4-3 Converted Land Cover Uses within the Geographic Focus Area

4.2 WILDLIFE VALUES AND ECOLOGICAL FUNCTION OF WESTERN JOSHUA TREES

Western Joshua tree plays an important ecological role in the desert ecosystem. The species provides foraging opportunities, nesting habitat, and cover for many wildlife species, and supports a biodiverse ecosystem.

The yucca moth is western Joshua tree's obligate, mutualistic pollinating partner (see Section 4.1.3, above). Other moth species potentially parasitize western Joshua tree. Cheater yucca moth (*Tegeticula corruptrix*) is abundant throughout western Joshua tree's range; and while they lay eggs in Joshua tree flowers and feed on seeds, they do not pollinate them (Smith and Leebens-Mack 2024). Two bogus moth species are also known to lay eggs on Joshua tree flowers but do not pollinate them (Smith and Leebens-Mack 2024). *Prodoxus sordidus* lay eggs on the flower stalk, and *Prodoxus weethumpi* lay eggs on the outside of the fruit; however, their larvae do not feed on the seeds and are not considered a direct competitor to the yucca moth (Smith, pers. comm., 2022, cited in USFWS 2023).

Seed-dispersing wildlife includes scatter-hoarding mammals that rely on western Joshua tree seeds for nutrition. These species include the Mohave ground squirrel (*Xerospermophilus mohavensis*), which is listed as threatened under the California Endangered Species Act (CESA), and other species, such as white-tailed antelope squirrel (*Ammospermophilus leucurus*), Merriam's kangaroo rat (*Dipodomys merriami*), agile kangaroo rat (*Dipodomys agilis*), San Diego pocket mouse (*Chaetodipus fallax*), little pocket mouse (*Perognathus longimembris*), and pinyon mouse (*Peromyscus truei*) (Zembal and Gall 1980; Borchert 2016). In addition, black-tailed jackrabbits (*Lepus californicus*) browse on western Joshua tree (Esque et al. 2015).

Source: Samantha Laarman, National Park Service.

Several bird species use Joshua trees for nesting and foraging. Scott's oriole (*Icterus parisorum*) often nests in the crown of Joshua trees and uses fibers stripped from dead leaves hanging below the living crown to construct their hanging, cup-shaped nests (Flood 2020). Ladder-backed woodpeckers (*Dryobates scalaris*) build nests in trunk cavities or limb holes of Joshua trees (Lowther et al. 2020). Swainson's hawk (*Buteo swainsoni*), a species listed as threatened under CESA, has been documented nesting in western Joshua trees in the Antelope Valley of the western Mojave Desert (Bloom et al. 2023). Tricolored blackbird (*Agelaius tricolor*), another species listed as threatened under CESA, has been observed foraging for arthropods within Joshua tree inflorescences in the Kelso Valley of Kern County (Terrill et al. 2019). In addition, common raven (*Corvus corax*) has been observed nesting and perching in Joshua tree branches (Abella et al. 2023). Other bird species that are associated with Joshua tree and may depend on the tree in the Mojave Desert region include cactus wren (*Campylorhynchus brunneicapillus*), loggerhead shrike (*Lanius ludovicianus*), and American kestrel (*Falco sparverius*) (Abella et al. 2023).

American kestrel (Falco sparverius) on top of a western Joshua tree.
Source: Carmen Aurrecoechea, National Park Service.

Joshua trees provide protection and feeding sites for some Mojave Desert lizard species. Desert night lizards (*Xantusia vigilis*) and desert spiny lizards (*Sceloporus magister*) are often found on Joshua tree bark and in clusters of dead leaves (Gucker 2006). Joshua tree woodland is also habitat for the federally listed threatened and state-listed threatened desert tortoise (*Gopherus agassizii*), which is known to construct burrows under fallen Joshua tree limbs (Abella et al. 2023).

Spiders, scorpions, beetles, and ants use dead Joshua tree leaves and fallen branches for refuge in the Mojave Desert (Gucker 2006). Other insect species feed on western Joshua trees regularly, including the yucca giant-skipper (*Megathymus yuccae*), Navaho yucca borer butterfly (*Megathymus yuccae navajo*), and yucca weevil. Yucca giant-skipper females glue eggs to the leaves of small host plants, and caterpillars feed near the tips of leaves and eventually bore into the ground at the base of the plant and feed on the root (Butterflies and Moths of North America 2023). Navaho yucca borer butterfly lays eggs on adult Joshua trees that arise from asexual growth, then the larvae bore into the rhizomes where they feed and later pupate (Jaeger 1965).

Yucca weevils have been observed eating the inflorescence, sap, and meristem (i.e., the region of cells capable of division and growth in plants) of western Joshua tree. Adult yucca weevils are thought to target flowering plants to bore into and lay their eggs (Heacox, pers.

comm., 2024). Yucca weevil grubs (i.e., larval form of certain beetle species) can be found on the ground, inflorescence, and leaf tips. The adult yucca weevil flies between trees, usually preferring to fly upwind for approximately 40 to 50 meters (131 to 164 feet). The adult stage is thought to last up to 2 years, and adults are easily identifiable because this species will wedge themselves head-first toward a western Joshua tree stem between leaves and can be observed with a hand lens. Yucca weevils have mostly been observed on western Joshua tree individuals that are about 1-meter (3.3 feet) tall, but these data may be biased due to challenges observing taller western Joshua trees.

Several special-status mammals associated with Joshua tree woodland include pallid bat (*Antrozous pallidus*), spotted bat (*Euderma maculatum*), American badger (*Taxidea taxus*), and bighorn sheep (*Ovis canadensis*) (Miller and Stebbins 1973).

In addition to the known ecological relationships with western Joshua tree described above, many other wildlife species and other organisms likely have ecological relationships with the species that are currently undiscovered.

4.3 KEY STRESSORS, THREATS, AND CONSERVATION ISSUES

> *"Nature's resilience is mirrored in the Joshua Trees' perseverance."*
> *— John Muir*

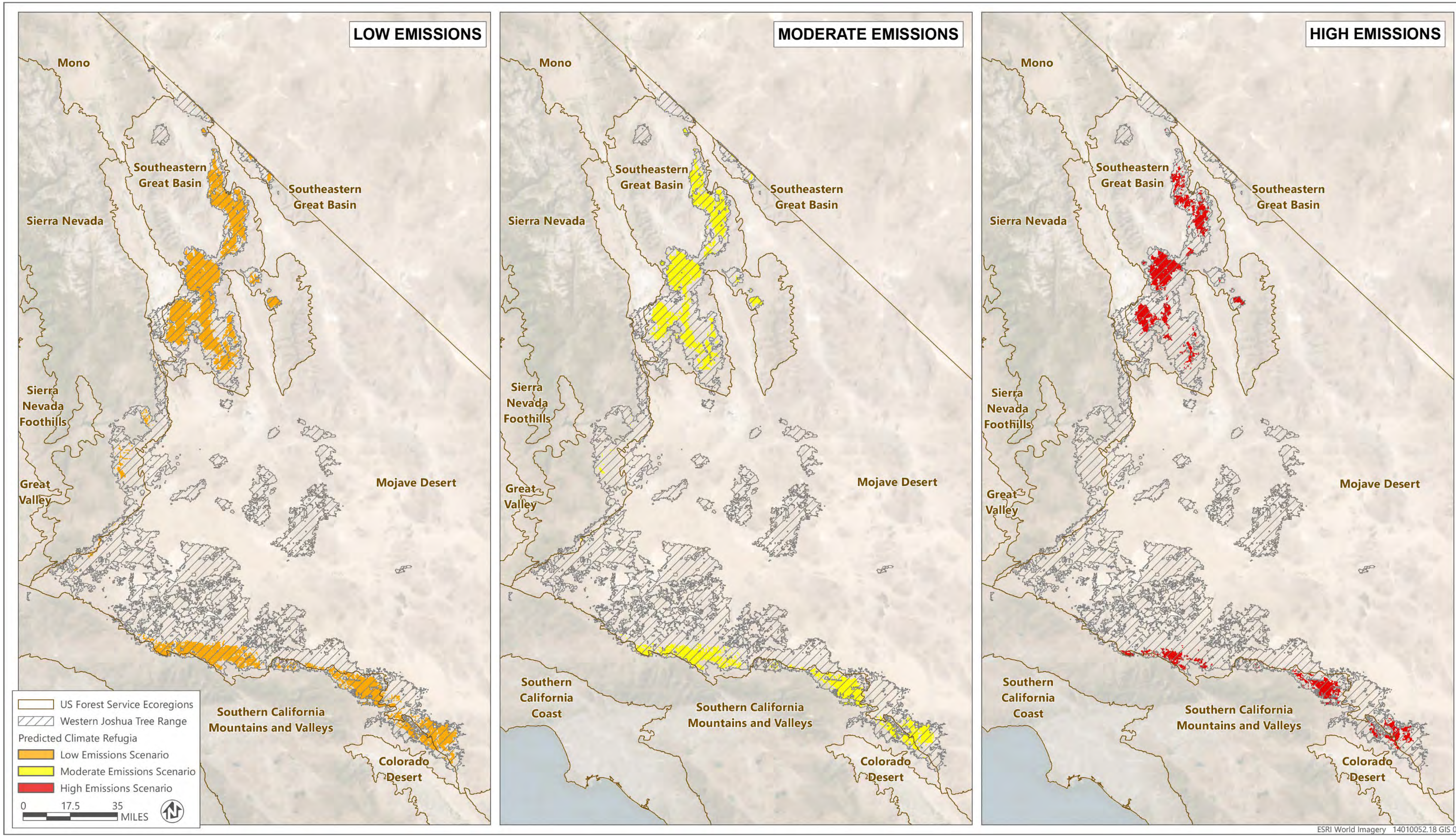
Western Joshua tree has experienced increasing stressors since Europeans arrived in the Mojave Desert region. Modern-day threats to western Joshua tree include changes in precipitation and temperature patterns due to climate change; increased frequency and severity of wildland fire; proliferation of invasive species; and loss of habitat from land use disturbance, increases in urban and infrastructure development, and recreation or other human activities within the species' range. These threats, coupled with the species' biology (e.g., limited dispersal capacity and slow growth rate) and habitat requirements, are cause for concern that western Joshua tree abundance may decline substantially in California.

4.3.1 Climate Change

California is experiencing increases in warming, droughts, variable precipitation, and intensity of heavy precipitation events due to climate change. These phenomena are predicted to worsen by the end of the 21st century (Garfin et al. 2013; Bedsworth et al. 2018). Climate change impacts to western Joshua tree are summarized in CDFW's March 2022 status review of western Joshua tree (CDFW 2022). Since the status review, information identifying potential western Joshua tree climate refugia has also been developed, which can help evaluate climate impacts on the species. In general, climate refugia are areas that are expected to be relatively buffered from contemporary climate change over time that enable persistence of valued physical, ecological, and sociocultural resources (Morelli et al. 2016). The direct and indirect effects of climate change are primary threats to western Joshua tree, and studies are increasingly investigating what detectable impacts to Joshua tree are occurring that should be attributed to these causes. For example, Yoder et al. (2024) found that Joshua trees are already experiencing impacts from climate change in the form of changes in the frequency of flowering events. In addition, areas of higher western Joshua tree recruitment have been observed within or significantly closer to predicted future climate refugia more often than areas of low recruitment (Sweet et al. 2019).

Changes in climate suitability for other species, particularly nurse plants of western Joshua tree, will also influence how western Joshua tree is affected by climate change. Singleleaf pinyon pine and blackbrush are some of western Joshua tree's nurse plants, which are important for the survival of western Joshua tree seedlings. Vulnerability assessments conducted by Barrows et al. (2014) show that singleleaf pinyon pine and blackbrush are highly vulnerable and likely vulnerable to climate change, respectively. In this study, Joshua tree itself was found to be likely vulnerable to climate change, although Joshua tree was found to be less vulnerable to climate change compared to singleleaf pinyon pine and blackbrush (Barrows et al. 2014). In addition, new climate suitability models by Thomas et al. (2023) show a much larger impact from climate change on blackbrush compared to western Joshua tree. The climate impacts on singleleaf pinyon pine and blackbrush could reduce the future availability of these western Joshua tree nurse plants, which could affect western Joshua tree's ability to survive past the seedling stage.

Because climate change may cause some areas currently occupied by western Joshua tree to become unsuitable for the species, western Joshua tree climate refugia will be important for maintaining populations of western Joshua tree in the future. Identifying western Joshua tree climate refugia is challenging because it relies on assumptions about global emissions scenarios, results from models of local climate conditions under those scenarios, and species distribution models. However, increasingly sophisticated species distribution models for Joshua tree have been prepared in recent decades (Thompson et al. 1998; Shafer et al. 2001; Dole et al. 2003; Cole et al. 2011; Barrows and Murphy-Mariscal 2012; Thomas et al. 2012; Sweet et al. 2019; Thomas et al. 2023). Furthermore, science identifying potential future climate refugia under three projected greenhouse gas emissions scenarios (described in Section 4.4) for western Joshua tree is currently in scientific review and uses newly released western Joshua tree range data from Esque et al. (2023). This new research provides the most accurate western Joshua tree range data to date, which allows models to predict refugia more accurately (Shryock et al. 2025). Preliminary results from this work, conducted by the US Geological Survey, have been shared with CDFW for consideration during preparation of this Conservation Plan (see Figure 4-4) and are presented in Section 4.4.



Source: Shryock et al. 2025; adapted by Ascent in 2025.

Figure 4-4 Predicted Climate Refugia

4.3.2 Development and Other Human Activities

Development and other human activities pose another threat to western Joshua tree and its habitat. Once disturbed, desert systems can be slow to recover due to their arid climate, delicate soils, and slow pace of ecological succession (Randall et al. 2010; Lovich and Ennen 2011). The western Joshua tree range in California has been disturbed by urban areas (which include industrial facilities), renewable energy installations (e.g., ground solar, wind turbine, and energy storage projects), agricultural areas, pastures used mainly for cattle grazing, and resource extraction facilities (Table 4-3; Figure 4-3) (CAL FIRE 2022; Fujita et al. 2023).

Table 4-3 Converted Land Cover Uses within Western Joshua Tree Range in California

Types	Area in Square Kilometers (sq mi)	Percent of Range (%)
Urban	646.0 (249.4)	4.9
Wind turbine facilities[1]	219.6 (84.8)	1.7
Agriculture	34.1 (13.1)	0.3
Ground solar installations[2]	36.4 (14.1)	0.3
Pasture	0.2 (0.1)	<0.1
Grand total	**936.2 (361.5)**	**7.2**

Notes: sq mi = square miles.

[1] Wind turbine facilities include wind turbines, roads connecting wind turbines, and open areas.

[2] Ground solar installation data includes facilities with capacity of 1 megawatt or more that became operational before 2022.

Sources: Hoen et al. 2018; CAL FIRE 2022; Esque et al. 2023; Fujita et al. 2023; compiled by Ascent in 2024.

Urban development

Western Joshua tree has been adversely affected by habitat modification and destruction since European settlement, particularly on unprotected, privately owned lands, and continues to be at substantial ongoing risk of additional habitat modification and destruction through development activities, such as for urban communities, renewable energy projects, and infrastructure. Aerial imagery and data from the US Geological Survey's National Land Cover Database from 1984 to 2021 show continued development within western Joshua tree habitat in the southern portion of the species' range in California in the cities of Palmdale, Lancaster, Yucca Valley, Joshua Tree, Twentynine Palms, Victorville, Hesperia, and Apple Valley (Krantz, pers. comm., 2021). A large portion of this recent habitat modification is the result of ongoing urban development, typically on private property near existing development. In addition, these privately owned lands are likely where housing development will occur in the future to accommodate population growth in the region and to address the State's housing crisis (HCD 2022). In these areas, and on private lands in general, western Joshua tree and its habitat have had limited protective regulation prior to CESA candidacy. Approximately 34 percent of western Joshua tree's range in California is privately owned (see Table 2-1 in Chapter 2, "Planning Influences").

Stress from development can reduce western Joshua tree's ability to recruit from seed, which may occur in degraded or disturbed habitat. Western Joshua tree surveys conducted at development sites near the cities of Palmdale and Lancaster found that relatively few western Joshua trees have established from seed in recent decades (CDFW 2022). Development also has the potential to reduce habitat for scatter-hoarding rodents, leading to site abandonment or population declines and limiting western Joshua tree seed dispersal capacity and seed germination rates—both of which are facilitated by scatter-hoarding rodent behavior. In addition, development could eliminate nurse plants from the landscape, which can be critical for western Joshua tree germination and early survival.

The trend of land conversion for renewable energy is expected to continue (BLM 2016a; Smith et al. 2023), which would result in removal of western Joshua tree habitat and mortality of individual western Joshua trees due to the physical impact of land clearance for increased renewable energy development to address climate change (Smith et al. 2023). In recent decades, renewable energy development has been increasing rapidly in the Mojave Desert, mainly on privately owned land and federal lands managed by the Bureau of Land

Source: Carmen Aurrecoechea, National Park Service.

Management (BLM). To meet California's goals for reduced carbon emission, millions of acres of the Mojave Desert could potentially be converted for renewable energy development; however, there are also conservation areas protected in accordance with the Desert Renewable Energy Conservation Plan (DRECP) (Smith et al. 2023), which has avoidance and minimization measures for Joshua tree woodlands. An update to a Mojave Desert ecoregional assessment (Randall et al. 2010) conducted by Parker et al. (2018) considered two areas of increased renewable energy development. The updated analysis showed that habitat with high conservation value was lost at a higher rate than habitat with low conservation value (Parker et al. 2018).

DRECP has designated focus areas for renewable energy development that overlap with approximately 0.7 percent of the western Joshua tree range in California; approximately 35.1 percent of the development focus areas overlap ecologically core or ecologically intact habitat (Randall et al. 2010; BLM 2016b; Parker et al. 2018). However, DRECP only applies to BLM-owned lands, whereas 60 percent of California's current renewable energy projects are located on private land (USFWS 2023).

Grazing cows rest by a Joshua tree.

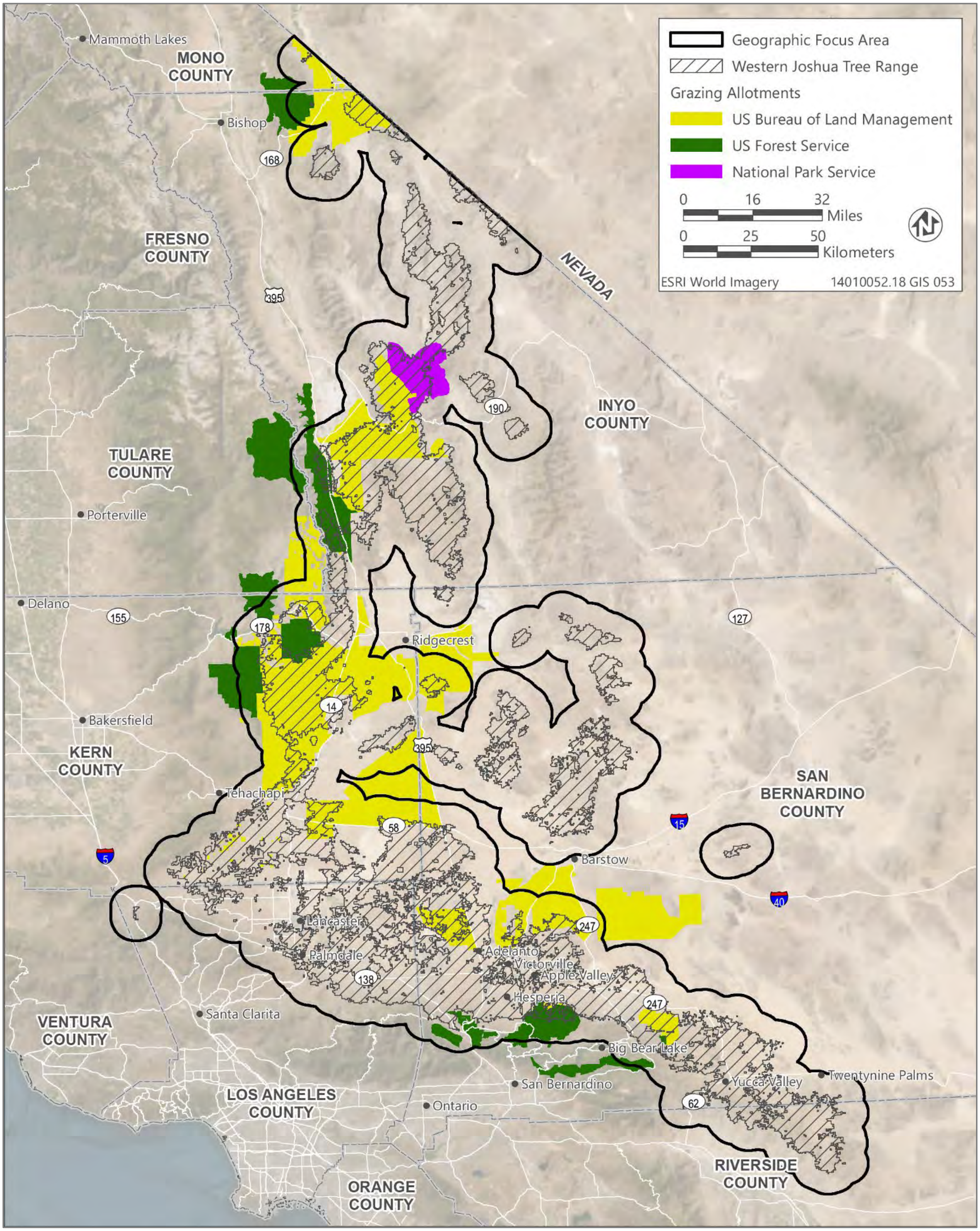
Grazing allotments and permits on federal lands overlap almost a quarter of the western Joshua tree range in California, mostly in the central and northern portions of the range (Table 4-4; Figure 4-5). Pasture land mapped by CAL FIRE (2024a) is minimal in the geographic focus area and only overlaps the western Joshua tree range in California in small patches in the southern and southwestern portions within Los Angeles County and in the eastern portions within Inyo County (Figure 4-3). Grazing can directly destroy or indirectly damage western Joshua trees by animals trampling or consuming individual western Joshua trees, likely young individuals, or nurse plants.

Table 4-4 Grazing within Western Joshua Tree Range in California

Types	Area in Square Kilometers (sq mi)	Percent of Range (%)
Bureau of Land Management grazing allotment	2,589.6 (999.9)	19.8
National Park Service grazing permit	240.5 (92.9)	1.8
US Forest Service grazing allotment	230.6 (89.0)	1.8
Grand total	**3,060.8 (1,181.8)**	**23.4**

Notes: sq mi = square miles.

Sources: Esque et al. 2023; McNeill, pers. comm., 2024; USFS 2024; BLM n.d.; compiled by Ascent in 2024.



Sources: Esque et al. 2023; McNeill, pers. comm., 2024; USFS 2024; BLM n.d.; adapted by Ascent in 2024.

Figure 4-5 Grazing on Federal Land Overlapping the Geographic Focus Area

An estimated 43 to 46 percent of modeled Joshua tree habitat is managed for multiple uses and is subject to resource extraction or open for unauthorized OHV use (Smith et al. 2023). On public land, incompatible recreational uses also pose a threat to western Joshua tree. Off-highway vehicles (OHVs) traveling off authorized trails and routes can crush young western Joshua trees and nurse plants and either damage or kill them. Western Joshua tree individuals and nurse plants can be trampled by outdoor recreationists, used as attachment points for hammocks and slacklines, and are sometimes collected for firewood. OHVs and campfires have the potential to start fires in western Joshua tree habitat. In addition, outdoor recreation and OHV use have the potential to spread and proliferate invasive species that compete with other plants including nurse plants, act as a fuel source for fire, and create fuel connectivity in Joshua tree habitat.

Impacts from development and other human activities can eliminate western Joshua tree habitat or degrade the quality habitat without eliminating it entirely. Habitat degradation can include habitat fragmentation from clearing for development; soil disturbance and compaction (including degradation or removal of biocrusts); introduction and spread of invasive plants (see Section 4.3.4 below), including more fire-prone invasive grasses; introduction and spread of pathogens; increased dust, pollution runoff, and trash; artificial noise, light, and vibration; and use of herbicides, pesticides, and other chemicals. Land clearing for development and agriculture has resulted in the fragmentation of remaining populations across the landscape, particularly in the species' southern range (Figure 4-3).

Source: Samantha Laarman, National Park Service.

Habitat fragmentation can have impacts to individual species or entire ecosystems, which can include increased edge effects, a reduced ability of species to migrate or colonize, and reductions in species richness (i.e., number of total species) (Haddad et al. 2015). The impacts of habitat fragmentation on western Joshua tree and the yucca moth, as well as their mutualism, are not well understood. Because western Joshua tree is a poor disperser, habitat fragmentation could disrupt population dynamics for the pollinator and plant by altering plant or pollinator densities and changing pollinator behaviors (Xiao et al. 2016). In addition, as fragmentation increases, specialists (i.e., organism adapted to a specific habitat and/or specific diet) such as the yucca moth needed for western Joshua tree reproduction, may decrease in number from the fragmented area while generalists (i.e., organism that occurs in a wide range of habitats and can use a wide variety of resources) become more prevalent (Xiao et al. 2016).

Development, herbicide application, raking, and clearing, and other human activities may have additional impacts on the yucca moth, such as accidental fire ignition, compaction of the soil, and trampling of yucca moths while they are dormant in the soil, or as adults. A lower abundance or absence of yucca moths would reduce sexual reproduction in western Joshua tree individuals, lowering recruitment, and in turn, lowering numbers of new western Joshua tree.

Native shrub communities associated with western Joshua tree in the Mojave Desert can take 100 years or more to recover to their original species composition and structure following disturbance if no action is taken, and perennial plants took an average of 76 years to reestablish following disturbance in an examination of 47 published studies (Abella et al. 2023). Studies evaluating postfire recovery of Mojave Desert shrub communities indicate that these systems may not be capable of achieving species composition similar to prefire conditions without active restoration (Abella et al. 2023). With wildland fire becoming an increasing threat to western Joshua tree, potentially degrading large areas of occupied habitat, restoration of burned sites will be a necessary component of species conservation, which may require many decades of recovery time. In addition, as land is cleared for development, biocrusts can be degraded or eliminated and can take decades to centuries to recover, depending on the impact (Kidron et al. 2020). Estimated biocrust recovery time after the severe disturbance of soil stripping (i.e., full removal of topsoil/A-horizon) by heavy machinery can take anywhere from 56 to 2,000 years (Kidron et al. 2020). Comparatively, biocrust recovery after the severe disturbance of biocrust removal (i.e., removal of 2 to 3 centimeters [approximately 0.7 to 1.2 inches] of topsoil) can take anywhere from 40 to greater than 250 years (Kidron et al. 2020).

4.3.3 Wildland Fire

Wildland fire poses a substantial threat to western Joshua tree. Wildland fire impacts to western Joshua tree are summarized in CDFW’s March 2022 status review of western Joshua tree (CDFW 2022), and additional information on wildland fire impacts since the status review is also presented. Although fire is a key component of most California ecosystems (Keeley et al. 2012; Sugihara et al. 2018), California deserts, where a large part of the western Joshua tree range is located, experience fire generally at a lower frequency and lesser severity compared to many other California ecosystems. Fires that occur in California's southeastern deserts are limited by fuel availability, and California deserts in general tend to have relatively long fire return intervals (i.e., time between fires) (Sawyer et al. 2009; Brooks et al. 2018). One study estimated a fire return interval for middle elevation areas of the Mojave Desert at approximately 687 years (Brooks et al. 2018). Since Joshua trees can be present in forest, shrub, and grassland ecosystems, the fire return intervals to which Joshua tree is subject can vary greatly. Fires occurring from 1900 to present in the western Joshua tree range in California have mostly burned the landscape within the western and southern edges of the range (CAL FIRE 2023).

Source: Hannah Schwalbe, National Park Service.

Historical fire regime modeling has been developed with input from more than 800 experts throughout the United States during 5 years of workshops using scientific literature, local data (e.g., inventory and monitoring data), and expert judgment (Blankenship et al. 2021). Historical fire regime modeling is presented by elevation in Table 4-5 and shows that the large majority of the western Joshua tree range in California has a V-A fire regime, which is defined as fire burning at any severity with a fire return interval of 201 to 500 years (Figure 4-6) (LANDFIRE 2024). This historical fire regime constitutes the majority of all elevation classes, except the high elevation class, which is mostly classified as having a III-B fire regime. The III-B fire regime is defined as having less than 66.7 percent of percent replacement fire (i.e., area that burned hot enough to eliminate all or a majority of vegetation) and a fire return interval of 101 to 200 years. Historical fire regime modeling shows that more than 76 percent of the western Joshua tree range in California has a fire return interval that is at least 100 years or greater, and 14 percent is classified as non-burnable; thus, only approximately 9 percent of the range in California has a historical fire regime of 100 years or less. Fires with perimeters greater than 2,023 hectares (5,000 acres) are mapped in Figure 4-7. The areas and percentage of the western Joshua tree range in California that burned more than once (i.e., reburned) are presented in Table 4-6. The reburn data presented in Table 4-6 shows a decrease in fire return interval within the western Joshua tree range in California. compared to historical fire regime modeling, which classified most of the range in California as having between a 101- and 500-year or 501-year or greater fire return intervals with approximately 64 percent of the range in California having between a 201- and 500-year fire return interval.

Table 4-5 Historical Fire Regimes by Elevation within the Western Joshua Tree Range in California

Historical Fire Regime	Low Elevation[1] (percent of range)	Middle-Low Elevation[1] (percent of range)	Middle-High Elevation[1] (percent of range)	High Elevation[1] (percent of range)	Total (percent of range)
I-B: Percent replacement[2] fire less than 66.7%, fire return interval 6–15 years	0.3	0.9	0.3	<0.1	**1.5**
I-C: Percent replacement fire less than 66.7%, fire return interval 16–35 years	0.3	0.4	0.2	<0.1	**0.9**
II-A: Percent replacement fire greater than 66.7%, fire return interval 0–5 years	0	<0.1	0	0	**<0.1**
II-C: Percent replacement fire greater than 66.7%, fire return interval 16–35 years	<0.1	0	0	0	**<0.1**
III-A: Percent replacement fire less than 80%, fire return interval 36–100 years	<0.1	<0.1	<0.1	<0.1	**<0.1**
III-B: Percent replacement fire less than 66.7%, fire return interval 101–200 years	<0.1	0.1	0.8	0.7	**1.6**
IV-A: Percent replacement fire greater than 80%, fire return interval 36–100 years	1.2	4.1	1.4	0.1	**6.7**
IV-B: Percent replacement fire greater than 66.7%, fire return interval 101–200 years	0.4	4.1	0.7	0.1	**5.3**
V-A: Any severity, fire return interval 201–500 years	34.9	18.1	10.4	0.6	**64.0**
V-B: Any severity, fire return interval 501 or more years	1.5	2.8	1.3	<0.1	**5.6**
Total	**48.0**	**34.3**	**16.1**	**1.6**	**–**

Notes: m = meters; ft = feet. Approximately 14.4 percent of the western Joshua tree range is not included in this analysis and was classified as non-burnable agriculture or other non-burnable categories.

[1] The elevational range of western Joshua tree was divided into four equal range classes: low elevation: 585–1,105.9 meters (1,919–3,628 feet); middle-low elevation: 1,106–1,625.9 meters (3,629–5,334 feet); middle-high elevation: 1,626–2,145.9 meters (5,335–7,040 feet); high elevation: 2,146–2,675.9 meters (7,041–8,780 feet).

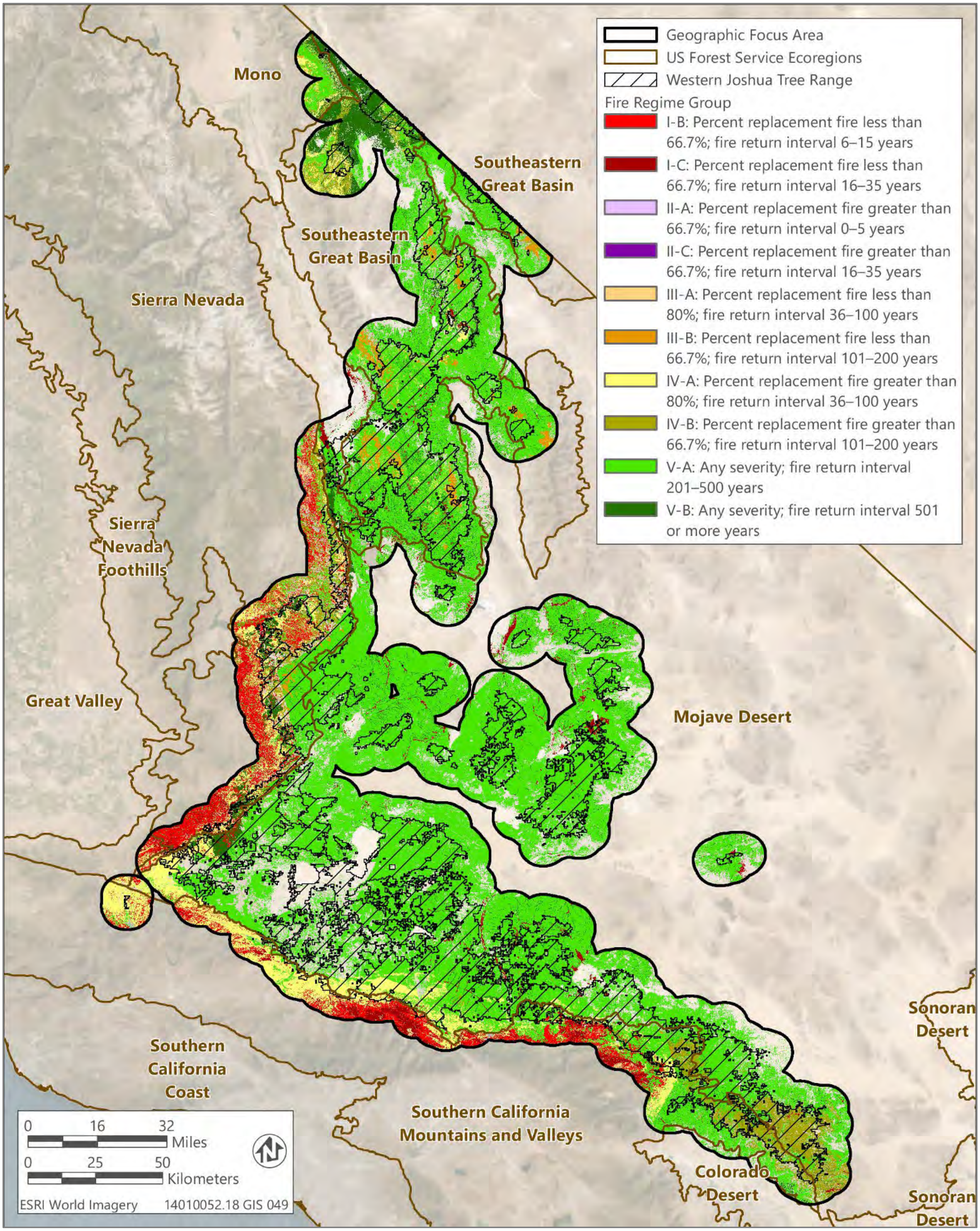
[2] Percent replacement fire refers to the area that burned hot enough to eliminate all or a majority of vegetation.

Source: Esque et al. 2023; LANDFIRE 2024; compiled by Ascent in 2024.

Table 4-6 Reburns from 1916 through 2023 within the Western Joshua Tree Range in California

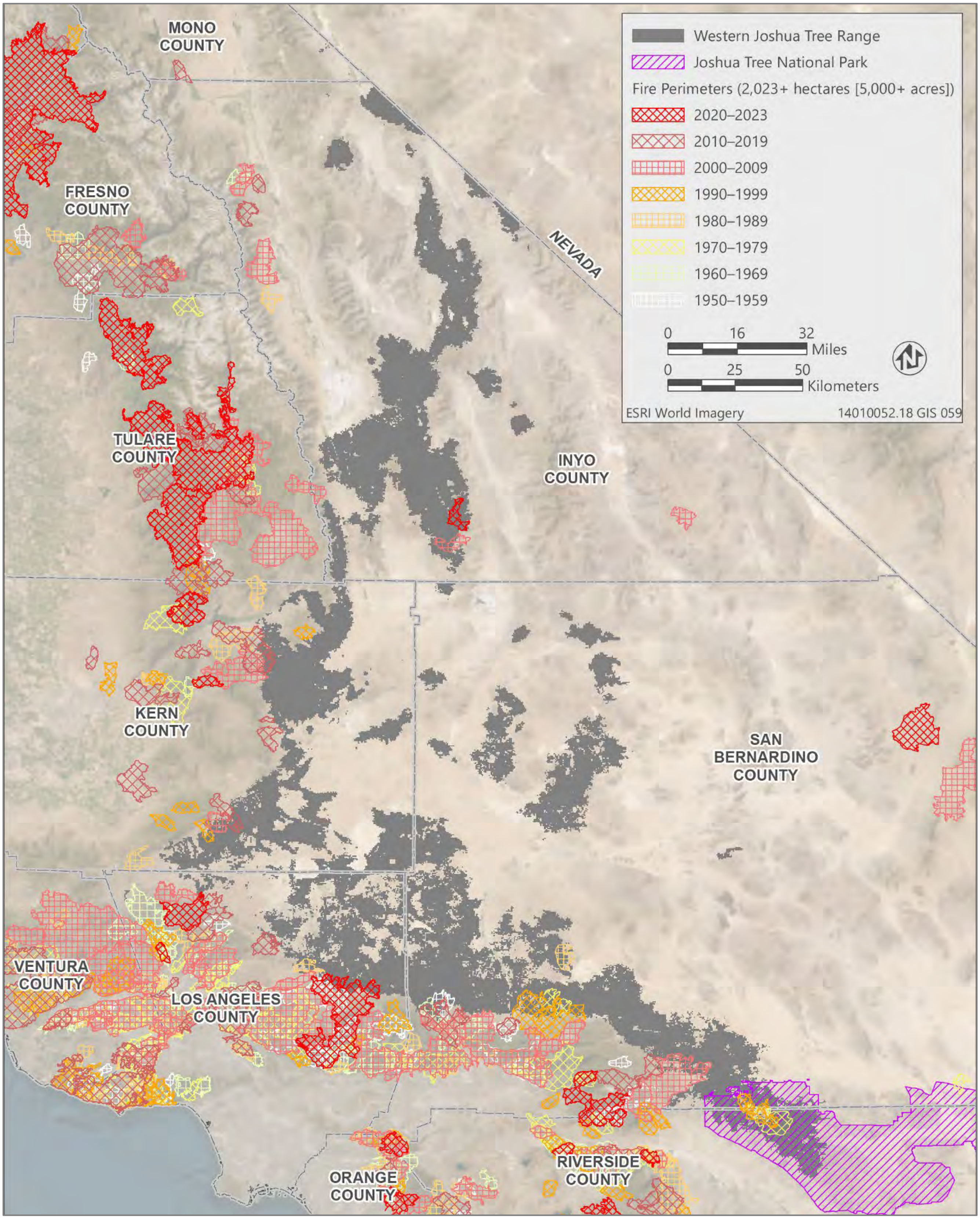
Number of Reburns	Area in Hectares (acres)	Percent of Range
One	69,822.3 (172,534.6)	5.3
Two	14,541.6 (35,933.2)	1.1
Three	2,390.1 (5,906.0)	0.2
Four	154.1 (380.8)	<0.1
Five	76.8 (189.8)	<0.1
One or more times	**86,984.9 (214,944.5)**	**6.6**

Source: CAL FIRE 2023; Esque et al. 2023; compiled by Ascent in 2024.



Source: Esque et al. 2023; LANDFIRE 2024; USFS 2024; adapted by Ascent in 2024.

Figure 4-6 Historical Fire Regimes within the Geographic Focus Area



Sources: CAL FIRE 2023; Esque et al. 2023; adapted by Ascent in 2024.

Figure 4-7 Fires Greater than 2,023 hectares (5,000 acres) within the Western Joshua Tree Range in California

Source: Sasha Travaglio, National Park Service.

Demonstrating how rapidly a wildland fire can affect a dense Joshua tree population, the 2020 Dome Fire burned more than 17,892 hectares (44,211 acres) and was estimated to have fully burned approximately 1.1 million and partially burned 200,000 eastern Joshua trees (Kaiser, pers. comm., 2024). The Dome Fire occurred while several other fires were burning throughout California (Figure 4-8), which limited available firefighting resources and likely led to the fire burning for a longer period. These types of conflicts with fire-fighting resources are anticipated to continue as the frequency of concurrent fires increases (USFWS 2023). Only 3 years later, the York Fire occurred in 2023, approximately 16 kilometers (10 miles) east of the Dome Fire perimeter and burned approximately 37,667 hectares (93,078 acres) within eastern Joshua tree habitat at the Mojave National Preserve (Figure 4-8) (CAL FIRE 2023). Combined, the Dome and York Fires burned approximately 14.5 percent of the eastern Joshua tree range in California in 3 years (Esque et al. 2023; CAL FIRE 2023).

Large scale fires can start from ignition sources including lightning strikes, escaped campfires, and combusting piles of mulch. Fire ignition from mulch piles is an issue in Los Angeles County where illegally dumped mulch can generate heat, combust, and develop into a wildland fire (Barger 2024).

Postfire vegetation changes can impede the distribution and recovery of native plant species and communities. Increases in fire size and decreases in fire return intervals within the western Joshua tree range can result in changes in vegetation conditions that can reduce the number of western Joshua trees, impair recruitment, and cause local extirpation of western Joshua tree populations. In addition to fire, these vegetation changes can also result from other disturbances, such as the onset of droughts, increased effects of climate change, and effects of continued land use development. Such vegetation change is referred to as “vegetation departure” – a landscape metric that measures how different the current vegetation on a landscape is from historical vegetation conditions. Vegetation departure is classified into categories ranging from very high to very low, indicating the percentage change from historical conditions. Within the range of western Joshua tree, the most substantial changes in vegetation conditions are classified as very high departure and have occurred along the southern edge of the range, likely creating highly vulnerable western Joshua tree populations in these areas (Figure 4-9) (LANDFIRE 2023). Very high vegetation departure is most prevalent in the middle-low elevation class in California for the species (Table 4-7). Most of this change is concentrated at the southeastern tip of the species range, where there are large patches of very high vegetation departure conditions (Figure 4-9) that partially overlap Joshua Tree National Park. This very high vegetation departure within and around Joshua Tree National Park aligns with two overlapping fire perimeters that are mostly within the park boundaries (Figure 4-7), which likely contributed to the altered vegetation conditions.

Table 4-7 Vegetation Departure Classifications by Elevation Classes within Western Joshua Tree Range in California

Elevation Classes	Very Low (0–16% Departure) (percent of range)	Low (17–33% Departure) (percent of range)	Moderate to Low (34–50% Departure) (percent of range)	Moderate to High (51–66% Departure) (percent of range)	High (67–83% Departure) (percent of range)	Very High (84–100% Departure) (percent of range)	Unclassified for Vegetation Departure[1] (percent of range)	Total (percent of range)
Low elevation class[2]	24.7	0.6	<0.1	6.5	2.6	0.3	13.2	**48.0**
Middle-low elevation class	1.9	1.4	1.0	18.2	2.1	3.6	6.0	**34.3**
Middle-high elevation class	<0.1	1.4	1.4	10.4	1.1	<0.1	1.8	**16.1**
High elevation class	<0.1	0.9	0.1	0.6	<0.1	0	0.1	**1.7**
Total	**26.7**	**4.3**	**2.5**	**35.7**	**5.8**	**3.9**	**21.0**	**-**

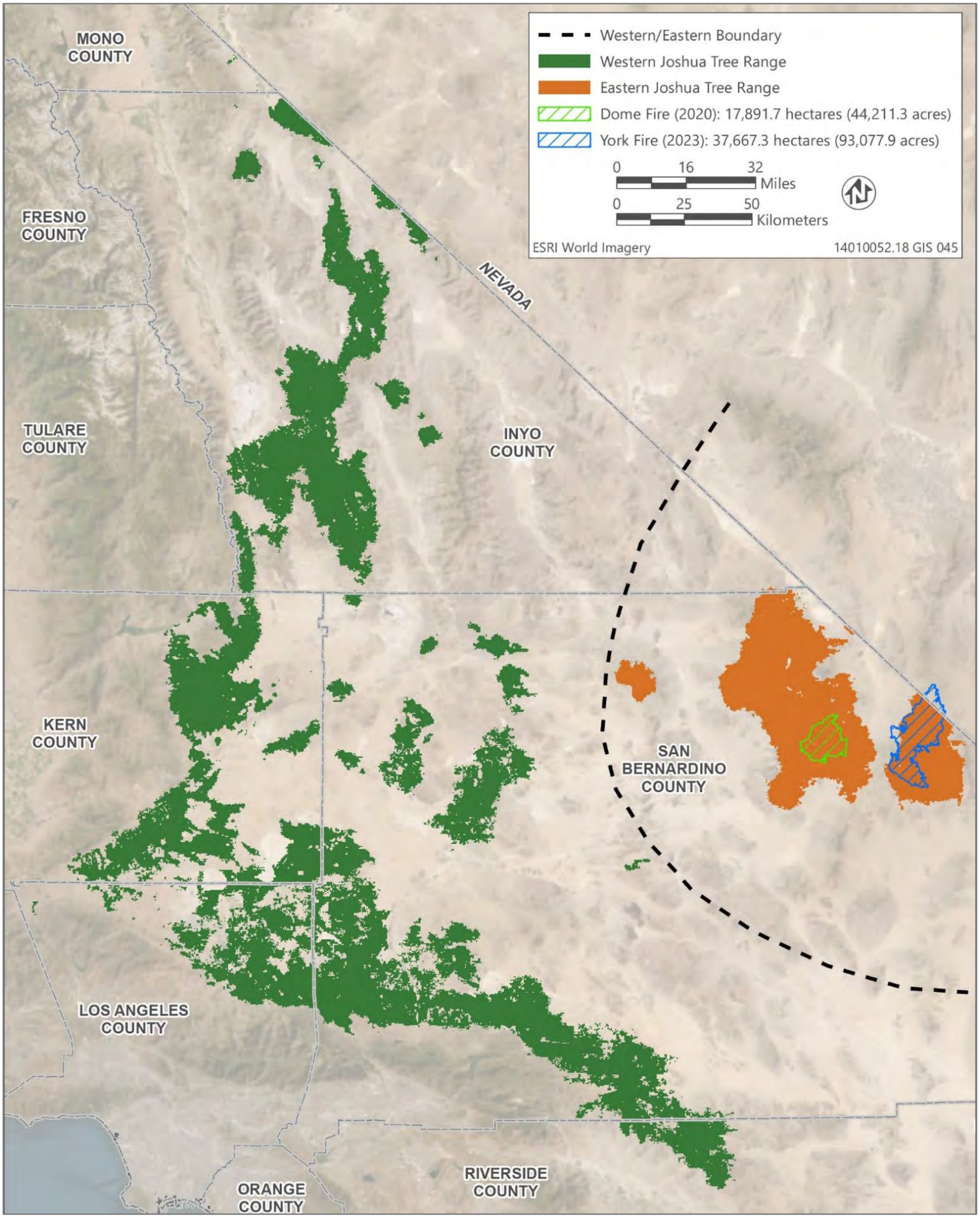
Note: m = meters; ft = feet.

1 Not included are portions of the range that are classified as water, non-burnable agriculture, non-burnable urban, and sparsely vegetated.

2 The elevational range of western Joshua tree was divided into four equal range classes: low elevation: 585–1,105.9 meters (1,919–3,628 feet); middle-low elevation: 1,106–1,625.9 meters (3,629–5,334 feet); middle-high elevation: 1,626–2,145.9 meters (5,335–7,040 feet); high elevation: 2,146–2,675.9 meters (7,041–8,780 feet).

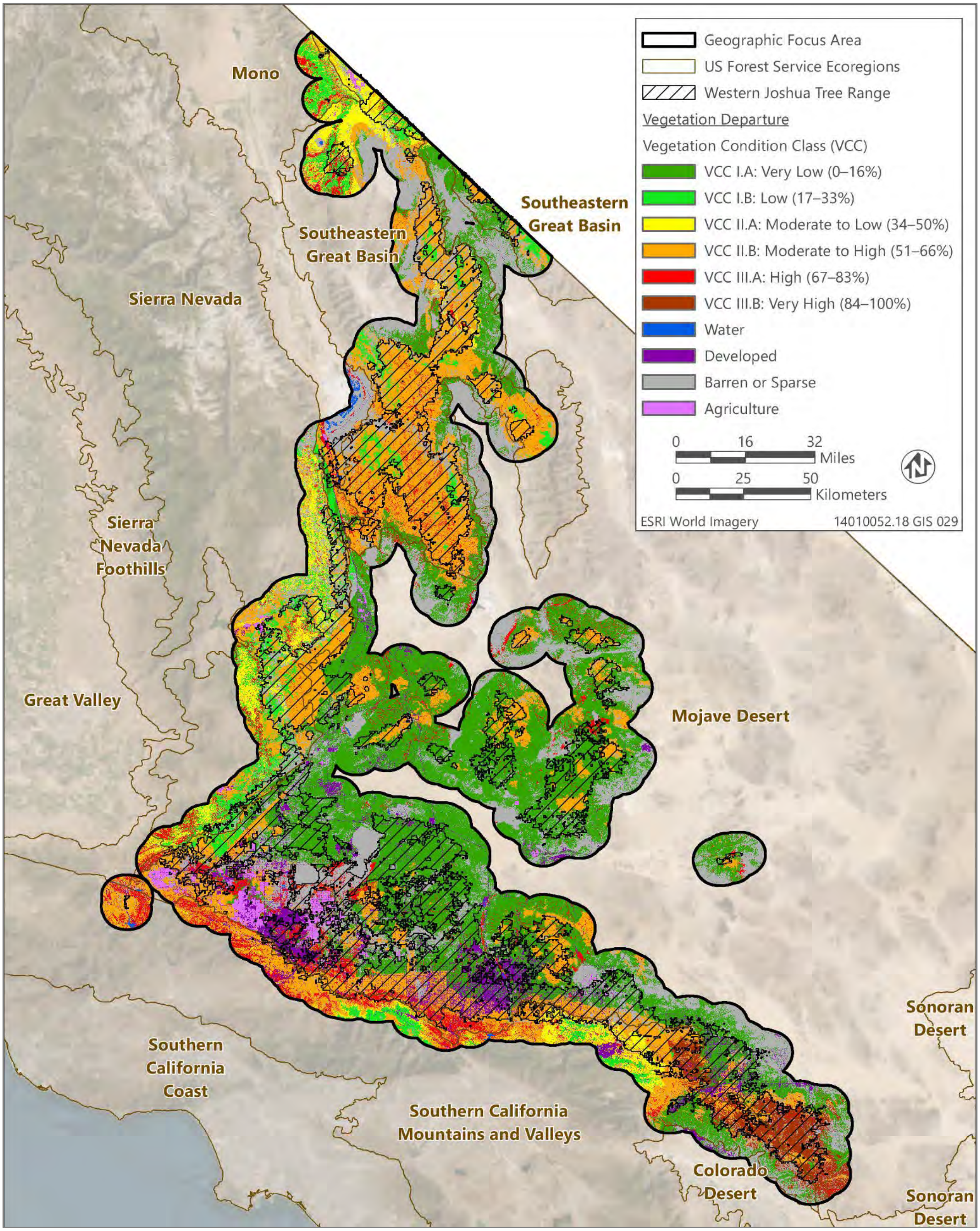
Source: Esque et al. 2023; LANDFIRE 2023; compiled by Ascent in 2024.

Most of the western Joshua tree range in California is modeled as moderate to high vegetation departure, which is mostly concentrated within the middle-low and middle-high elevation classes (Table 4-7). In addition, there are high and very high departure categories present with these middle-elevation areas. Although vegetation departure is mainly very low in the lowest elevation class where western Joshua tree is present, there is also a large amount of land within this elevation class that is classified as moderate to high and high vegetation departure. The low elevation class is defined as 585 to 1,105.9 meters (1,919 to 3,628 feet) and therefore still represents mid-elevation areas. This substantial vegetation change is likely at least partially explained by the increase in annual fire area in middle-elevation areas from 1984 to 2013 (Brooks et al. 2018).



Sources: CAL FIRE 2023; Esque et al. 2023; adapted by Ascent in 2024.

Figure 4-8 Dome and York Fires Overlapping the Eastern Joshua Tree Range in California



Sources: Esque et al. 2023; LANDFIRE 2023; USFS 2024; adapted by Ascent in 2024.

Figure 4-9 Vegetation Departure within the Geographic Focus Area

Wildland fire tends to be unevenly distributed in the Mojave Desert with most large and recurring fires located in areas that experience relatively high amounts of summer precipitation (Tagestad et al. 2016). Higher precipitation leads to more plant growth and in turn, more fuel for fire. Because of fuel availability, fires tend to also be more frequent at middle to high elevations (Brooks et al. 2018).

These patterns of wildland fire occurrence could threaten future western Joshua tree population persistence because some middle to high elevation areas of the Mojave Desert have the highest probability of retaining 20th century–suitable climate conditions for western Joshua tree (Shryock et al. 2025), and therefore, fire may disproportionately affect these areas of western Joshua tree climate refugia. The middle-elevation areas, which have experienced recent increases in annual burn area, are where the highest densities of western Joshua trees are usually found (Brooks et al. 2018). The Bridge Fire (2024) burned partially within modeled future climate refugia in the Southern Mountains and Valleys ecoregion near Piñon Hills, California (CAL FIRE 2024; Shryock et al. 2025).

Joshua tree stands can be heavily affected by fire; for example, one study found that 80 percent of the burned western Joshua tree and 26 percent of unburned western Joshua trees died at Joshua Tree National Park approximately 5 years postfire (DeFalco et al. 2010). Burned Joshua tree stands recover slowly following fire, partially because postfire resprouts of young Joshua trees can be heavily targeted by herbivores (DeFalco et al. 2010). One study measured the condition of resprouts 2 years postfire and found that only approximately 49 percent of resprouts were healthy (De Vera 2022). This slow recovery is further exacerbated by the low germination success of Joshua tree seeds; postfire recruitment of new Joshua trees is typically seen only in areas that have not previously burned within the past 40 years (Brooks et al. 2018). In addition, another study in the Dome Fire footprint found eastern Joshua tree to have an approximately 18 percent survival rate 2.5 years postfire (Sweet et al. 2023). Between 1.5 and 2.5 years postfire, approximately 5 percent of surviving eastern Joshua trees died (Sweet et al. 2023), highlighting that even Joshua trees that initially survive a burn still may not survive. However, the postfire mortality rates of eastern Joshua tree and western Joshua tree may be different (Cornett 2022).

4.3.4 Invasive Plant Species

Invasive species are plants that are nonnative (i.e., do not naturally occur in an area) to an environment, and once introduced, they establish, quickly reproduce and spread, and cause harm to the environment, economy, or human health (Cal-IPC n.d.-a). Invasive plant species, particularly annual grasses, can rapidly invade Mojave Desert habitats and compete with other plants for light, water, space, and nutrients (Brooks 2000; DeFalco et al. 2003; DeFalco et al. 2007; Blank 2009; Perkins and Hatfield 2014). Western Joshua tree is likely most vulnerable to competition from invasive plant species in the years immediately following its germination and would become less vulnerable as it gets larger and can better compete for resources. Invasive annual plant species currently indirectly affect all western Joshua trees age classes by providing a fuel source for fire, which increases the fire risk in western Joshua tree habitat.

Red brome, an invasive grass species that occurs in the western Josua tree range.

Source: Robb Hannawacker, National Park Service.

In the greater Mojave Desert region, within the western Joshua tree range, these invasive plant species include those the California Invasive Plant Council has ranked as "high"—meaning they have severe negative ecological impacts on physical processes, plant and wildlife communities, and vegetation structure and moderate to high rates of dispersal and establishment. The species that are ranked high for exhibiting those impacts in the western Joshua tree range in California include Saharan mustard (*Brassica tournefortii*), red brome (*Bromus rubens*), and cheatgrass (*Bromus tectorum*) (Cal-IPC n.d.-b). In addition, stinknet (*Oncosiphon pilulifer*) is ranked high and has been recognized as an emerging significant threat to Mojave Desert ecosystems that can outcompete native plant species and contribute to increased fire frequency (Cal-IPC 2021). Additional invasive plant species are present in the region that are ranked as "limited," which are plants defined as having a low to moderate rate of invasiveness and minor ecological impacts on a statewide level or not enough information to justify a higher rating. Plants ranked limited generally tolerate a limited range of environmental conditions and therefore have a limited distribution, but these species may be locally persistent and problematic (Cal-IPC n.d.-b, n.d.-c). Invasive plants ranked limited that are present in the range of western Joshua tree include Russian thistle (*Salsola tragus*), Arabian schismus (*Schismus arabicus*), and common Mediterranean grass (*Schismus barbatus*) (Cal-IPC n.d.-b, n.d.-c). The presence of invasive plant species in the Mojave Desert is most associated with human disturbance and development, including roads, OHV use, livestock grazing, and agriculture (Brooks and Berry 2006). Even within protected areas, such as Joshua Tree National Park, there are few places that do not support invasive annual plant species (Frakes, pers. comm., 2021).

4.3.5 Herbivory and Predation

Western Joshua trees rely on different organisms for reproduction and seed dispersal and provide food and shelter for many other species. Sometimes relationships between western Joshua tree and other organisms that are ordinarily harmless or mutualistic can become predatory or damaging under certain conditions. For example, although the relationship between scatter-hoarding rodents and Joshua trees can be mutualistic (i.e., both organisms benefit one another), in non-masting years when Joshua trees only produce a small number of seeds, an overabundance of rodents may consume all the seeds, which shifts the relationship to a predatory one (Waitman et al. 2012). In addition, small mammal species sometimes strip the bark from Joshua trees for food, nesting material, and moisture. Small mammals, including black-tailed jackrabbits, white-tailed antelope ground squirrels, Botta's pocket gophers (*Thomomys bottae*), and woodrats (*Neotoma* spp.) sometimes strip the bark from Joshua trees, a behavior that occurs with more frequency during drought periods (Esque et al. 2003; DeFalco et al. 2010; Esque et al. 2015). Bark-stripped trees experience higher rates of mortality compared to unstripped trees, and the amount of damage to the tree correlates to its ability to survive (i.e., more damage results in higher likelihood of mortality) (Esque et al. 2003).

Source: Preston Jordan Jr., National Park Service.

Heacox (pers. comm., 2024) reported that observations of yucca weevil, which can also damage Joshua trees, have been increasing. Yucca weevil larvae build protective cases near the ends of Joshua tree branches, and resulting damage to the meristem has been noted to cause branching in affected plants (Jaeger 1965). Adult yucca weevils have been known to feed on host sap, which is thought to not threaten plant health; however, larvae feeding on yucca plants combined with decaying microorganisms that colonize wounded tissue commonly causes infested plants to collapse and die (UC IPM 2020). Heacox (pers. comm., 2024) observed adult yucca weevils feeding and targeting inflorescences of western Joshua tree, the effects of which are not well understood. Signs of yucca weevil infestation on western Joshua tree include rotted branches full of grubs, black sticky substances oozing from holes on the stem and leaves, and discoloration of plant parts. In addition, signs of infestation also include yucca weevil presence on multiple trees in a stand and rotting bases of younger western Joshua trees (Heacox, pers. comm., 2024). However, parasitic wasps, which parasitize yucca moth larvae, may mediate the effects of yucca weevil predation on Joshua tree when present, as has been in observed in Spanish dagger (*Yucca treculiana*) (Crabb and Pellmyr 2006). Lastly, Joshua trees can also experience infestations of other insects, such as a small, contained outbreak of the yucca plant bug (*Halticotoma valida*), which was reported as negatively affecting several planted Joshua trees at a demonstration garden in the town of Joshua Tree, California (JTNP 2017).

4.4 MANAGEMENT UNITS

Conservation management units are defined in the Conservation Plan to organize and prioritize management actions for western Joshua tree based on physical, ecological, and management characteristics. The current and predictable future characteristics of the environment, such as quality of habitat and climate conditions, influence the relative importance and expected effectiveness of specific management actions. Management characteristics are determined by the level of existing protection of western Joshua tree and the entity with authority for land management. Organizing the landscape by its physical, ecological, and management characteristics will help guide the application of the Conservation Plan's management actions.

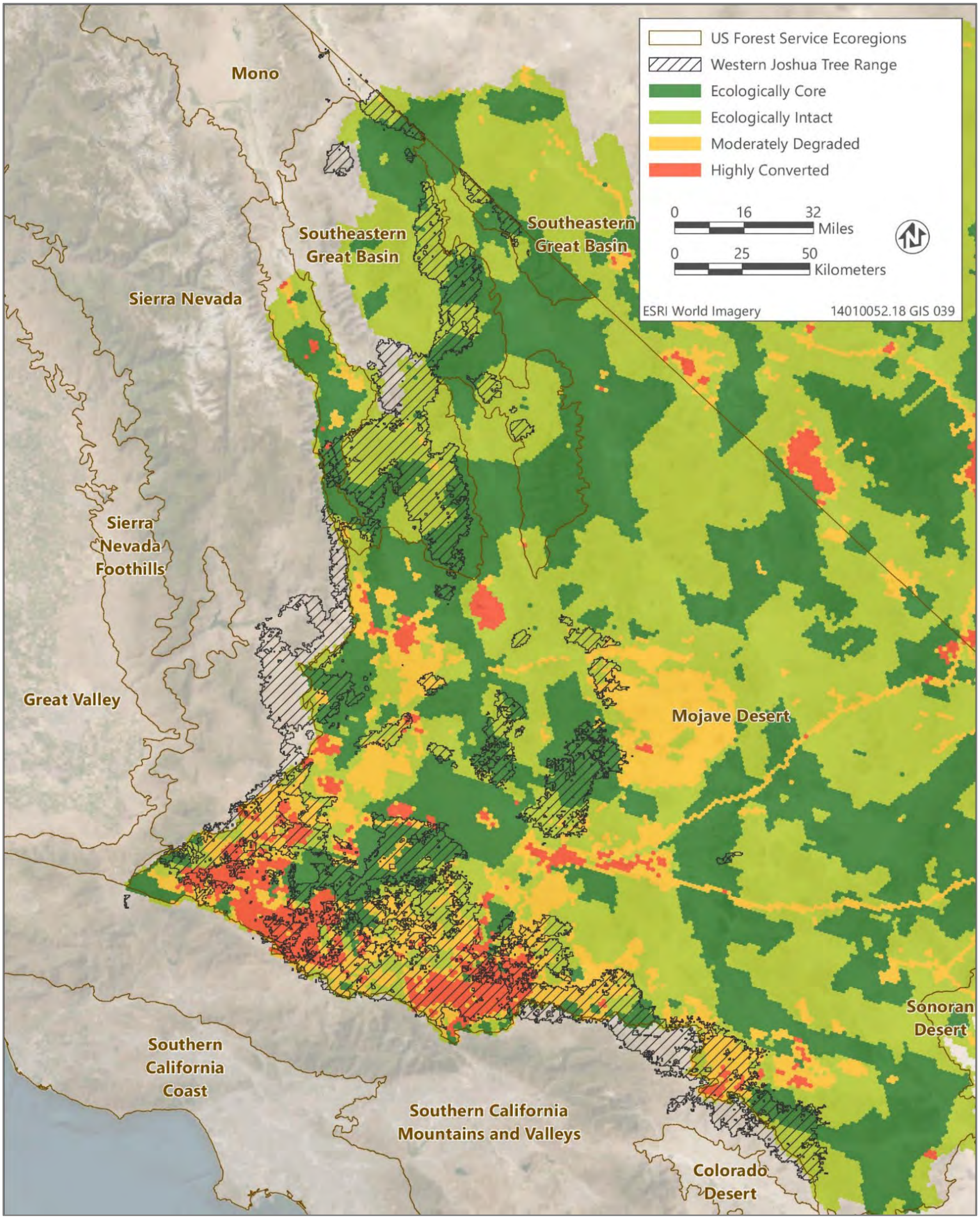
Climate change is the greatest threat to western Joshua tree, and therefore, climate refugia areas (as shown in Figure 4-4) are critical for long-term western Joshua tree conservation. A buffer around climate refugia provides an area that can absorb impacts from other threats to predicted future climate refugia (e.g., invasive species, wildland fire, development). Unoccupied areas of future suitable habitat are important for natural dispersal and possibly assisted migration. Predictions regarding climate refugia using data and modeling from Shryock et al. (2025) were used to determine climate-related management criteria, and were based on Shared Socioeconomic Pathways (SSP) emissions scenarios (IPCC 2023). These data are preliminary or provisional and are subject to revision. They were provided to CDFW to meet the need for timely science. The data have not received final approval by US Geological Survey and are provided on the condition that neither the US Geological Survey nor the US Government shall be held liable for any damage resulting from the authorized or unauthorized use of the data. The categories delineating current and future climate refugia for the purposes of this Conservation Plan are in areas in which the species can naturally migrate and are as follows:

1. **Predicted climate refugia category:** Areas identified within western Joshua tree distribution that are predicted to continue to provide suitable habitat conditions in the future based on low (SSP 2-4.5), moderate (SSP 3-7.0), and high (SSP 5-8.5) emissions climate change modeling scenarios for the 2071 through 2100 timeframe. These three emissions scenarios were selected to ensure that a sufficient area of occupied habitat is targeted for protection to meet the effectiveness criteria for management actions in the Conservation Plan that identify priority conservation lands and restoration and enhancement areas, and assist western Joshua tree migration through connectivity corridors (see Sections 5.2, "Management Actions Necessary to Conserve Western Joshua Tree," and 5.3, "Effectiveness Criteria").

2. **Buffered climate refugia category:** Areas within a 2.5-kilometer (approximately 1.6-mile) buffer of the predicted climate refugia category boundaries for the low, moderate, and high emissions modeling scenarios that overlap currently occupied and unoccupied western Joshua tree habitat. The buffered climate refugia category contains lands that are modeled as climate refugia and lands that are not modeled as climate refugia.

3. **Unoccupied future suitable habitat category:** Areas where western Joshua tree can disperse naturally that are currently unoccupied by western Joshua tree but are predicted to be climate refugia and therefore modeled to provide future suitable habitat based on climate models for the low, moderate, and high emissions modeling scenarios in the 2071 through 2100 timeframe. Unoccupied future suitable habitat does not overlap lands in the buffered climate refugia category.

The Mojave Desert ecological assessment (see Figure 4-10) was conducted to describe and understand the ecological character of the region and assist in identifying areas for protection (Randall et al. 2010). This assessment was developed to help inform planning and management for land use and conservation investment across the region (Randall. et. al. 2010). A majority of the habitat that encompasses the western Joshua tree range in California in the Mojave Desert region was split into the following conservation value categories presented from least to most disturbed: ecologically core, ecologically intact, moderately degraded, and highly converted (see Table 4-8 for category definitions and recommended management strategies) (Randall et al. 2010). This initial assessment of the current ecosystem conditions was updated to include recent areas of solar development (Parker et al. 2018). For the Conservation Plan, additional data for solar and wind development (Hoen et al. 2018; Fujita et al. 2023) were added. This assessment is an important starting point for prioritizing areas that will be most important for western Joshua tree conservation and management. It should be noted that approximately 15.6 percent of the western Joshua tree range in California was not assessed, and therefore conservation value has not been evaluated for these areas. The ecological assessment did not consider climate refugia modeling as a criterion for conservation value and the climate refugia modeling did not consider conservation value when modeling climate refugia.



Sources: Randall et al. 2010; Hoen et al. 2018; Parker et al. 2018; Esque et al. 2023; Fujita et al. 2023; USFS 2024; adapted by Ascent in 2024.

Figure 4-10 Conservation Value Categories Overlapping the California Range of Western Joshua Tree

A variety of strategies may be required to conserve western Joshua tree, depending on the general conservation value of habitat (Table 4-8). Strategies include protecting high conservation value (i.e., ecologically core) lands through redesignation of public lands and acquisition or leasing of private and State School Lands, respectively, enhancing the management and restoration of public lands, and promoting adaptive management. Because the initial assessment covered the entire Mojave Desert region based on satellite data, the ecological assessment authors recommend a finer-scale and site-specific assessment for decision-making regarding specific projects or site-scale planning (Randall et al. 2010).

Table 4-8 Conservation Value Category Definitions and Land Management Strategies for each Category

Conservation Value	Category Definition	Strategies
Ecologically core	These lands of highest conservation value are largely undisturbed and unfragmented and support the conservation targets (species, ecological systems, springs, and seeps) selected for this analysis. Their full protection is critical for long-term conservation of biodiversity in the Mojave Desert.	Protect the large, intact habitat blocks comprising ecologically core lands to conserve irreplaceable conservation targets, support the ecological processes they depend upon, and maintain habitat connectivity. Prevent fragmentation of these areas caused by development and roads, and prevent degradation caused by invasions of exotic species, uncharacteristic (frequent) fire regimes, excessive groundwater withdrawals, and other direct and indirect human impacts.
Ecologically intact	These lands of high conservation value are largely undisturbed and unfragmented and support conservation targets. They buffer ecologically core lands and require levels of protection that will allow them to remain relatively undisturbed to preserve ecological processes and to provide viable habitat and connectivity for native wildlife, plants, and communities. Most ecologically intact lands are functionally equivalent to ecologically core lands and may contain many of the same conservation targets, including sensitive species. However, they may have been classified as ecologically intact because they support more widespread ecological systems, are at higher risk of degradation, or support conservation targets for which the conservation goals have already been met on ecologically core lands.	Promote land uses and management practices that maintain or improve landscape integrity and protect conservation targets. Promote restoration of habitat connectivity, natural vegetation communities, and ecological processes (e.g., sand transport and water-flow regimes).
Moderately degraded	These lands are fragmented by roads or off-road-vehicle trails or are in close proximity to urban, agricultural, or other developments. They often maintain ecological functionality (e.g., maintain groundwater infiltration and flow, serve as sand sources, provide connectivity) or provide habitat for native species, including the conservation targets selected for this analysis.	Encourage sustainable land uses that minimize impacts to native species and communities and other natural resources, allow protection of sensitive species and isolated high value native ecosystems, and maintain landscape permeability to wildlife movement.

Conservation Value	Category Definition	Strategies
Highly converted	These urban, suburban, and agricultural lands are heavily altered. Whereas some can support important conservation targets, their ecological context is highly compromised.	Encourage clustering of new land uses in areas already converted for human uses and encourage siting of developments selected to minimize impacts to conservation targets and other biological resources. Focus conservation and management efforts within highly converted lands on existing open spaces, riparian habitats, and canyons that support local wildlife, improve air and water quality, recharge and prevent overdrafts of groundwater aquifers, and otherwise improve human quality of life. Promote management of agricultural lands and urban landscapes that supports wildlife.

Note: Approximately 15.6 percent of the western Joshua tree range was not mapped by Randall et al. 2010 plus the assessment update by Parker et al. (2018).

Source: Randall et al. 2010; compiled by Ascent in 2024.

Federal, state, local, and tribal jurisdictional boundaries; land ownership; and land management authority are also important considerations in determining which management actions are most important to pursue within management units. Because similar types of management actions and written agreements may be implemented for western Joshua tree conservation within different ownerships and management authorities, categories of land use with similar management have been grouped to define the management units as follows:

1. **Wilderness.** Designated BLM, US Forest Service (USFS), and National Park Service (NPS) wilderness areas, and BLM wilderness study areas.

2. **Preservation with Light Recreation/Other Use.** USFS-recommended wilderness areas, non-wilderness NPS land, California State Parks land (except for State Vehicular Recreation Areas [SVRAs]), BLM areas of critical environmental concern, USFS special interest management areas (includes research natural areas and botanical areas), USFS wild and scenic river areas, BLM National Monuments, USFS National Monuments, local county conservation areas (includes wildlife and wildflower sanctuaries), and other protected lands that are managed for conservation (i.e., land trusts and lands with conservation easements).

3. **Defense.** US Department of Defense lands consisting of multiple installations.

4. **Tribal Land.** Lands held in trust by California Native American tribes (rancherias/reservations) or tribal members (individual allotments usually within rancherias/reservations).

5. **Mixed Use.** California SVRAs, BLM recreation management areas, BLM and USFS grazing allotments, NPS grazing permitted land, USFS and BLM lands that are not included in Wilderness or Preservation with Light Recreation/Other Uses, and city-owned infrastructure lands consisting of cemeteries, irrigation districts, water districts, school districts, and community services.

6. **Little or No Protection.** All other lands (including private and State School Lands as well as DRECP development focus areas and variance process lands).

The percent of the current western Joshua tree range within each conservation category and management unit is summarized in Table 4-9.

4.4.1 Range-Wide Management Units

Table 4-9 shows the percentage of the western Joshua tree range in California by conservation value category and management unit. The majority of the range in California is in the Little to No Protection unit, followed by Mixed Use and Defense units. Wilderness units constitute another large portion of the western Joshua tree range in California and have more protection than the previous three units due to the management of Wilderness lands, which includes protection of land and preservation of wilderness character. Tribal land contains less than 1 percent of the range in California.

Table 4-9 Percent of Western Joshua Tree Range in California within Conservation Value Categories by Management Unit

Management Unit	Ecologically Core	Ecologically Intact	Moderately Degraded	Highly Converted	Not Categorized	Total
Little or No Protection	3.0	6.4	14.5	9.1	2.6	**35.5**
Mixed Use	4.4	10.1	1.9	0.1	7.7	**24.1**
Defense	10.4	5.6	1.3	0.3	0	**17.7**
Wilderness	3.7	6.3	<0.1	0	4.2	**14.2**
Preservation with Light Recreation/Other Use	3.4	3.0	0.7	0.1	1.2	**8.4**
Tribal Land	0	<0.1	0	0	<0.1	**<0.1**
Total	**24.9**	**31.5**	**18.4**	**9.6**	**15.6**	**99.99**[1]

Notes: Totals may not sum exactly due to independent rounding.

[1] Data do not equal total species range due to mapping discrepancies.

Sources: Randall et al. 2010; Hoen et al. 2018; Parker et al. 2018; Esque et al. 2023; Fujita et al. 2023; compiled by Ascent in 2024.

The majority of the ecologically core habitat, which is defined as the least disturbed, is within Defense units. The next largest amount of ecologically core habitat is within the Mixed Use and Wilderness units (Table 4-9). The majority of ecologically intact habitat is within Mixed Use units. Wilderness, Little to No Protection, and Defense units also contain substantial portions of ecologically intact habitat. The majority of moderately degraded habitat is within Little to No Protection units, followed by Mixed Use and Defense units. The majority of the highly converted habitat, which is the category of land that is most disturbed within the region, is within Little to No Protection units.

The portion of the western Joshua tree range in California that was not categorized in the Mojave Desert ecological assessment is mainly within Mixed Use units, followed by Wilderness, Little to No Protection, and Preservation with Light Recreation/Other Use units. Approximately 22.6 percent of the western Joshua tree range in California is within areas that already have land protections in place and are generally being managed with conservation in mind: Wilderness and Preservation with Light Recreation/Other Use.

Source: Jeb Bjerke, California Department of Fish and Wildlife.

4.4.2 Management Units for Climate Refugia

PREDICTED CLIMATE REFUGIA CATEGORY

The predicted climate refugia category consists of areas identified within western Joshua tree distribution that are predicted to continue to provide suitable habitat conditions in the future. Shryock et al. (2025) shows that as emissions levels increase causing land within the predicted climate refugia category to decrease, the proportion of land within the predicted climate refugia category at lower elevations decreases. The predicted climate refugia category for the low emissions modeling scenario makes up approximately 23.4 percent of the western Joshua tree range in California, whereas the predicted climate refugia category for the moderate and high emissions modeling scenarios make up approximately 15.7 and 8.7 percent of the western Joshua tree range in California, respectively. Most of the land within the predicted climate refugia category for the low emissions modeling scenario is within the middle-low elevation (1,106–1,625.9 meters [3,629–5,334 feet]) and middle-high elevation (1,626–2,145.9 meters [5,335–7,040 feet]) classes, constituting approximately 44.7 percent and 43.4 percent of the predicted climate refugia category for the low emissions modeling scenario, respectively. Comparatively, only approximately 4.5 percent of the predicted climate refugia category for the low emissions modeling scenario is within the high elevation class (2,146–2,675.9 meters [7,041–8,780 feet]).

Predicted climate refugia for the moderate emissions modeling scenario are predominantly within the middle-low and middle-high elevations classes as well, constituting approximately 39 and 51.5 percent, respectively, of the predicted climate refugia category for the moderate emissions modeling scenario, although a larger proportion is present within the middle-high elevation class compared to the low emissions modeling scenario. In addition, approximately 6 percent of the predicted climate refugia for the moderate emissions modeling scenario is within the high elevation class, which is an increase in percentage from the low emissions modeling scenario.

Predicted climate refugia for the high emissions modeling scenario is predominantly within the middle-low and middle-high elevations classes as well, constituting approximately 29.4 percent and 61.8 percent of the predicted climate refugia category for the high emissions scenario, respectively, although a larger proportion is present within the middle-high elevation class compared to the moderate emissions modeling scenario. Lastly, approximately 8.7 percent of the predicted climate refugia for the high emissions modeling scenario is within the high elevation class, which is an increase from the moderate emissions modeling scenario.

Over half of the land within the predicted climate refugia category for the low emissions modeling scenario is within the Southeastern Great Basin ecoregion in the northern portion of the species' range in California; approximately 26.5 percent is in the Mojave Desert ecoregion; 14.4 percent is in the Southern California Mountains and Valleys ecoregion; and 2.0 percent is within the Sierra Nevada ecoregion. Comparatively, approximately 24.4 percent of the current western Joshua tree range in California is within the Southeastern Great Basin ecoregion; 59.9 percent is within Mojave Desert ecoregion; 6.9 percent is within Southern California Mountains and Valleys ecoregion; 8.7 percent is within Sierra Nevada ecoregion; and less than 1 percent is within both the Mono ecoregion and Sierra Nevada Foothills ecoregion (Table 4-1, Section

4.1.1). For land within the predicted climate refugia category for the moderate emissions modeling scenario, almost 60 percent is within Southeastern Great Basin ecoregion and approximately 23.7 percent is in the Mojave Desert ecoregion; 16.6 percent is in the Southern California Mountains and Valleys ecoregion; and only 0.6 percent is within the Sierra Nevada ecoregion. Lastly, for land within the predicted climate refugia category for the high emissions modeling scenario, approximately 64 percent is within Southeastern Great Basin ecoregion, 18.5 percent in the Southern California Mountains and Valleys ecoregion and 17.5 percent is in the Mojave Desert ecoregion.

Table 4-10 outlines the percentage of land within the predicted climate refugia category for the low, moderate, and high emissions modeling scenarios within each conservation value category and management unit. Overall, most of the land within the predicted climate refugia category for all three emission modeling scenarios is in Mixed Use management units, followed by Wilderness units, then Little to No Protection units. For the low and moderate emissions modeling scenarios, Defense units constitute the next largest proportion of land within the predicted climate refugia category; although for the highest emissions modeling scenario, Preservation with Light Recreation/Other Use units comprise a larger proportion of land than Defense units. These data show that as emissions increase and land within the predicted climate refugia category decreases, Defense units would eventually contain less of the land within the predicted climate refugia category and Preservation with Light Recreation/Other Use units would contain more. Tribal Land units do not contain land in the predicted climate refugia category in any of the three emission modeling scenarios.

Table 4-10 Percent of Predicted Climate Refugia (Low, Moderate, and High Emissions Modeling Scenarios) Overlapping Conservation Value Categories and Management Units

Management Units	Climate Modeling Scenarios	Ecologically Core	Ecologically Intact	Moderately Degraded	Highly Converted	Not Categorized	Total
Mixed Use	Low Emissions	2.2	16.0	0.5	<0.1	9.9	**28.6**
	Moderate Emissions	1.6	15.9	0.3	<0.1	11.2	**29.1**
	High Emissions	1.7	18.3	0.4	<0.1	16.8	**37.2**
Wilderness	Low Emissions	8.2	14.6	<0.1	0	5.3	**28.2**
	Moderate Emissions	8.9	14.3	<0.1	0	5.8	**29.0**
	High Emissions	10.0	14.6	0	0	6.1	**30.7**

Management Units	Climate Modeling Scenarios	Ecologically Core	Ecologically Intact	Moderately Degraded	Highly Converted	Not Categorized	Total
Little or No Protection	Low Emissions	0.7	3.9	5.7	9.6	1.8	**21.7**
	Moderate Emissions	0.6	3.4	4.0	9.7	2.0	**19.7**
	High Emissions	0.2	2.2	2.3	6.2	1.9	**12.9**
Defense	Low Emissions	5.2	8.1	<0.1	0	0	**13.3**
	Moderate Emissions	4.3	9.1	<0.1	0	0	**13.4**
	High Emissions	2.4	6.9	0	0	0	**9.4**
Preservation with Light Recreation/Other Use	Low Emissions	3.2	1.9	0.2	0.1	2.9	**8.2**
	Moderate Emissions	3.3	1.7	0.1	0.1	3.6	**8.8**
	High Emissions	3.8	1.8	<0.1	0.1	4.1	**9.9**
Tribal Land	Low Emissions	0	0	0	0	0	**0**
	Moderate Emissions	0	0	0	0	0	**0**
	High Emissions	0	0	0	0	0	**0**
Total	**Low Emissions**	**19.5**	**44.5**	**6.4**	**9.6**	**19.9**	**100.0**
	Moderate Emissions	**18.8**	**44.4**	**4.5**	**9.8**	**22.6**	**100.0**
	High Emissions	**18.2**	**43.9**	**2.7**	**6.3**	**28.9**	**100.0**

Notes: Totals may not sum exactly due to independent rounding.

Sources: Randall et al. 2010; Hoen et al. 2018; Parker et al. 2018; Esque et al. 2023; Fujita et al. 2023; Shryock et al. 2025; compiled by Ascent in 2024 and 2025.

Most of the land within the predicted climate refugia category for low, moderate, and high emissions modeling scenarios is within ecologically intact habitat areas, with lesser amounts within uncategorized areas and ecologically core habitat areas, and the least in highly converted habitat areas (Table 4-10). Although this pattern is similar for all three emission modeling scenarios across the conservation categories, there is some variation in the relative amount of land in each of the emissions modeling scenarios within the conservation categories. For instance, as emissions increase and land within the predicted climate refugia category decreases, a larger portion of the predicted climate refugia category is modeled within uncategorized areas. Conversely, the proportion of land within ecologically core and ecologically intact areas decreases slightly as emissions rise.

The majority of the ecologically core habitat in the predicted climate refugia category for all emissions modeling scenarios is within Wilderness units. The next largest amount of ecologically core habitat is within Defense units for low and moderate emissions modeling scenarios, then in Preservation with Light Recreation/Other Use units in the high emissions modeling scenario. The majority of ecologically intact habitat in the predicted climate refugia category for all emissions modeling scenarios is within Mixed Use units, followed by, in descending order, Wilderness, Defense, and Little to No Protection units. The majority of moderately degraded habitat in the predicted climate refugia category for low, moderate, and high emissions modeling scenarios is within Little to No Protection units, followed by Mixed Use units, then Preservation with Light Recreation/Other Use units. For all three emission modeling scenarios, most of the highly converted habitat in the predicted climate refugia category is within Little to No Protection units. Lastly, for all three emission modeling scenarios, the portion of land within the predicted climate refugia category that is within areas that were not categorized in the Mojave Desert ecological assessment is mainly within Mixed Use units, followed by Wilderness, Preservation with Light Recreation/Other Use, and Little to No Protection units.

Portions of land within the predicted climate refugia category for all three emission modeling scenarios are present within areas that already have land protections in place and are generally being managed with conservation in mind (i.e., Wilderness and Preservation with Light Recreation/Other Use units); however, modeling data show that as emissions increase and land within the predicted climate refugia category decreases, a smaller proportion of the predicted climate refugia category will be within these areas. For the low emissions modeling scenario, approximately 36.4 percent of the predicted climate refugia category is within these areas. This constitutes approximately 8.5 percent of the western Joshua tree range in California for the low emissions modeling scenario. In addition, approximately 37.8 percent of the predicted climate refugia category for the moderate emissions modeling scenario and approximately 40.5 percent of the predicted climate refugia category for the high emissions modeling scenario are within areas that already have land protections in place. These areas constitute approximately 5.9 percent of the western Joshua tree range in California for the moderate emissions modeling scenario and only 3.5 percent of the western Joshua tree range in California for the high emissions modeling scenario.

BUFFERED CLIMATE REFUGIA CATEGORY

The buffered climate refugia category is a 2.5-kilometer (approximately 1.6-mile) buffer around the predicted climate refugia category. Almost 60 percent of the buffered climate refugia category is occupied by western Joshua tree, and approximately 41 percent is not occupied by western Joshua tree. The buffered climate refugia category constitutes 22.6 percent of western Joshua tree's California range. Most of the buffered climate refugia category is within the middle-low elevation (1,106–1,625.9 meters [3,629–5,334 feet]), middle-high elevation (1,626–2,145.9 meters [5,335–7,040 feet]), and low elevation (585–1,105.9 meters [1,919–3,628 feet]) classes, constituting 54.8 percent, 22.6 percent, and 18.2 percent of the buffered climate refugia category, respectively. Unlike the predicted climate refugia category, the buffered climate refugia category is present within a very high elevation class (greater than 2,675.9 meters [greater than 8,780 feet]), constituting approximately 0.1 percent of the buffered climate refugia category. In addition, 42.5 percent of the buffered climate refugia category is within the Southeastern Great Basin ecoregion in the northern portion of the species' range in California, 27.5 percent is in the Mojave Desert ecoregion, 17.6 percent in the Southern California Mountains and Valleys ecoregion, and 12.4 percent is within the Sierra Nevada ecoregion.

Table 4-11 outlines the percentage of buffered climate refugia category within and outside of the western Joshua tree range in California by conservation value category and management unit. The majority of the buffered climate refugia category is in Wilderness units, followed by Mixed Use, Little to No Protection, then Preservation with Light Recreation/Other Use units. Tribal Land units contain a minimal amount of land within the buffered climate refugia category in ecologically intact habitat within the species' California range and uncategorized areas within and outside the species' California range.

Table 4-11 Percent of Buffered Climate Refugia Category Overlapping Conservation Value Categories and Management Units

Management Units	Presence of Western Joshua Tree Range	Ecologically Core	Ecologically Intact	Moderately Degraded	Highly Converted	Not Categorized	Total
Wilderness	Occupied	3.7	6.6	<0.1	0	3.3	13.6
	Unoccupied	5.5	10.5	<0.1	0	2.5	18.4
	Total	**9.2**	**17.0**	**<0.1**	**0**	**5.8**	**32.0**
Mixed Use	Occupied	2.5	5.1	0.6	0.1	8.0	16.2
	Unoccupied	1.4	2.4	0.4	0.2	5.9	10.3
	Total	**3.9**	**7.5**	**1.0**	**0.2**	**13.9**	**26.5**

Management Units	Presence of Western Joshua Tree Range	Ecologically Core	Ecologically Intact	Moderately Degraded	Highly Converted	Not Categorized	Total
Little or No Protection	Occupied	0.9	3.1	6.7	4.5	2.1	17.3
	Unoccupied	0.3	0.7	0.9	1.0	1.5	4.4
	Total	**1.2**	**3.9**	**7.6**	**5.4**	**3.7**	**21.7**
Preservation with Light Recreation/Other Use	Occupied	1.0	1.9	0.5	<0.1	1.0	4.4
	Unoccupied	0.7	1.1	0.1	<0.1	3.7	5.7
	Total	**1.7**	**3.0**	**0.7**	**0.1**	**4.7**	**10.1**
Defense	Occupied	4.3	3.2	<0.1	0	0	7.5
	Unoccupied	1.4	0.7	<0.1	0	0	2.1
	Total	**5.6**	**3.9**	**<0.1**	**0**	**0**	**9.6**
Tribal Land	Occupied	0	0.1	0	0	<0.1	0.1
	Unoccupied	0	0	0	0	<0.1	<0.1
	Total	**0**	**0.1**	**0**	**0**	**<0.1**	**0.1**
Total	Occupied	12.3	19.9	7.8	4.6	14.4	59.1
	Unoccupied	9.3	15.4	1.4	1.2	13.6	40.9
	Total	**21.6**	**35.3**	**9.3**	**5.7**	**28.1**	**100.0**

Notes: Totals may not sum exactly due to independent rounding.

Sources: Randall et al. 2010; Hoen et al. 2018; Parker et al. 2018; Esque et al. 2023; Fujita et al. 2023; Shryock et al. 2025; compiled by Ascent in 2025.

Most of the buffered climate refugia category is within the ecologically intact habitat areas, followed by areas that are not categorized, ecologically core habitat, and moderately degraded habitat. The majority of the ecologically core habitat in the buffered climate refugia category is within Wilderness units. The next largest amount of ecologically core habitat is within the Defense units and then Mixed Use units. The majority of ecologically intact habitat in the buffered climate refugia category is also within Wilderness units. The next largest amount of ecologically intact habitat is within Mixed Use, then Defense and Little to No Protection units. The majority of moderately degraded habitat and highly converted habitat in the buffered climate refugia category is within Little to No Protection units.

Approximately 42.1 percent of the buffered climate refugia category is within areas that already have land protections in place and are generally being managed with conservation in mind: Wilderness and Preservation with Light Recreation/Other Use units. The portion of land within the buffered climate refugia category that was not categorized in the Mojave Desert ecological assessment is mainly within Mixed Use units, then Wilderness, Preservation with Light Recreation/Other Use, and Little to No Protection units.

Source: Jeb Bjerke, California Department of Fish and Wildlife.

UNOCCUPIED FUTURE SUITABLE HABITAT CATEGORY

Most of the unoccupied future suitable habitat category, areas that are predicted to provide future suitable habitat based on climate modeling for the low, moderate, and high emissions modeling scenarios, are predominantly within the middle-high elevation (1,626–2,145.9 meters [5,335–7,040 feet]) and middle-low elevation (1,106–1,625.9 meters [3,629–5,334 feet]) classes, constituting 71.1 percent and 21.7 percent of the unoccupied future suitable habitat category, respectively. In addition, over 75 percent of the unoccupied future suitable habitat category is within the Southeastern Great Basin ecoregion in the northern portion of the species' range in California; 14.2 percent is within the Sierra Nevada ecoregion, 6.2 percent in the Mojave Desert ecoregion; and 3.8 percent is within the Southern California Mountains and Valleys ecoregion.

Table 4-12 outlines the percentage of unoccupied future suitable habitat category by conservation value category and management unit. The majority of the unoccupied future suitable habitat category is within Wilderness units, followed by Mixed Use, Preservation with Light Recreation/Other Use, and then Little to No Protection units. Tribal Land units do not contain land in the unoccupied future suitable habitat category.

Table 4-12 Percent of Unoccupied Future Suitable Habitat Category Overlapping Conservation Value Categories and Management Units

Management Units	Ecologically Core	Ecologically Intact	Moderately Degraded	Highly Converted	Not Categorized	Total
Wilderness	32.2	10.2	0	0	27.3	**69.7**
Mixed Use	0.4	3.8	4.4	0	13.8	**22.3**
Preservation with Light Recreation/ Other Use	2.9	0.4	0	0	1.8	**5.0**
Little or No Protection	<0.1	0.6	<0.1	<0.1	2.3	**3.0**
Defense	0	<0.1	0	0	0	**<0.1**
Tribal Land	0	0	0	0	0	**0**
Total	**35.5**	**15.0**	**4.4**	**<0.1**	**45.1**	**100.0**

Notes: Totals may not sum exactly due to independent rounding.

Sources: Randall et al. 2010; Hoen et al. 2018; Parker et al. 2018; Esque et al. 2023; Fujita et al. 2023; Shryock et al. 2025; compiled by Ascent in 2024.

Most of the unoccupied future suitable habitat category is within areas not categorized by the Mojave Desert ecological assessment. In addition, there is a minimal amount of land within the unoccupied future suitable habitat category in the highly converted areas. The majority of the ecologically core habitat in unoccupied future suitable habitat category is within Wilderness units. The next largest amount of ecologically core habitat is within the Preservation with Light Recreation/Other Use units and then Mixed Use units (Table 4-12). Most of ecologically intact habitat within the unoccupied future suitable habitat category is also within Wilderness units. The next largest amount of ecologically intact habitat is within Mixed Use, Little to No Protection, followed by Preservation with Light Recreation/ Other Use units. The majority of moderately degraded habitat is within Mixed Use units. The only highly converted habitat in the unoccupied future suitable habitat category is within Little to No Protection units.

Approximately 74.7 percent of the unoccupied future suitable habitat category is within areas that already have land protections in place and are generally being managed with conservation in mind: Wilderness and Preservation with Light Recreation/Other Use units. The portion of unoccupied future suitable habitat category that was not categorized in the Mojave Desert ecological assessment is mainly within Wilderness units, followed by Mixed Use, Little or No Protection, then Preservation with Light Recreation/Other Use units.

5 CONSERVATION MANAGEMENT ACTIONS AND EFFECTIVENESS CRITERIA

> *"Wilderness is not a luxury but a necessity of the human spirit."*
> *— Edward Abbey*

Management actions necessary to conserve western Joshua tree and objective, measurable criteria to assess the effectiveness of such actions are the heart of the Conservation Plan. This chapter describes the breadth of actions that are likely to be necessary to conserve western Joshua tree and provides a conceptual framework for how to use these actions to achieve the vision, purpose, and objectives of the Conservation Plan described in Chapter 1, "Introduction."

The management actions are guidelines for conservation and the criteria help define the effectiveness of the actions; they do not create new statutory or regulatory mandates. Nevertheless, the management actions in this chapter can be used in several ways. They can be voluntarily adopted and implemented by project proponents, land managers, and philanthropists to help the species or to prevent the species from being harmed. California Native American tribes (Tribes) and the State can work together to co-manage conservation consistent with the Conservation Plan's guidance. The management actions can also be incorporated into project approvals by local governments and regulatory agencies that authorize projects in western Joshua tree's range in California. Researchers can implement management actions related to research, and private citizens and other organizations can implement actions related to education and awareness. Western Joshua tree conservation will require action from many different people and organizations.

Section 5.1 introduces the sources of information behind western Joshua tree conservation. Section 5.2 includes descriptions of management actions in five categories:

- Impact avoidance and minimization,
- Land conservation and management,
- Tribal co-management,
- Research to inform long-term conservation, and
- Education and awareness.

Section 5.3 provides objective, measurable criteria to assess the effectiveness of management actions, the Conservation Plan, and the Western Joshua Tree Conservation Fund (Conservation Fund) for conservation of western Joshua tree in California. Section 5.4 is intended to guide which management actions may be most impactful for conservation in specific western Joshua tree management units.

5.1 SCIENCE INCLUDING TRADITIONAL ECOLOGICAL KNOWLEDGE TO INFORM MANAGEMENT ACTIONS

The Conservation Plan is informed by science including Traditional Ecological Knowledge (TEK). Integration of TEK with other sources of science has been shown to lead to more sustainable, productive, and locally accepted natural resource management systems worldwide (Bussey et al. 2016). Please refer to Chapter 3, “Traditional Values and Uses of Western Joshua Tree by California Native American Tribes,” for a description of California Native American uses, values, and TEK related to western Joshua tree. Refer to Section 5.2.3, below, for management actions facilitating co-equal collaboration between the State and Tribes.

The critical role of science supporting effective management and conservation of the species is reflected in the seven-step approach to conservation in the face of climate change described by Smith et al. (2023), as summarized below.

1. **Identify genetic structure and distinct populations.** The first step toward conservation is identifying genetic structure and distinct populations. Genomic (i.e., study of genes) tools can provide accurate estimates regarding populations, such as effective population size, demographic history, and population structure, which are all important for successful conservation efforts (Hohenlohe et al. 2021). Genetic data of populations can be used to identify distinct populations, as well as genes that may be responsible for adaptation to changing environments, highlighting populations that may require different management strategies (Hohenlohe et al. 2021). As discussed in Section 4.1.1, “Range and Distribution,” recent research suggests that western Joshua tree populations have significant genetic differences (Smith et al. 2021) that have the potential to respond

differently to climate change (Smith et al. 2023). Population genetic data can also assist in identifying populations with high genetic diversity, which can translate to greater potential for adapting to environmental change (Smith et al. 2023).

2. **Develop species distribution models and identify climate refugia.** Developing species distribution and demographic models for distinct populations using high-quality data that document where western Joshua trees occur (i.e., occurrence data) is important for accurately identifying climate refugia that should be given high priority for protection. These models are imperative for successful species conservation (Morelli et al. 2016; Morelli et al. 2020) and will help determine the degree that climate change poses a threat to a species (Jones et al. 2016). The several species distribution models that have been developed for Joshua tree resulted in very different predictions of suitable habitat distribution by the end of the 21st century (Smith et al. 2023). The wide range of results from these models is a byproduct of different methods used and differences in input data (Smith et al. 2023). For species distribution models to be reliable, accurate occurrence data must be used, then multiple independent data sources must be used to validate models (Sweet et al. 2019). Incorporating physiological (i.e., how plants function) data can also improve the accuracy of species distribution models (Buckley et al. 2010; Evans et al. 2015). Species distribution models can help predict areas of future habitat for a species; however, these models need to include realistic estimates of the species' ability to disperse and access new areas (Bateman et al. 2013). Species distribution models may improve their ability to predict future species distributions under climate change, by incorporating the adaptive potential of populations (Bush et al. 2016; Razgour et al. 2019). Models should focus on fine scale distribution as genetic information becomes available and distinct populations are identified since they may require different management strategies (Hohenlohe et al. 2021).

   An important step toward developing accurate range-wide species distribution and climate refugia models for western Joshua tree has been completed with new species distribution data recently published by Esque et al. (2023). These models used remote sensing and ground-validation methodologies to document western Joshua tree presence and absence throughout the species range. This unprecedented dataset has been used to develop climate refugia models that include identification of possible future habitat that is within dispersal range of its current distribution, but that is not currently populated by western Joshua tree (Shryock et al. 2025). These data informed management unit delineation in Section 4.4, "Management Units," land conservation and management actions in Section 5.2.2 (below), and management unit recommendations in Section 5.4 (below).

3. **Validate potential refugia.** Once refugia models have been developed, the next step is to validate the models using demographic data to assess population growth or decline and other data sources to confirm that the potential refugia will be viable in the long term (Sweet et al. 2019). Demographic data can have considerable influence on predicted future species distributions and in validating predicted climate refugia (Merow et al. 2014). Spatial patterns of recruitment can also be used as a predictor of potential climate refugia, which could be compared to predictions based on climate models (Barrows et al. 2020a, 2020b). In addition, incorporating information on the adaptive potential of populations into species distribution models may improve model accuracy for future distribution predictions under climate change (Bush et al. 2016; Razgour et al. 2019).

4. **Assess adaptive genetic variation.** After genetic structure and distinct populations have been identified, the next step is to assess adaptive genetic variation within populations using either association genetics (i.e., identification of genes or genetic markers with underlying important traits) or ideally, experimental approaches coupled with genomic data (Smith et al. 2023). Conservation genetics should focus on the protection of adaptive genetic variation to help manage species that are dealing with climate change (Razgour et al. 2019). Adaptive genetic variation directly affects a species' ability to respond to environmental factors, such as heat stress and drought, highlighting the importance of conserving adaptive genetic variation and not just overall genetic variation (Smith et al. 2023). Landscape genomics (i.e., study of how genetic variation is distributed between populations across a species range) and association genetics can identify genes or genetic markers that are likely the basis for local adaptation to climate variation in current populations (Lotterhos and Whitlock 2015).

Source: Jeb Bjerke, California Department of Fish and Wildlife.

Genome-wide association studies looking at seedling survival, growth, and specific ecophysiological traits (i.e., physiological processes crucial for interacting with the environment, including gas exchange and water regime) can potentially identify genes underlying climate adaptation (Smith et al. 2023), which can be used to predict these traits in natural populations (Swarts et al. 2017). Studies in common gardens are particularly important because they can be used to validate the adaptive value of identified genes or genetic markers and reveal underlying physiological mechanisms (Weigel and Nordborg 2015). Common garden experiments are indoor or outdoor plantings of species or populations collected from multiple distinct geographic locations, grown together under shared conditions (Schwinning et al. 2022).

Current common garden research within the US Geological Survey's Mojave Desert Common Gardens network uses Joshua tree seedlings from different locations that are planted outside in various climates throughout the Mojave Desert and in the lab. This research can help determine the extent to which different populations of Joshua tree are adapted to certain local climate conditions and identify the physiological mechanisms by which Joshua trees tolerate drought and heat stress (Smith et al. 2023). Another effort to identify Joshua tree genes and genetic markers associated with specific climate variables is supported by Revive and Restore, a leading wildlife conservation nonprofit organization, to sequence the whole genome from individual Joshua trees sampled across the range of climates in which the species occurs (Smith et al. 2023).

Once climate-associated genes or genetic markers have been identified, the next step will be genotyping (i.e., analyzing genome sequence data) wild populations of Joshua tree to predict long-term potential of adaptation to warming climates (Smith et al. 2023). Populations identified to have the highest probability of adaptation and survival should be prioritized for conservation (Smith et al. 2023).

5. **Identify high priority areas for protection.** Informed by the results of the four steps described above, the next step will be to identify locations within each population that should have the highest priority for protection (Morelli et al. 2020). Determining whether there are any areas slated for development that contain climate refugia and then taking steps to try to protect these areas will be important (Smith et al. 2023). A Mojave Desert ecoregional assessment (Randall et al. 2010; Parker et al. 2018), which identified conservation value for a large portion of the western Joshua tree range, can also be used to help prioritize conservation lands. Even areas that have been identified as highly degraded may still have conservation value if potential refugia is present (Smith et al. 2023). In addition, some areas that have been identified as ecologically intact may experience severe damage due to climate change and, therefore, may have little long-term conservation value (Smith et al. 2023).

   Identification of high priority areas for protection to further the conservation of western Joshua tree will be completed as needed by CDFW and partners and will be supported by information produced by the research and tribal communities. While it would be ideal to complete steps 1 through 4 before prioritizing areas for protection, CDFW must begin work to conserve western Joshua tree immediately and must therefore begin initial prioritization of areas for protection based on the best, currently available information. As additional information generated from steps 1 through 4 becomes available, CDFW will incorporate it into decision making and future updates of the Conservation Plan.

An initial land-prioritization scheme guided by Smith et al. (2023) has been developed by CDFW (described in Section 5.2.2) to help identify high priority areas for protection.

6. **Protect priority areas while accommodating compatible existing and emerging land uses.** Informed by the results of step 5, high priority areas should be protected while accommodating existing and emerging land uses that are compatible with the overall western Joshua tree conservation strategy (Henson et al. 2018). This work should be done in collaboration with California Native American tribes, state and federal government agencies, local jurisdictions, nongovernmental organizations (NGOs), the public, and affected businesses and property owners. The Mojave Desert region is the homeland territory of many California Native American tribes and is made up of a diverse patchwork of land owned by tribes, federal, state, and local land ownerships and jurisdictions, including the National Park Service (NPS), the Bureau of Land Management (BLM), the US Forest Service (USFS), as well as state and county reserves (Smith et al. 2023). Focus should be on landscape-scale conservation criteria while also engaging with the public to create broad public support (Smith et al. 2023). CDFW will use the Conservation Fund to conserve priority lands.

7. **Identify other impacts and develop management to mitigate them.** The last step is to identify additional factors beyond climate change that could negatively affect the persistence of western Joshua tree (e.g., invasive species, incompatible recreation, inappropriate fire frequencies) and management efforts, including traditional cultural practices, to mitigate these impacts (Morelli et al. 2020). Other impacts on the persistence of western Joshua tree are identified in Section 4.3, “Key Stressors, Threats, and Conservation Issues,” and mitigation approaches for them are presented in Section 5.2.1.

There are marked challenges with identifying and protecting existing populations that meet all the necessary criteria for conservation. Some scientists have suggested assisted migration (i.e., human-assisted movement of species in response to climate change) as a management strategy for species limited by dispersal ability, such as Joshua tree (Cole et al. 2011; Williams and Dumroese 2013). However, some ecologists have strongly criticized assisted migration for its potential to promote invasive species, spread pathogens, and disrupt ecosystems (Ricciardi and Simberloff 2009). Assisted migration may have a high rate of failure if species or populations are strongly adapted to local conditions that are not present at the introduction site (Vitt et al. 2010). Although assisted migration has been suggested for Joshua trees, including in Action LC&M 4.4, “Assisted Migration through Connectivity Corridors”, below, Smith et al. (2023) do not advise this method. This is partially due to suspected high costs and logistical planning needed for success, as well as this approach not preserving intact, functional ecosystems. In addition to what is outlined in Smith et al. (2023), given that there are climate refugia modeled within the current range of western Joshua tree (Shryock et al. 2025), it would be easier to protect the trees where they are currently growing compared with moving them to new places outside the current range. If assisted migration were employed, these areas could still need protection, the trees could need support to establish new self-sustaining populations, and the presence of tribal cultural monitors and a trained arborist may be encouraged (FIICPI, pers. comm., 2024b). More research is needed on assisted migration for western Joshua tree, which is addressed in Action R&I 1.12, “Investigate Assisted Migration where Natural Migration is Unlikely to Occur.”

Source: Anna Cirimele, National Park Service.

Ongoing research and field experiences by public agencies, Tribes, NGOs, and academic institutions will continue to improve the information for western Joshua tree conservation. The Conservation Plan will be reviewed every 2 years, at which time, new information relevant to the Conservation Plan’s goals, management actions, and effectiveness criteria will be incorporated to maintain the standard of applying science including TEK to decision-making. If relevant science is published or new information is available in the middle of an update cycle, updated management approaches may be implemented before the next update of the Conservation Plan, at the discretion and recommendation of CDFW.

5.2 MANAGEMENT ACTIONS NECESSARY TO CONSERVE WESTERN JOSHUA TREE

> *"Our task must be to free ourselves...by widening our circle of compassion to embrace all living creatures and the whole of nature and its beauty"*
> *-Albert Einstein*

To achieve the Conservation Plan vision, purpose, and objectives described in Section 1.2, "Conservation Plan Vision, Purpose, and Objectives," five major categories of management actions have been identified: avoidance and minimization, land conservation and management, tribal co-management, research to inform long-term conservation, and education and awareness (Table 5-1). Specific management actions within each of these categories are discussed in more detail below. In addition, Appendix D, "Avoidance and Minimization Best Management Practices and Guidelines" provides detailed guidance for implementing management actions that avoid or minimize adverse impacts on western Joshua tree.

Table 5-1 Management Actions

Management Action Title	Management Action Topic
A&M: Avoidance and Minimization	Avoidance and minimization to lessen negative effects of human activities.
LC&M: Land Conservation and Management	Land conservation and management to protect existing populations and increase abundance.
TCM: Tribal Co-Management	Tribal co-management that reflects California Native American tribes' interests and priorities, improves decision-making, protects existing populations, and increases abundance.
R&I: Research to Inform Long-Term Conservation	Research to inform long-term conservation and improve decision-making.
E&A: Education and Awareness	Education and awareness to increase public support and lessen the negative effects of human activities.

5.2.1 Impact Avoidance and Minimization

The first priority for conservation of western Joshua tree and its habitat is to avoid adverse impacts altogether. Although climate change stress may be impossible to avoid in the short-term, other impacts are avoidable, such as project-related degradation and destruction of habitat. Impact avoidance should be emphasized as the first preferred choice whenever feasible, especially in areas identified as climate refugia. Furthermore, the importance of avoiding take to western Joshua tree and its habitat has been emphasized during discussions with Tribes, in particular the principle of not harming a tree unless it is absolutely critical for people (FIICPI, pers. comm., 2024b).

When complete avoidance cannot be achieved, efforts should be made to minimize impacts on western Joshua tree and its habitat, and the presence of tribal cultural monitors and a trained arborist to minimize these impacts are encouraged (FIICPI, pers. comm., 2024a). Minimization may include efforts to reduce the number of trees and seeds taken; the area of habitat that is lost or degraded; the severity of impacts on individual trees; impacts on other organisms on which western Joshua tree depends; and indirect impacts on trees, seeds, habitats, and other ecologically related organisms.

The avoidance and minimization actions in this section could be voluntarily adopted and implemented by project proponents and land managers, incorporated into project approvals by local governments and regulatory agencies, or incorporated into voluntary, cooperative agreements between relevant agencies, organizations, and other parties. The Western Joshua Tree Conservation Act (WJTCA) requires the avoidance and minimization of impacts on western Joshua tree to the maximum extent practicable as a condition of obtaining a WJTCA incidental take permit (ITP) (Fish & G. Code, § 1927.3, subd. (a)(2)). WJTCA also states that the Conservation Plan shall include guidance for the avoidance and minimization of impacts on western Joshua trees and protocols for the successful relocation of western Joshua trees (Fish & G. Code, § 1927.6, subd. (a)).

The impact avoidance and minimization (A&M) management actions listed in this chapter are intended to promote the survival of existing western Joshua trees and the protection of their habitat where they could potentially be harmed by development, human activities, and natural hazards. Impacts on western Joshua trees could occur from urban development, infrastructure construction, resource extraction, damage by people and vehicles, and other forms of landscape alteration (see Section 4.3). When these activities affect the root systems or the seedbanks of western Joshua tree, the survival of populations can be compromised.

MANAGEMENT ACTION A&M 1: AVOID DIRECT AND INDIRECT IMPACTS

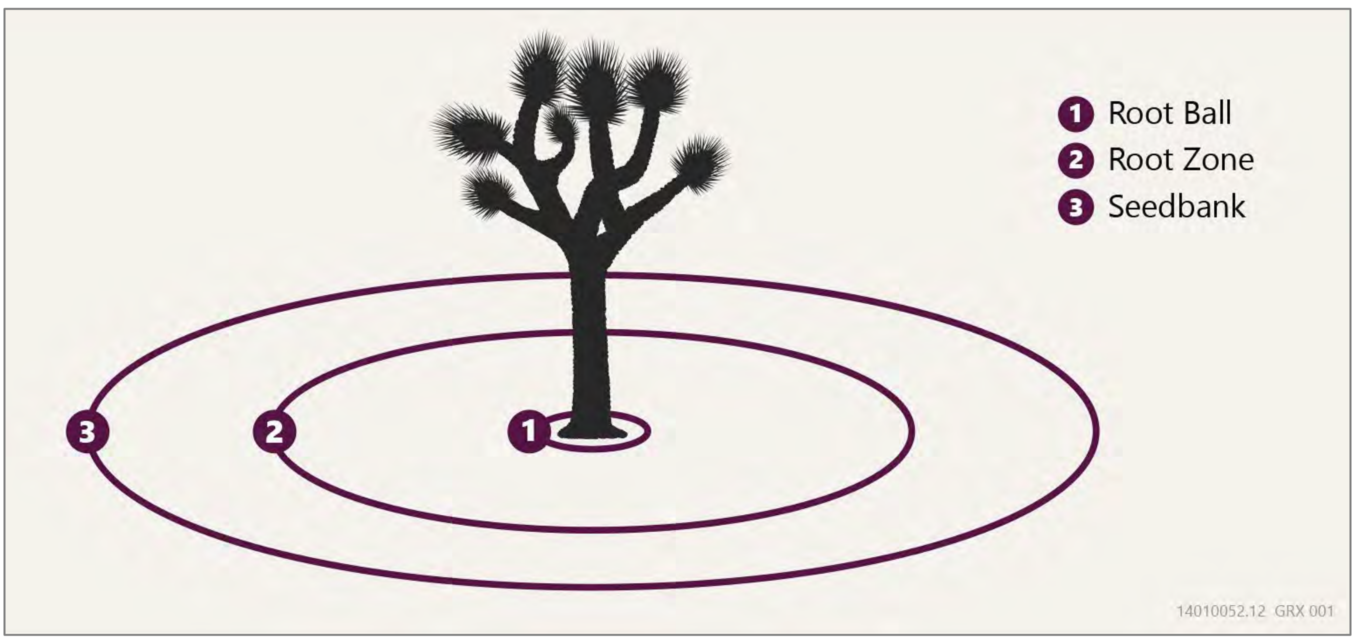
When landscape-altering projects occur near western Joshua trees, avoidance buffers should be established to avoid direct impacts on above ground and below ground western Joshua tree parts and their seedbank. Scientific information on western Joshua tree root ball width, root zone width, and seedbank width was used to inform direct impact avoidance buffers. Direct impact buffers for avoidance should apply to ground-disturbing activities, such as construction and resource extraction, fire control and suppression, and any other actions that could harm or kill western Joshua trees or seeds. The following actions provide activity-specific guidance for direct impact avoidance.

Action A&M 1.1: Retain Healthy Trees

Project proponents (e.g., private and public entities) or agencies (e.g., local, state, and federal agencies) should prioritize retaining healthy western Joshua trees in place when planning a project. Mature/reproductive western Joshua trees in good condition, western Joshua trees in areas within and adjacent to contiguous suitable habitat, and western Joshua trees in habitat that is prioritized as having high value for conservation should be prioritized for retention in place. Signs a tree is healthy may include 60 percent or more living branches, minimal pest damage, recent unrestricted hard growth, recent flowering, and strong tree vigor (see Appendix E, "Relocation Guidelines and Protocols").

Action A&M 1.2: Implement Avoidance Buffers

When activities occur in the vicinity of western Joshua trees, project proponents, land managers, and agencies should implement buffers around western Joshua trees to avoid direct impacts to their vulnerable root balls, the root zone where tree roots could occur in the soil, and where living western Joshua trees seeds could be present in the seedbank (see Figure 5-1). In addition to considering characteristics of western Joshua tree root growth and seed dispersal distances, implementation of avoidance buffers should consider other relevant scientific information on adverse effects of impacts to western Joshua tree.



Note: Graphical representation of buffer zones (not to scale).

Source: Compiled by Ascent in 2024.

Figure 5-1 Western Joshua Tree Buffer Zones

Information to consider when determining a buffer may include, but is not limited to:

- Density of trees within each project site as provided by the project census or other biological survey information.
- Location of a tree in relation to existing structures, such as fences, driveways, or other permanent structures.
- Intensity and depth of proposed ground-disturbing activities (e.g., trenching and excavation impacts may be different than installing fencing).
- Duration of proposed impacts (temporary or permanent).
- Additional minimization measures to reduce impacts of buffer encroachment (e.g., supplemental watering, protecting roots and trees from access, or avoiding equipment damage, etc.).
- Geographic location (e.g., Is the project located in an urban, developed, or undeveloped area? Is the project within priority climate refugia?).
- Life stage of tree, including reproductive stage. Branched trees are more likely to have produced seed and may have more extensive root structures.

Disturbances outside of buffers are less likely to negatively affect the health and survival of the tree or its seeds. CDFW may develop guidance for western Joshua tree impact avoidance in the future and update the Conservation Plan, based on available science and other relevant information.

Action A&M 1.3: Avoid Impacts during Pesticide Application

Project proponents, landowners, land managers, and agencies should not apply pesticides on western Joshua trees and should implement best management practices that avoid pesticide drift onto western Joshua trees, nontarget native vegetation (e.g., nurse plants), pollinators, and seed-dispersing rodents. See Action A&M 1.3.1, "Avoid Impacts during Pesticide Application" in Appendix D for recommended best management practices related to this Action.

Action A&M 1.4: Avoid Impacts Related to Unauthorized Vehicle Use

Land managers should implement measures to prohibit unauthorized off-highway vehicle (OHV) and other vehicle use off designated trails in western Joshua tree habitat, such as by closing areas outside of designated routes with signage, vertical mulching, or installing other barriers. On public lands authorized for open, overland OHV recreation within western Joshua tree habitat, vehicle use rules should be modified to restrict travel to existing designated trails.

Action A&M 1.5: Avoid Impacts from Overgrazing

Land managers and regulatory agencies should prohibit grazing activities within western Joshua tree habitat if grazing is causing adverse effects. This can be accomplished by not renewing existing grazing leases, excluding portions of allotments with western Joshua trees, and installing property fences to avoid free range or trespass grazing. Feral, nonnative grazing animals (e.g., burros, horses) should be removed or relocated from western Joshua tree habitat. However, targeted grazing by prescribed herbivory may be useful to reduce annual invasive species (see Action A&M 2.7, "Minimize Impacts from Grazing Activities," below, and Action A&M 3.5.1, "Implement Fuel Treatments" in Appendix D) (Berryman et al. 2023).

MANAGEMENT ACTION A&M 2: MINIMIZE DIRECT AND INDIRECT IMPACTS

If avoidance is not feasible, direct and indirect impacts on western Joshua tree and its habitat should be minimized. When landscape-altering projects occur near western Joshua trees, effort should be made to minimize direct impacts on western Joshua tree. The following actions provide activity-specific guidance for direct impact minimization.

Action A&M 2.1: Minimize Impacts from Climate Change

Climate change is a significant threat to western Joshua tree. All entities, including governments, businesses, and individuals should reduce greenhouse gas emissions to help minimize the impacts of climate change on species (IPCC 2023).

Action A&M 2.2: Minimize Impacts on Occupied Western Joshua Tree Habitat

Landowners, developers, and land managers should minimize the area of western Joshua tree habitat that is directly affected by their activities, and minimize the number of trees that are taken or harmed. Western Joshua tree habitat that is in good condition, in ecologically core or intact areas, and within predicted climate refugia should be prioritized first for avoidance and conservation, but if this avoidance is not feasible, impacts on these areas should be minimized to the maximum extent possible. The importance of minimizing harm to western Joshua trees and their habitat has been emphasized during discussions with Tribes. It is important for trained tribal cultural monitors to be present during destruction or removal of western Joshua trees to provide cultural protection of trees and respect ancestral lands (FIICPI, pers. comm., 2024b). Minimization of habitat disturbance should include minimizing impacts on areas with nurse plants and minimizing disruption of the movements of small mammal seed dispersers (e.g., not using rodent barrier fencing).

Minimizing impacts to ecologically core or intact western Joshua tree habitat could potentially be achieved by "low-conflict siting," a method of land use planning that involves directing development (typically renewable energy development) toward areas of lower ecological value, such as previously disturbed or converted areas (e.g., urban infill, degraded agricultural land, rooftops), where impacts to sensitive species and habitats would be minimized. In an example of an analysis aimed at identifying low-conflict areas, in this case, for utility-scale solar facility development, Cameron et al. (2012) focused on the western Mojave Desert subregion from the Mojave Desert ecoregional assessment (Randall et al. 2010) described in Section 4.4. Using a planning method based on "avoidance" categories such as lands protected for ecological purposes, sites considered critical to maintaining landscape connectivity, and lands with unique biodiversity attributes; and "attractor" factors that included degraded lands and areas in proximity to infrastructure that would support energy development (e.g., roads, developed communities, transmission lines), the authors identified areas within the subregion that could be prioritized for site-specific evaluation as lower impact areas for solar development.

Similarly, the California Energy Commission (CEC) has compiled land-use datasets used by the CEC, California Public Utilities Commission (CPUC), and California Independent Service Operator (California ISO) depicting environmental constraints to energy development that include biological planning priority areas (e.g., areas of high biodiversity, connectivity, irreplaceability, and critical habitat), areas of terrestrial intactness, and high-quality cropland. These areas of environmental constraints are then used to create "land-use screens," in which the low/least-conflict areas – areas with a high potential for renewable energy development – are those that remain after land-use screens are applied. The land-use screens can be used to inform renewable energy planning statewide (Hossainzadeh et al. 2023). Considering western

Joshua tree habitat in a low-conflict siting analysis, and potentially including other development types such as housing or industrial development, could provide a proactive approach to minimizing impacts to ecologically core and intact habitat.

Action A&M 2.3: Relocate Trees

Western Joshua trees should be relocated when project proponents, landowners, developers, and land managers are unable to retain trees in place or when there is a high probability of substantially damaging or lethal impacts occurring to a retained tree. Project proponents, landowners, land managers, and agencies should follow the Western Joshua Tree Relocation Guidelines and Protocols provided by CDFW (presented in Appendix E) when determining whether a tree should be relocated or not. Appendix E also provides a detailed protocol for conducting tree relocations, including recommendations for selecting relocation areas, consideration of maintaining genetic integrity of healthy receiver western Joshua tree populations, methods for physically relocating the tree, types of relocation, and maintenance and monitoring standards. It is important for trained tribal cultural monitors to be present during transplantation of western Joshua trees to provide cultural protection of trees and ensure proper removal methods are followed (FIICPI, pers. comm., 2024b).

Action A&M 2.4: Collect and Store Seeds

Collection and long-term storage of viable western Joshua tree seeds can preserve local genetic diversity and therefore can help minimize the loss of western Joshua tree diversity from project activities. In addition, seeds kept in long-term conservation storage can provide source material for restoration of occupied or previously occupied habitat or outplanting to unoccupied habitat (such as areas modeled as climate refugia within the buffered climate refugia category and unoccupied future suitable habitat category) and can be used to inform conservation, including targeting locations for conservation nurseries. Seed collection and storage activities should follow Center for Plant Conservation's *CPC Best Conservation Practices to Support Species Survival in the Wild* (CPC 2019) or other accepted standards, and seed collection and storage may be a required minimization measure in western Joshua tree incidental take permits issued by CDFW. CDFW may provide additional specific guidelines and methods for using western Joshua tree seed collection as a minimization measure in the future and update recommendations in the Conservation Plan if necessary.

Action A&M 2.5: Minimize Impacts from Invasive Plants

Project proponents, landowners, land managers, and agencies should implement best management practices to prevent the spread of invasive plants (Cal-IPC 2012) for all activities that have the potential to spread invasive species in western Joshua tree habitat. These activities include but are not limited to construction, resource extraction, OHV use, outdoor recreation, fire control and suppression, fuel treatment implementation, and grazing. See Action A&M 2.5.1, "Minimize Impacts from Invasive Plants," in Appendix D for best management practices.

Action A&M 2.6: Minimize Impacts during Pesticide Application

Project proponents, landowners, land managers, and agencies should implement best management practices that minimize pesticide drift or other inadvertent contact affecting western Joshua trees and other nontarget native vegetation (e.g., nurse plants) (see Action A&M 2.6.1, "Minimize Impacts during Pesticide Application," in Appendix D).

Action A&M 2.7: Minimize Impacts from Grazing Activities

When grazing is adversely affecting western Joshua tree, landowners, land managers, and grazing practitioners should decrease grazing intensity when complete avoidance is not feasible (see Action A&M 1.5, "Avoid Impacts from Overgrazing"). Guidance to minimize the impact of grazing can include implementing rotational grazing, lowering stocking rates and the allowable annual forage utilization rate, implementing short grazing periods for herds and long post-recovery (i.e., rest) periods, and retaining sufficient litter and plant cover to protect the soil from erosion and allow plant regrowth. In areas where western Joshua trees are recovering from wildland fire, grazing should be suspended to allow resprouts and seedlings to establish (See Action A&M 3.3.1, "Minimize Impacts from Postfire Rehabilitation," in Appendix D). In addition, incompatible land uses, such as livestock grazing, should be addressed through the restoration design (see Action L&M 4.3, "Develop and Implement Restoration/Enhancement Plans"). Land managers and project proponents should consult with CDFW prior to implementing prescribed grazing to ensure potential impacts including but not limited to disease transfer to special-status species, including bighorn sheep, are avoided.

Action A&M 2.8: Minimize Impacts from OHV Use and Outdoor Recreation

On public lands where OHV recreation is allowed, land managers should restrict OHV use to designated roads and trails. If new trails are developed, they should avoid western Joshua tree populations. Land managers should encourage responsible OHV use behaviors through continued implementation of education programs to minimize damage to western Joshua tree root systems, nurse plants, and seedbanks. Education programs should emphasize practice and principles for responsible outdoor recreation, such as those provided by Tread Lightly (Tread Lightly n.d.) and other organizations.

MANAGEMENT ACTION A&M 3: MINIMIZE IMPACTS FROM WILDLAND FIRE AND FIRE MANAGEMENT

Wildland fire is a significant threat to western Joshua tree, but efforts to reduce wildland fire risks, fight active wildland fires, and restore landscapes after fires can also damage western Joshua trees and their habitat. This management action includes activities to minimize impacts on western Joshua tree from wildland fire, and from fire risk reduction, suppression, and postfire restoration activities. Wildland fire is unpredictable; however, planned activities for responding to wildland fire events can effectively minimize impacts on western Joshua tree habitat.

Action A&M 3.1: Fight Active Wildland Fires

Land managers and wildland fire responders should aggressively fight and contain active wildland fires in or near western Joshua tree habitat to protect the habitat, minimize loss of western Joshua trees, and sustain western Joshua tree habitat values.

Action A&M 3.2: Minimize Impacts from Fire Suppression

To minimize impacts on western Joshua trees and their habitats caused by wildland fire suppression response, when it does not threaten the safety of firefighters, the public, or important infrastructure, land managers and wildland fire responders should minimize direct and indirect tree damage or removal, ground disturbance in western Joshua tree habitat, and degradation of habitat values from fire suppression and control activities. Minimum Impact Suppression Techniques (MIST) and best management practices are provided in Action A&M 3.2.1, "Minimize Impacts from Fire Suppression," in Appendix D. Examples of best practices for wildland fire response include using preexisting fuel breaks as fire lines and stopping all habitat-damaging tactics as soon as they are no longer required.

Action A&M 3.3: Minimize Impacts from Postfire Rehabilitation

Land managers should minimize direct impacts on western Joshua trees after a wildland fire by developing and implementing measures when rehabilitating burned areas. A postfire monitoring plan should include measures to protect existing western Joshua trees, replant western Joshua trees using appropriate seed sources if they no longer exist, replant other native species, control invasive plants, and protect exposed soil as part of plans for landscape revegetation. Appendix D, Action A&M 3.3.1, "Minimize Impacts from Postfire Rehabilitation" contains specific elements to include in a postfire monitoring and control plan.

Bulldozer, firefighter, and fire engine conducting fire suppression efforts on the Elk Fire in 2024

Source: Hannah Schwalbe, National Park Service.

Action A&M 3.4: Minimize Accidental Ignition of Fires

Best management practices should reduce the potential for accidental ignition of wildland fires and be implemented during construction, outdoor recreation activities, operation and maintenance of infrastructure, and other activities involving overland use of motorized vehicles or mechanical equipment. Fire extinguishers, backpack sprayers, water trailers, or water tenders equipped with hoses should be available to suppress accidental ignitions during hot, dry, or windy conditions. To reduce the potential sources of ignition that may accidentally burn vegetation, best management practices should be implemented as described in Appendix D, Action A&M 3.4.1, "Minimize Accidental Ignition of Fires."

Action A&M 3.5: Implement Fuel Treatments

Fuel treatments in the vicinity of western Joshua trees could be conducted when appropriate, such as when high fuel loads are present (e.g., invasive plants) or when an area has burned more frequently than the natural fire return interval.

Land managers should develop and implement measures to avoid and minimize direct impacts on western Joshua trees during fuel treatment for wildland fire risk reduction. Several types of fuel treatments that could be implemented in western Joshua tree habitat include fuel breaks, treatments in the wildland-urban interface, and treatments focused on removing invasive species and restoring areas to the natural fire regime (i.e., ecological restoration). Fuel breaks (areas cleared of vegetation or graded as a fuel treatment in anticipation of a fire) have been found to be ineffective at containing wildland fire under certain circumstances, for example high winds (Syphard et al. 2011; Oliveira et al. 2016), but they are useful for firefighter access (Syphard et al. 2011). Treatments in the wildland-urban interface "consist of strategic removal of vegetation to prevent or slow the spread of non-wind driven wildland fire between structures and wildlands, and vice versa" (California Board of Forestry and Fire Protection 2019). Fuel treatments designed for ecological restoration are intended to restore "degraded, damaged, or destroyed ecosystems and habitats to conditions associated with a natural fire regime" and may be implemented in areas where invasive species such as red brome (*Bromus rubens*), cheatgrass (*Bromus tectorum*), Sahara mustard (*Brassica tournefortii*), stinknet (*Oncosiphon pilulifer*), Russian-thistle (*Salsola tragus*), or red-stemmed filaree (*Erodium cicutarium*) or dead, woody debris have increased in cover and have resulted in a shift in the fire regime (Brooks and Minnich 2018; Cal-IPC 2021). Additional guidance to avoid and minimize impacts on western Joshua tree and its habitat during fuel treatments can be found in Appendix D, Action A&M 3.5.1 "Implement Fuel Treatments."

5.2.2 Land Conservation and Management

With climate change as a primary threat to western Joshua tree, protecting and managing lands that are occupied by the species and within the predicted climate refugia category are high priorities for conserving the species. Managing climate refugia and maintaining ecological functions necessary for western Joshua tree survival also allows time for natural systems to adapt and for humans to develop longer-term solutions for conservation (Peterson et al. 2011).

The goal of land conservation is to permanently protect western Joshua tree habitat from development and other incompatible human uses. Conserving lands before habitat degradation and destruction occur is a critical first step toward ensuring the land remains occupied by and suitable for western Joshua tree in the future.

The goal of land management is to create and maintain environmental conditions on conserved land that promote viable populations of western Joshua trees and their habitat. The threats from climate change, wildland fire, invasive species, and other human activities may still be present after land is permanently protected from development. Land management will be necessary to avoid, minimize, and remediate these threats on a long-term basis to ensure that conserved lands continue to support sustained populations of western Joshua trees and the natural processes on which they depend.

Land conservation and management actions have been developed with principles of conservation biology in mind and will be a critical component in achieving the goals of the Conservation Plan.

MANAGEMENT ACTION LC&M 1: IDENTIFY PRIORITY CONSERVATION LANDS

With finite resources available for conservation efforts, CDFW will define criteria for prioritizing lands that are most suited to the persistence of western Joshua tree. The criteria will help guide agencies, NGOs, Tribes, and others in protecting conservation land. Smith et al. (2023) suggest that western Joshua tree conservation efforts focus on protecting populations that meet criteria for resiliency to climate change and that have demographic signatures of long-term viability. Protecting lands that are already occupied by western Joshua tree should be prioritized because establishing populations of western Joshua tree in new areas is extremely challenging, sometimes controversial, and costly, with a high risk of failure. Nevertheless, it is also important to sustain connectivity of western Joshua tree populations to nearby or adjacent unoccupied habitat that is expected to be suitable for the species in the future and protection of these areas should also be prioritized.

Smith et al. (2023) recommend the following four steps (which are summarized further in Section 5.1 under the seven-step approach to conservation) for identifying locations within western Joshua tree populations that should have highest priority for protection:

1. Identify genetic structure and distinct populations.
2. Develop species distribution models for these populations using high-quality occurrence data to identify climate refugia.
3. Validate potential refugia using demographic studies and other independent data sources.
4. Assess adaptive genetic variation within populations, using either association genetics or, ideally, experimental approaches coupled with genomic data.

Detailed information on the genetic structure, distinct populations, and the adaptive genetic variation of western Joshua tree is not currently known. A species distribution model for western Joshua tree using high-quality occurrence data was developed by Esque et al. (2023) and has been applied to a model developed to identify western Joshua tree climate refugia within the current range and future refugia outside the current range (Shryock et al. 2025). Categories of climate refugia based on these data (described in Section 4.4) were used to help identify priority conservation lands. Detailed range-wide data from western Joshua tree demographic studies to validate potential refugia are not yet available but will be incorporated into the Conservation Plan in the future.

The intactness of ecosystems is an important predictor of ecosystem function and overall conservation value. Ecosystems that are more intact are better equipped to support western Joshua tree habitat functions and are essential for maintaining the species in the future. Parker et al. (2018) updated the ecological assessment conducted by Randall et al. (2010) and assessed the conservation value of areas that overlap western Joshua tree's range as part of an assessment of the impacts of solar and wind development in two locations in California. This assessment was conducted on a coarse scale—2.59 square kilometers (1 square mile) hexagons—based on 2017 conditions. Parker et al. (2018) assigned each hexagon one of the following four conservation values (in order of decreasing value) from the Randall et al. (2010) framework: ecologically core, ecologically intact, moderately degraded, and highly converted.

Young western Joshua trees growing at high elevation (1,773 meters [5,817 feet])

Source: Michael Faist, National Park Service.

As a range-wide strategy, CDFW will apply conservation priority to the areas identified as climate refugia (comprising categories of predicted and buffered climate refugia, and unoccupied future suitable habitat; see Section 4.4) and assigned conservation values of ecologically core or intact, recognizing they will be the areas most valuable for western Joshua tree in the future. Areas of climate refugia that are moderately degraded may also be valuable for western Joshua tree in the future. Additional information on climate refugia and ecological intactness is in Section 4.4.

On a local scale, CDFW will identify priority conservation lands based on the best available site data relevant to western Joshua tree's ecological needs for long-term viability. Available information will be analyzed initially, and additional information will be collected to properly assess the relative conservation value of the evaluated lands.

Synthesizing the characteristics of land with the highest conservation value for western Joshua tree, priority conservation lands should possess all or at least some of the following attributes:

- A large area occupied by western Joshua tree.
- A high density of reproductive adult individuals.
- Presence within the predicted climate refugia category (prioritizing areas with the highest likelihood of sustaining western Joshua tree under higher emissions scenarios).
- A high recruitment rate.
- Presence of pollinator moths, nurse plants, and small mammal seed dispersers.
- Low risk of stressors from adjacent land use (e.g., fire ignition risk, invasive species encroachment, OHV-related damage, planned development; disturbance from high-traffic roads).
- High-value lands that currently have little to no protection.
- Good overall tree health within populations (e.g., few signs of pests, damage, exposed roots, or health problems; higher vigor; trees and limbs upright).
- Large patch size (low perimeter-to-edge ratio) and connectivity to other areas occupied by western Joshua tree.
- Connectivity to land within the predicted climate refugia category, such as landscape connections across elevation gradients and ecological transition zones (e.g., where desert communities transition to montane communities of the Sierra Nevada and Transverse ranges [Randall et al. 2010] and between the Mojave Desert and Great Basin).
- Genetically distinct populations with adaptive genetic diversity.

A weighted scoring system is useful for evaluating and prioritizing potential conservation lands. CDFW has used the preliminary lands assessment criteria (presented in Appendix F, “Conservation Lands Prioritization Assessment”) as an initial tool to help focus Conservation Fund expenditures on the acquisition and protection of lands with the greatest western Joshua tree conservation value. CDFW will update or revise this tool as needed in the future based on new information and data.

MANAGEMENT ACTION LC&M 2: PROTECT PRIORITY CONSERVATION LANDS

CDFW will apply a multifaceted approach to safeguard conservation lands supporting western Joshua trees on a local scale and within the predicted climate refugia category range-wide. Protection of areas identified as priority conservation lands is particularly important to achieve the goals of this Conservation Plan, but any lands supporting western Joshua tree may contribute to the conservation of the species. Strategies for land conservation may include designations by state, federal, local, and tribal governments (e.g., designated parks, preserves, monuments, conservation areas, and wilderness areas); protection of lands for conservation by NGOs; acquisition of fee title or conservation easement; and implementation of interagency agreements or written memoranda of understanding (MOUs). Durable legal protection mechanisms are described further in Chapter 6, “Implementation.”

Action LC&M 2.1: Implement Priority Conservation Land Protection

Lands identified through Management Action LC&M 1, “Identify Priority Conservation Lands,” as high priority for western Joshua tree conservation could be protected through the following implementation approaches:

- Establishment of a State Parks Natural Reserve or Natural Preserve within a State Park or State Recreation Area, CDFW Ecological Reserve, and conserved land under state conservancies or Resource Conservation District land protection programs.
- Purchase or lease of State School Lands from the California State Lands Commission for western Joshua tree conservation purposes.
- Conservation of other state lands through written MOUs or other collaboration agreements with CDFW.
- Designation of national monuments, federal conservation areas, wilderness areas, national parks, and other federal protections.
- Conservation of other federal lands through interagency agreements or written memoranda of understanding and other mechanisms in coordination with US Fish and Wildlife Service (USFWS) (see example agreements in Section 2.2.2, “Federal Listing Status”).
- Acquisition of land by governments, Tribes, or NGOs from willing sellers through fee title or conservation easement acquisition.
- Establishment of conservation easements cooperatively by landowners.
- Written MOUs for conservation on tribal land.
- Establishment and protection of public open space, parks, or/and preserves by local agencies.

Action LC&M 2.2: Track Progress of Conserved Lands

Regardless of the land protection approaches used, a central tracking system for conserved lands should be maintained by CDFW to track progress in protecting priority conservation lands. The system should use a geographic information system to document locations of protected lands in relation to western Joshua tree’s distribution and priority conservation lands identified under Management Action LC&M 1, “Identify Priority Conservation Lands.”

MANAGEMENT ACTION LC&M 3: MANAGE CONSERVATION LANDS

Long-term management of conservation lands should be carried out to support western Joshua tree populations and habitat. Land management activities, such as invasive species control, fuel break maintenance, fence repair, garbage removal, monitoring and adaptive management, and law enforcement, are often required to avoid, minimize, and remediate ongoing and persistent threats. Land management is particularly important for priority conservation lands at high risk from wildland fire, invasive species, ongoing and adjacent land use, and illegal or trespass activities. Land management is an important action for maintaining the natural processes western Joshua tree needs in its habitat. TEK would help define beneficial land management practices for western Joshua tree, as discussed in Section 5.2.3, below.

Source: Anna Cirimele, National Park Service.

Management of federal and state lands is typically the responsibility of an agency, with resources allocated based on the budget and priorities of the agency in compliance with its laws and regulations. Although some agencies allocate resources with biodiversity conservation in mind, land use policies or mandates may conflict with conservation priorities and can negatively affect biodiversity. Even if conservation is a priority, agency resources may be limited to implement land management for the benefit of western Joshua tree.

Action LC&M 3.1: Develop Long-Term Plan for Conservation Lands

Landowners, land managers, and agencies should develop management and long-term monitoring plans to promote long-term persistence of western Joshua tree on conservation lands. These plans should describe how the land will be managed to maintain habitat function and minimize or remediate threats to western Joshua tree. CDFW will work with land managers to develop long-term monitoring and management plans or conservation easement stewardship agreements for conserved lands.

Land management plans should be tailored to the needs of individual properties based on site evaluations. Management priorities may include invasive species control, wildland fire risk reduction, cultural burning, restoring degraded areas, and measures to reduce threats from adjacent land uses or to prevent trespassing and unauthorized uses. Monitoring for adaptive management should be incorporated into plans to track the condition of western Joshua trees and other habitat characteristics. Management actions or alternative management approaches should then be implemented, if necessary, based on monitoring results.

Management should emphasize protecting priority conservation lands from wildland fire where fire risk to western Joshua tree populations is high. Maintenance of existing fuel breaks and establishment of new low-impact fuel breaks may be effective approaches to protecting western Joshua tree populations from wildland fire damage. Existing roads and other infrastructure should be maintained as fuel breaks to the extent feasible and effective.

Action LC&M 3.2: Prioritize Management of State and Federal Lands for Western Joshua Tree

Approximately 2 and 63 percent of the western Joshua tree range in California are on state and federal lands, respectively. Therefore, CDFW will seek to establish written MOUs or other written agreements with state and federal agencies for long-term monitoring and management to benefit western Joshua tree on priority conservation lands. Additionally, a considerable percentage of state and federal lands are within predicted climate refugia. In the low emissions scenario, approximately 28 percent of state and federal lands are within the predicted climate refugia category. For the moderate emissions scenario, approximately 19.2 percent of federal and state lands are within the predicted climate refugia category, and for the high emissions scenarios, approximately 11.6 percent of these lands are within the predicted climate refugia category. The extents of both the current western Joshua tree range and future modeled climate refugia within state and federal lands highlights the importance of managing these lands to conserve western Joshua tree.

Action LC&M 3.3: Establish Endowments and Provide Other Long-Term Funding Mechanisms for Management of Conservation Lands

Funding for long-term land management is necessary to ensure that critical monitoring and management activities of conservation lands are implemented. Funding may be provided with endowments, annual budgets, grants, use of the Conservation Fund, or other mechanisms applicable to the land management agency, organization, or California Native American tribe.

MANAGEMENT ACTION LC&M 4: RESTORE AND ENHANCE HABITAT

Restoration of damaged or degraded lands and enhancement of lands to help support western Joshua tree can aid in the conservation of the species. Given that desert ecosystems are slow to recover after disturbance, active restoration can be a valuable tool for increasing ecosystem recovery and improving habitat suitability for western Joshua tree (Abella et al. 2023).

Habitat restoration is the holistic process of reestablishing ecological function and repairing characteristics of a site to return it to a condition that is self-sustaining. Realizing self-sustaining habitat may be achieved under the care of Tribes and/or by aiming to re-create conditions that existed before it was damaged or degraded by natural or human disturbances post-colonization. Restoration actions may include reconstructing natural topography or other physical characteristics of the land, rehabilitating compacted soils, removing invasive plants, and replanting native vegetation. Examples of habitat restoration include replanting western Johua trees and associated native plants on a site where these species were destroyed by wildland fire and reestablishing natural topography where OHV use created rills and gullies (Abella et al. 2023). In some circumstances, restoring moderately or highly degraded lands occupied by western Joshua tree can provide conservation value for the species overall. Restoration is especially valuable where ecologically core or ecologically intact lands are not available, or where degraded or converted lands are within or connected to land within the predicted climate refugia category.

Habitat enhancement involves the modification of certain characteristics of a site with the goal of increasing specific habitat functions based on management objectives, such as increasing habitat suitability for a particular species (Vaughn et al. 2010). An example of habitat enhancement is vertical mulching a site occupied by western Joshua tree that is lacking sufficient nurse plants to support western Joshua tree recruitment. Another example is implementing projects that use science-based, assisted gene flow methods to introduce climate-adapted genes into stands of western Joshua trees to enhance their capacity for climate adaptation and resilience, provided there is sufficient scientific justification to do so. Habitat enhancement may be appropriate on some ecologically core or ecologically intact conservation lands, such as those within the predicted climate refugia category. Enhancement may also be beneficial on sites that support populations with advantageous genetic traits, such as climate resilience adaptations, to increase seed production or recruitment within those populations.

Assisted migration is another strategy that could support western Joshua tree conservation by facilitating establishment of the species in unoccupied habitat that has become suitable due to climate change; however, concerns have been raised about the costs, uncertainties, and risks of this approach. Any assisted migration of western Joshua tree should therefore be carefully planned, cautiously implemented, and closely monitored, with a focus on connectivity corridors to existing and future suitable habitat.

Land managers should use a comprehensive restoration approach to return ecosystem functions to degraded sites, or to enhance a site's resilience, ecological function, and ability to recruit western Joshua trees. Where appropriate, funds from the Western Joshua Tree Conservation Fund could be used for restoration efforts on strategically located habitats that have been degraded by fire, invasive plants, development, grazing, unauthorized OHV use, or other disturbances.

Action LC&M 4.1 Identify Priority Restoration Areas

Western Joshua tree habitat of high conservation value that is damaged by wildland fire or other stressors should have priority for restoration. Habitat of high conservation value includes sites within or connected to land within the predicted climate refugia category and other priority conservation areas as determined through implementation of Management Action LC&M 1, "Identify Priority Conservation Lands." Other priority restoration sites should be selected based on where land is within the predicted climate refugia category, where research indicates climate-adapted individuals are already found growing. Other factors to consider when evaluating lands for restoration potential include adjacent land uses, western Joshua tree cover and demography, seed sources or presence of a seedbank, soil condition, absence of invasive plant infestation, condition of topsoil, presence of biotic soil crusts, and availability of nurse plants.

Action LC&M 4.2 Identify Priority Enhancement Areas

Enhancement should be implemented to improve ecosystem processes on sites already occupied by western Joshua tree to increase recruitment and population resilience. Enhancement projects would be focused on relatively undisturbed areas to ecologically improve western Joshua tree habitats on priority conservation lands. Enhancement activities should be focused on sites that are situated in areas within the predicted climate refugia category or other priority conservation areas where natural processes or habitat functions could be improved for a specific conservation objective, and where enhancement projects will clearly result in an overall net improvement in ecosystem processes for western Joshua tree and its habitat. The following are examples of enhancement for conservation objectives:

- Assist the natural regeneration of western Joshua trees and nurse plants.
- Introduce climate-adapted genes in populations through assisted gene flow methods, such as translocating individuals and outplanting nursery stock.
- Irrigate during drought periods.
- Improve regeneration by introducing yucca moth pollinators.

Action LC&M 4.3: Develop and Implement Restoration/Enhancement Plans

Once a site is identified for a restoration or enhancement project, a detailed design plan for implementing the project should be developed. The design plan should incorporate clear, explicit, and measurable goals based on current baseline potential and site conditions before disturbance. The design plan should include a summary of the site's existing habitat conditions, a description of habitat features required for western Joshua tree persistence, quantitative metrics to define goals and measure success, a monitoring and management plan, an undisturbed reference site to compare with the restoration or enhancement site to help evaluate success, an estimate of the project's cost, and review of the design plan by a qualified desert restoration specialist.

Western Joshua tree habitat restoration site managed by Mojave Desert Land Trust.
Source: Jessie Quinn, Ascent.

The steps to implementing enhancement activities should be site-specific depending on management goals; however, any potential restoration action on a disturbed site could likely be implemented on a relatively undisturbed site to improve natural processes, habitat functions, or climate resiliency for western Joshua tree.

Typical restoration or enhancement goals for western Joshua tree habitat include increasing western Johsua tree recruitment; increasing cover of native plant species, especially native shrubs; reducing competition from invasive annual plant cover; and stabilizing and repairing soils including soil microbiomes (biocrusts). Typical challenges to achieving restoration or enhancement goals in desert ecosystems include low and unpredictable precipitation; hot, dry summers; infertile, shallow, or damaged soils; intensive herbivory when other forage plants are limited; limited availability of plant resources for revegetating restoration sites; and competition from invasive plants (Abella et al. 2023). The restoration or enhancement design plan should identify methods to address these challenges.

Modified and disturbed habitats often have little or no remaining cover of live western Joshua trees and native associate plants and therefore require active planting as an element of restoration. These sites must be revegetated with western Joshua tree and nurse plant species. Depending on the needs of the site, availability of plant and seed sources, and funding availability, revegetation may use a combination of these methods: outplanting appropriate nursery stock, salvaging and transplanting from other sites, planting cuttings from plants, and seeding. Ideally, this would include planting western Joshua tree seedlings grown from seeds that are collected from individuals genetically adapted to similar site conditions, from the same general geography, and from individuals with climate adaptive traits. Where necessary and feasible for vegetation establishment, all plantings of western Joshua tree and nurse plants should be caged to prevent damage from herbivory, and supplemental irrigation should be provided. Assisted natural regeneration of western Joshua trees and nurse plants may be an appropriate element of restoration to promote their growth and establishment, which might include tree shelters, removal of competing invasive vegetation, and other techniques based on science including TEK.

Disturbed lands often have degraded soils and may require soil rehabilitation before revegetation. Soil conditions should be evaluated before beginning revegetation, and a strategy for improving soil suitability for western Joshua tree establishment should be incorporated into the restoration design plan as necessary. Soil rehabilitation techniques may include decompaction, roughening soil surfaces, replacing topsoil, and inoculating soil with associated beneficial microorganisms (e.g., arbuscular mycorrhizal fungi).

Active restoration of biotic soil crusts (biocrusts) can be an important part of returning degraded sites to conditions favorable for western Joshua tree by limiting soil erosion, increasing soil organic matter and nutrients, facilitating native plant seed germination, and limiting invasive plant establishment. Arbuscular mycorrhizal fungi live in the soil and form mutualistic symbiosis with plant roots that facilitate nutrients to roots, increase drought tolerance by increasing water uptake in roots, and may increase resistance to soil pathogens. As new research improves understanding of biocrust restoration and arbuscular mycorrhizal fungi associations with western Joshua tree, strategies in restoration plans should be updated and refined.

Vertical mulching consists of placing dead plant material upright into the ground to provide vertical structure that replicates some functions provided by nurse plants, such as shading, trapping windblown sand and seeds, and moisture retention. If appropriate for the site, this technique can be implemented to reduce erosion, discourage vehicle or foot traffic, and facilitate the establishment of western Joshua tree and native shrub seedlings (Abella et al. 2023).

Climate change is predicted to make the region hotter for longer periods of the year and increase the occurrence of droughts, variable precipitation, and intensity of heavy precipitation events; therefore, reducing as many other threats and stressors as possible will increase the likelihood of restoration success (Abella et al. 2023). Anything that degrades the habitat value for western Joshua tree, such as invasive plants, incompatible land uses (e.g., livestock grazing, OHV use), erosion, and wildland fire (e.g., fuel breaks around the restoration site) should be addressed through the restoration design. If appropriate and feasible, restoration sites should be fenced to prevent human activities (e.g., foot traffic, OHV use, cattle grazing, illegal dumping) from influencing restoration success.

Restoration or enhancement activities should include conducting an invasive species assessment of the site, including mapping infestations. Then, if appropriate, invasive species control should be conducted, using targeted herbicides (e.g., indaziflam) or other treatment methods appropriate for target species, early in the growing season before restoration occurs, as well as for maintenance (see Action A&M 2.6, “Minimize Impacts during Pesticide Application”).

Yucca moths play a critical role in western Joshua tree reproduction; therefore, introducing yucca moth pollinators to restoration or enhancement sites where they are absent should be considered as part of a restoration or enhancement design plan and incorporated as appropriate to facilitate pollination and contribute to successful regeneration. Ongoing monitoring to track moth survival and reproduction and management to protect moths from threats would be necessary for successful establishment of a self-sustaining yucca moth population.

Source: Anna Cirimele, National Park Service.

Regular maintenance and monitoring are necessary to ensure ecological processes are trending toward meeting the goals described in the design plans. Monitoring allows projects to be adaptively managed if performance standards are not being met along the way. Quantitative performance criteria that trigger adaptive management actions if performance standards are not being met should be incorporated into the maintenance and monitoring plan. Monitoring duration and intervals should be included in the plan. Restoration and enhancement projects should be monitored for long periods of time following completion of the initial restoration or enhancement activities due to the slow nature of desert ecosystem processes. Monitoring, maintenance, and adaptive management should continue until success criteria are met.

Action LC&M 4.4: Assist Migration through Connectivity Corridors

Species distribution models suggest that currently unoccupied habitat that is nearby (and in some cases, adjacent to) the current distribution of western Joshua tree will be suitable habitat for western Joshua tree in the future (Cole et al. 2011; Shryock et al. 2025). Western Joshua trees have low capacity to colonize newly available areas on their own; however, given sufficient time, it is reasonable that western Joshua tree would naturally disperse into these unoccupied habitats along accessible connectivity corridors. Humans could help the species to establish in new habitats via deliberate movement of western Joshua trees, seeds, and ecologically related organisms. Such activities are commonly referred to as assisted migration. There has been much discussion and debate over the risks and benefits of assisted migration (Twardek et al. 2023). Assisted migration has been suggested as a conservation strategy for western Joshua tree by some authors (Cole et al. 2011), as well as by tribal representatives (Przeklasa, pers. comm., 2024), but others suggest that the cost, logistical requirements, and ecological concerns make this strategy inadvisable (Smith et al. 2023). Indigenous peoples have translocated species for millennia (Silcock 2018; Rayne et al. 2020), including Joshua tree (see Section 3.3, “Traditional Ecological Knowledge for Conservation”). Nevertheless, there are very few studies on implementation of assisted migration for the purpose of conservation (Twardek et al. 2023). The need for further study of assisted migration is emphasized in Action R&I 1.12.

Opportunities for assisted migration of western Joshua tree may be the most valuable and the least risky where connectivity corridors to future suitable habitat have been identified via modeling (i.e., Shryock et al. 2025), translocation distances are relatively short, and owners and managers of receiving land are supportive. This management action should occur within unoccupied habitat within the buffered climate refugia category that is modeled as climate refugia and unoccupied future suitable habitat category as defined in Section 4.4. Tribal co-management and adaptive management principles may further increase the likelihood of success. Assisted migration of western Joshua tree over short distances are likely to be valuable for conserving the species over the long term but should be implemented carefully and should not be considered an alternative to protecting occupied climate refugia (i.e., areas within the predicted climate refugia category).

MANAGEMENT ACTION LC&M 5: DEVELOP AND IMPLEMENT A SEED CONSERVATION STRATEGY

While preserving western Joshua tree in the wild is the top priority, developing a seed conservation strategy that includes establishment of seed banks is an important way to minimize loss of western Joshua tree genetic diversity over the long term (see Action A&M 2.4, "Collect and Store Seeds"). Seeds collected for long-term conservation storage could be used to grow western Joshua trees for restoration and enhancement projects or research. With sufficient additional research, the conservation seed bank could provide opportunities to assist gene flow to facilitate climate adaptation by planting western Joshua trees in areas of climate refugia (i.e., within all three climate refugia categories, presented in Section 4.4).

A comprehensive seed conservation strategy should be implemented to develop a seed repository that is representative of western Joshua tree genetic diversity over a wide geographic area across a range of environmental conditions. The seed strategy should include protocols for seed collection, storage, and distribution for conservation and recovery purposes following the guidelines published in Center for Plant Conservation's *CPC Best Conservation Practices to Support Species Survival in the Wild* (CPC 2019) that will ensure long term preservation of a viable, genetically diverse western Joshua tree population.

Action LC&M 5.1: Develop Seed Collection Standards and Protocols

Joshua tree seed pods.
Source: Anna Cirimele, National Park Service.

In collaboration with other agencies and institutions, CDFW will develop and adopt standards and protocols for western Joshua tree seed collection strategies to maximize genetic seed diversity. The seed collection standards and protocols will be designed to conserve western Joshua seeds that are adapted to climates expected to persist in the future. Collections will include seeds from areas at high risk of wildland fire, areas recently subjected to wildland fire, and areas with hotter, drier microclimates (i.e., seeds from genetically adaptive individuals). This would likely include collection of seeds during masting years. Seed collection could also be a permit condition for take of western Joshua tree (see Action A&M 2.4). The seed collection standards will be based on the Center for Plant Conservation's *CPC Best Conservation Practices to Support Species Survival in the Wild* (CPC 2019) and will include the following actions:

- Obtain necessary permits from CDFW and permission from the landowner before attempting any collection of western Joshua tree seeds.
- Collect no more than 10 percent of seeds produced within a given western Joshua tree population in any 1 year, or no more than the maximum amount of seeds allowed by CDFW and/or the relevant permitting authority.
- Capture the full genetic diversity of the population by collecting from individuals across the whole site, from as many maternal plants as possible, and from all sizes of seed-producing plants present. Collect seeds over multiple years, if possible, to increase genetic diversity of seeds collected.
- Collect only mature seeds and collect the full diversity of seed morphologies represented in the population.
- Track seed origin, or georeferenced latitude and longitude, of the parent plant from which the seeds were collected. Seed origin is important because genetic material and adaptations of seeds can vary widely between different locations. Offspring from seeds collected in a specific geography may not be genetically adapted for growth under environmental conditions in another location. Therefore, tracking their origin can help identify the geographic range suitable for growing the seed, increasing the odds of successful growth.
- Record accession information for seed collections, such as collector, date, location, habitat and associate species information, population demographics, and number of individuals from which seeds were collected.

Action LC&M 5.2: Develop Seed Storage Standards and Protocols

Stored seed will be important for use in ecological restoration/reforestation projects and assisted gene flow programs. Assisted gene flow programs could be used to enhance climate change resilience by translocating genetically adaptive individuals into western Joshua tree populations that do not currently support individuals with climate change adaptations. Seed viability and germination testing should be conducted prior to being put into storage and then retested for viability at regular intervals and before seeds are used to grow trees. Seeds should be stored following practices that promote high seed quality and increase seed longevity, as discussed in CPC (2019), such as:

- Keep accurate records, including documentation and accession information.
- Clean seeds prior to storage.
- Follow the recommended drying conditions.
- Package seeds from different maternal lines separately.

- Divide collected seeds into two batches and store at separate storage institutions to mitigate loss from natural or human-caused catastrophe.
- Adhere to the appropriate moisture targets to maintain relative humidity during storage.
- Store at the appropriate temperature.
- Monitor storage conditions and seed viability.

Action LC&M 5.3: Develop Nursery Standards and Protocols

Nurseries used to grow seedlings should be qualified and abide by established standards and protocols. When western Joshua tree plants are required for restoration projects or assisted gene flow attempts, viable seeds from the repositories should be grown in a qualified nursery until seedlings have established to a point where they have a greater chance of survival in the wild. Standards should include guidance on plant and seed distribution and tracking, how long juvenile plants should grow in the nursery before they are ready for outplanting, proper soil mixtures, watering schedules, recommended pot sizes, and how seedlings should be transported to identified restoration and outplanting sites. CDFW may develop nursery standards and protocols for western Joshua tree propagation and outplanting and include them in a future Conservation Plan update, if necessary.

5.2.3 Tribal Co-Management

Source: Native American Land Conservancy.

CDFW recognizes that California's Native American tribes have long taken care of California's fish, wildlife, and plants and possess unique and valuable expert knowledge and practices for conserving and using these resources in a sustainable manner. Engaging in co-management is key for western Joshua tree conservation, and it is important to do so in ways that respect the interests and priorities of Tribes. The goal of co-management is to collaboratively share management functions and responsibilities for conservation of western Joshua tree and its habitat. Co-management provides an avenue to improve the conservation strategies by ensuring Tribes have access and pathways to implement their extensive life experience and unique understanding of the landscape. This also ensures their knowledge is incorporated into the Conservation Plan, as appropriate, while acknowledging that the Tribes choose what and how knowledge is shared.

The process to develop meaningful co-management will require time that extends beyond the publishing timeline of the Conservation Plan. TEK shared by Tribes will influence management actions in the Conservation Plan. In turn, this tribal knowledge and guidance will inform specific standards for co-management of the species. The actions in this section describe establishing the framework needed to guide development, incorporation, and implementation of co-management functions and responsibilities.

MANAGEMENT ACTION TCM 1: ESTABLISH CO-MANAGEMENT PRINCIPLES

Collaboratively establishing core principles of co-management is an essential first step toward co-creating written agreements and long-term collaborations between the State and Tribes for western Joshua tree conservation. The goal of developing co-management principles is to guide future decision making and the elements of co-management practices between CDFW and Tribes. These core principles may include expectations and use of vocabulary that signifies the respect, commitment, intent, and responsibilities of multiple sovereign governments and integrate their respective management philosophies into mutually beneficial approaches to achieve a common set of goals. It is important that the co-management principles reflect tribal interests and priorities that complement other actions designed to implement WJTCA and to comply with other California laws. Therefore, development of co-management principles requires time and multiple discussions to achieve an approach and written agreement that works for both CDFW and Tribes. This will warrant ongoing work together after the initial approval of the Conservation Plan.

After reviewing the Advisory Council on Historic Preservation's Policy Statement on Indigenous Knowledge and Historic Preservation (ACHP 2024), CDFW developed initial foundational commitments, which was requested by tribal members (FIICPI, pers. comm., 2024a). A draft of CDFW's foundational commitments is provided in Appendix G, "Foundational Commitments by CDFW for Developing Western Joshua Tree Conservation Plan Co-Management Principles with California Native American Tribes." The following topic summaries are addressed in the commitments:

- **Respect and relationship building**. Tribal knowledge, including TEK, will be treated with respect in all circumstances.
- **Valid and self-supporting knowledge**. TEK held by a tribe is a valid, sound, and self-supporting source of information and is an aspect of science.
- **Cultural and religious significance of Traditional Ecological Knowledge**. Conservation actions affect resources and properties that may be of religious and cultural significance to tribes.

- **Fair compensation**. If a state agency requests a tribe to provide TEK via research, survey, monitoring, or other efforts, the state agency and the tribe are encouraged to collaborate to identify potential funding mechanisms (which may include grants, to the extent permitted by applicable laws and regulations and sufficient resources) to fairly reimburse or compensate the tribe.
- **Transparency and records of tribal involvement**. Maximum transparency is essential to demonstrate how and what tribal priorities, including TEK and other sensitive information, will be documented in conservation project records.
- **Consultation timelines**. Timelines will reflect the complexity and nature of the undertaking and will recognize and seek to accommodate to the capacity of tribes throughout the decision-making processes.
- **Professional qualifications of tribal representatives**. The State recognizes that representatives of tribes have professional qualifications.
- **Managing and protecting sensitive tribal information**. The State will prevent or limit to the maximum extent feasible any inappropriate disclosure of confidential or sensitive information through all available mechanisms.

Source: Jessie Quinn, Ascent.

MANAGEMENT ACTION TCM 2: MUTUALLY DEFINE ELEMENTS OF CO-MANAGEMENT

Guided by the foundational commitments and co-management principles from Management Action TCM 1, "Establish Co-Management Principles," CDFW and California Native American tribes will co-create elements of the Western Joshua Tree Conservation Plan actions that incorporate tribal values, knowledge, priorities, and co-management on tribal land or other properties that contain resources or lands that may be of religious and cultural significance to Tribes. Mutually defining elements that should be included in co-management agreements to carry out both traditional and contemporary land stewardship practices promote meaningful collaboration and tangible outcomes. The following actions present elements that need to be addressed and agreed upon with Tribes for inclusion as co-managed conservation actions:

- Articulate a process for take of western Joshua tree by California Native American tribes in a culturally appropriate manner or for a specific purpose (FIICPI, pers. comm., 2024a).
- Continue consultation to provide a platform for Tribes to articulate aspects of TEK that include spiritual and cultural elements that may be new to agencies. Agencies should seek to consider these unfamiliar aspects of environmental protection and include them in guidance and policies (FIICPI, pers. comm., 2024b).
- Upon request of a California Native American tribe, collaborate on developing a process to relocate western Joshua trees to tribal lands when there is an opportunity to do so. For example, an opportunity may be related to coordinating with a developer that is openly seeking a pathway for relocating trees they are permitted to take.
- Encourage the presence of tribal cultural monitors at development or other ground-disturbing projects during the salvage, destruction, or removal of western Joshua trees as a measure to provide spiritual and cultural protection to western Joshua trees that are either taken or are affected in the project area. Ideally, tribal cultural monitors may also be trained as arborists working as desert native plant specialists to ensure proper salvaging methods are implemented (FIICPI, pers. comm., 2024b).
- Encourage employment of trained tribal members or local tribal conservation crews to support restoration and relocation efforts of western Joshua trees that are carried out with cultural and biological integrity.
- Collaborate with Tribes to identify where ethnographic studies are requested. Identify needs and potential resources, including but not limited to funding, so Tribes can carry out these studies.
- Identify priority lands of significance to individual California Native American tribes that may overlap with the biological criteria outlined in Management Action LC&M 1, "Identify

Priority Conservation Lands” so that they can be prioritized for long-term conservation and tribal stewardship.

- Collaborate and identify initiatives for tribal management of western Joshua trees, for example, supporting nurseries developed and led by California Native American tribes for western Joshua tree conservation.
- Incorporate California Native American tribes’ TEK or provide supporting pathways for Tribes to implement TEK into western Joshua tree conservation strategies. For example, Tribes and CDFW will collaborate to incorporate cultural burning where it would be an effective tool (outlined under Management Action LC&M 3, “Manage Conservation Lands”) for reduction of wildland fire risk or enhancement of western Joshua tree population conditions on tribal lands (ACTCI, pers. comm., 2024).
- Collaborate and identify all applicable and available sources of funding (including but not limited to the use of the Conservation Fund) to support tribal TEK implementation. Non-tribal parties assuming TEK implementation responsibility without explicit tribal permission would be a breach of intellectual property use and would be an extractive practice toward the California Native American tribes (FTBMI, pers. comm., 2024).
- Develop written MOUs or other written collaboration agreements between CDFW, California Native American tribes, and relevant entities that would embody co-management principles (see Section 6.4, “Tribal Co-Management”).

5.2.4 Research to Inform Long-Term Conservation

The scientific understanding of the long-term persistence of western Joshua tree is evolving as research continues. It is currently difficult to determine what ecological factors are influencing long-term persistence. These difficulties are centered around a lack of range-wide demographic data and the amount and frequency of recruitment necessary to maintain populations, uncertainty about the magnitude and timing of heat and drought stressors and how western Joshua tree will respond, and lack of information about the environmental tolerances and population dynamics of yucca moth (USFWS 2023). Therefore, additional research is necessary to fill these information gaps.

MANAGEMENT ACTION R&I 1: CONTINUE RESEARCH AND INFORMATION DEVELOPMENT

CDFW will encourage scientific research needed to inform effective conservation of western Joshua tree. There are currently numerous information gaps related to species genetics, distinct populations, demography, distribution, microbial associations, fire effects, climate response, and other factors that will be important to the conservation and management of western Joshua tree. Science and research are fundamental to long-term species conservation and for developing meaningful strategies to avoid, minimize, and mitigate threats to western Joshua tree. The seven-step approach recommended by Smith et al. (2023) for effective species conservation in the face of climate change requires acquisition of information that is currently lacking for western Joshua tree. Research also provides a foundation from which to track the success of conservation and management actions and adapt management strategies as needed if monitoring indicates performance targets are not being met.

Action R&I 1.1: Identify Genetic Structure and Distinct Populations

Research focused on genetic studies is needed for western Joshua tree conservation. Preserving a species' full range of genetic variation is one of the pillars of conservation biology. Understanding the range of western Joshua tree's genetic variation is needed to inform effective conservation. Specifically, genomic research is needed following these steps, which are outlined in Smith et al. (2023):

- Quantify neutral diversity (i.e., genetic variation that is not affected by natural selection).
- Delineate genetically distinct populations.
- Identify climate-adaptive variants.
- Catalog adaptive diversity (i.e., range of adaptive traits that make individuals better suited to withstand the effects of climate change and other stressors).

Action R&I 1.2: Collect and Analyze Range-Wide Demographic Information

Develop a program of long-term, range-wide direct population and vegetation monitoring with emphasis on leading and trailing edges, and highest and lowest elevations of the species' range in California. Range-wide demographic information is needed to detect baseline population trends, and identify populations with high recruitment (i.e., addition of new adult plants that develop from seeds or sprouts) and those that do not appear to be recruiting/reproducing new individuals onsite at sustainable levels (i.e., plants are not reproducing at a sufficient rate to replace themselves generation after generation). Researchers should look for collaboration opportunities to develop standardized monitoring protocols to collect demographic data and abundance trends across the species' range, and to establish and maintain a database for data collected.

Action R&I 1.3: Develop Refined Species Distribution Models

Once genetically distinct populations have been delineated, research should use these data to develop refined species distribution models to help identify habitat suitable for western Joshua tree in the future (Smith et al. 2023). Potential refugia models should be validated with range-wide demographic data collection and other independent data sources (Smith et al. 2023).

Action R&I 1.4: Assess Adaptive Genetic Variation

Research should evaluate climate adaptive genomics. Once genetic variation of the species is better understood, researchers should identify subpopulations with adaptive traits that make them better suited to withstand the effects of climate change. Researchers should consider genome-wide association studies, as recommended by Smith et al. (2023), to identify adaptive genes responsible for greater tolerances to heat, drought, and other stressors. Genotypes (genome sequence data) of individuals that survive climate extremes and from populations with greater numbers of individuals with these adaptive traits should be prioritized for conservation and used for assisted gene flow (i.e., relocating genetically adaptive individuals or their propagules to areas already occupied by western Joshua tree to facilitate climate change adaptation).

Action R&I 1.5: Study Yucca Moth

Research should investigate the western Joshua tree's obligate pollinator, yucca moth's life history, environmental tolerances, distribution, local adaptation to host plant populations, and association genetics or other approaches to identifying adaptive genetic variation (see "Pollination" in Section 4.1.3). Researchers should produce range-wide species distribution models for yucca moth; determine the percentage of larvae in diapause that are lost to predation and other factors, such as project-related impacts; and study the cues that trigger metamorphosis.

Action R&I 1.6: Update Ecoregional Assessment

Update previous work done by Randell et al. (2010) and Parker et al. (2018) or other datasets to assess ecological intactness within the entirety of western Joshua tree's range.

Action R&I 1.7: Research Microbial Associations and Restoration Techniques

Research should investigate biocrust associations and arbuscular fungi associations and their role in western Joshua tree conservation, as well as other microbial associations that may be important to western Joshua tree survival. Research should include techniques to restore biocrusts and fungi associations important to western Joshua tree, such as biocrust salvage and transplantation in the wild, and propagation and inoculation techniques in nursery settings. Biocrusts could also be applied to fuel breaks to reduce exposed soil and limit invasive plant establishment while maintaining effective fuel breaks (Condon et al. 2023).

Action R&I 1.8: Investigate Fire Resilience/Postfire Recovery

Research should investigate fire resiliency of western Joshua tree and its nurse plants. Studies could include postfire monitoring of western Joshua tree recruitment, seed production of trees that survive, or basal sprouting. Sweet et al. (2023) suggests monitoring could include collecting baseline data in nurse plant cover at burned sites and following recruitment patterns. Research should also investigate fire regime-plant community interactions, including the positive feedback loop invasive plants can have on promoting recurrent fire in western Joshua tree habitat (Brooks and Matchett 2006). This research should consider impacts of annual rainfall amounts to inform when invasive plant control is needed to protect western Joshua tree populations (Brooks and Matchett 2006).

Action R&I 1.9: Investigate Invasive Plant Control Techniques

Research should investigate the most effective ways to control the spread and abundance of invasive plant species to reduce fire risk through the following possible activities:

- Identify the most effective treatment strategies to manage invasive species that optimize benefits while minimizing negative tradeoffs under a range of conditions (Abella et al 2023; Reed et al. 2009; Darst et al. 2013; Tuma et al. 2016).
- Investigate indirect effects of herbicide application (e.g., indaziflam) in western Joshua tree habitats, particularly on western Joshua tree seedlings and nurse plants, as well as other native plants. Using this information, identify demographic effects and appropriate avoidance buffer standards and application methods for herbicide use in areas occupied by western Joshua tree (Abella et al 2023).

Action R&I 1.10: Research Long-Term Climate Effects

Research should investigate the effects of multiyear and multidecade climate variability patterns on western Joshua tree recruitment, survival, and population density. Research should aid the development of a large-scale demographic study that is needed to inform conservation acquisitions and other forms of protection.

Source: Drew Kaiser, California Department of Fish and Wildlife.

Action R&I 1.11: Study Salvage and Relocation Methods

Evaluate and improve salvage and relocation methods to increase survival of western Joshua trees salvaged from development sites and transplanted to mitigation sites. Successful relocation can increase the persistence of western Joshua tree and ensure genetic diversity and adaptive variation are retained from populations lost to development.

Action R&I 1.12: Investigate Assisted Migration where Natural Migration is Unlikely

Research the feasibility, practicality, effectiveness, and risks of implementing future assisted migration and translocation of western Joshua tree into areas modeled as climate refugia to which the species cannot naturally migrate (Figure 5-2) or would migrate to very slowly (Cole et al. 2021; Shryock et al. 2025). This information could be used to inform the usefulness of conserving lands that are outside the current range of western Joshua tree but that may become suitable for the species in the future under different climate scenarios. Western Joshua trees have low capacity to colonize newly available areas on their own because of their low dispersal ability and limited connectivity between currently occupied and potential future habitat. Assisted migration is frequently contemplated as a conservation tool to get species to newly available habitat; however, there are few studies on the implementation of assisted migration for the purpose of conservation (Twardek et al. 2023). The studies that have been conducted generally examine only short periods of time and rarely provide information on the translocated species' population and ecological community-level impacts and outcomes. Further study is needed to test the effectiveness of assisted migration of western Joshua tree, and to determine how it can be done cost effectively and without adverse effects to the receiving ecosystems (Smith et al. 2023).

Action R&I 1.13: Study Basal Sprout Survival and Vulnerabilities

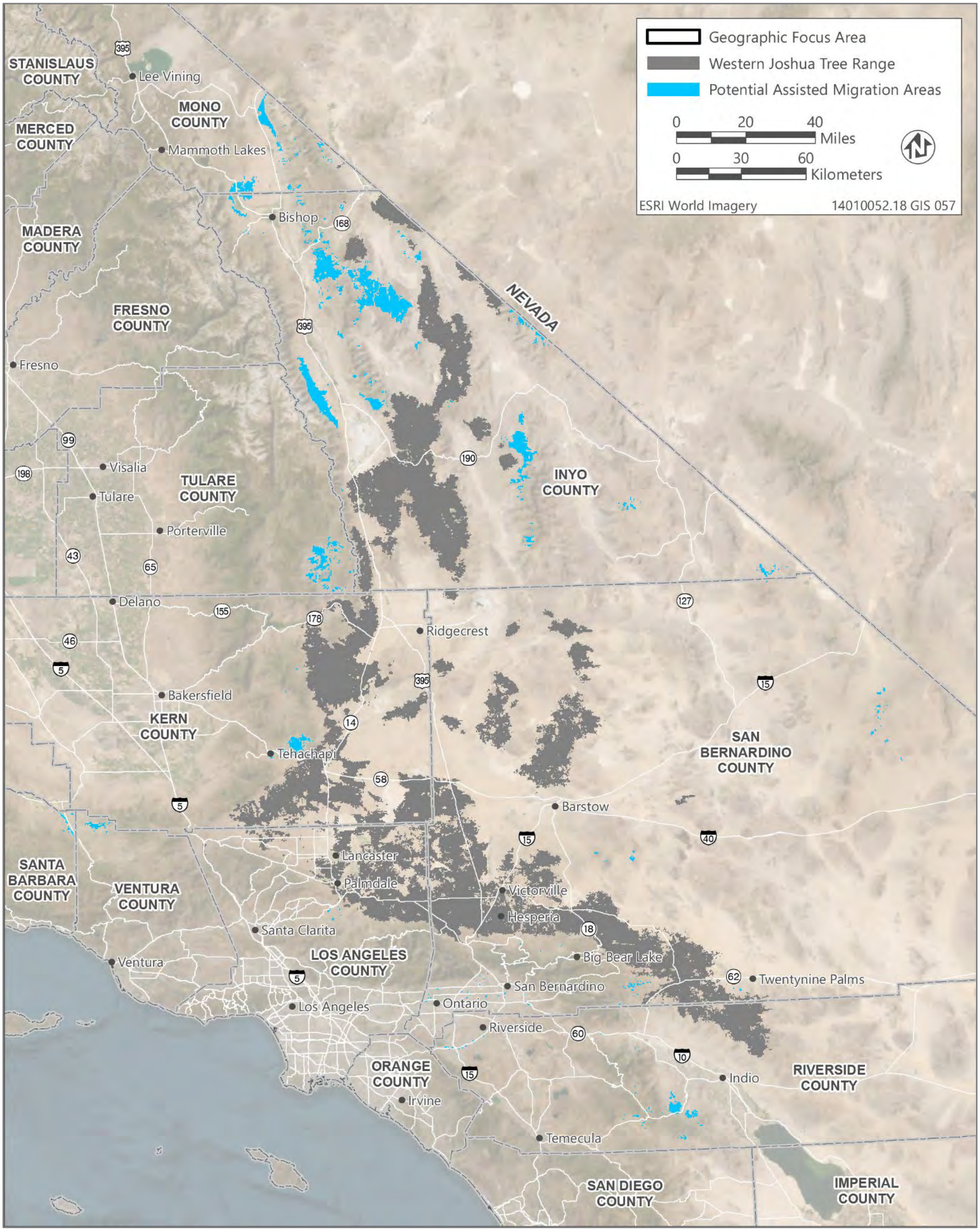
Research the resource needs (e.g., nutrients, water) and vulnerability of basal resprouts of western Joshua tree to increase persistence, for example, whether they may be vulnerable to drought or herbivory. Further study could include an analysis of survival data based on various environmental and biological factors and may include unburned reference sites for estimating background mortality. Analysis of these data is ongoing pending further funding support (Sweet et al. 2023). These data will enhance understanding of demographic trends. Research should help inform potential site-specific management needed to ensure growth and survival of individual western Joshua trees.

Action R&I 1.14: Tribal Ethnobotanical Studies

Ethnobotanical studies of the greater Mojave Desert and Great Basin regions and western Joshua tree habitat should be conducted if requested by a California Native American tribe. Ethnobotanical studies research how people of a particular culture and region use native plants for food, medicine, shelter, dyes, fibers, oils, resins, soaps, waxes, ceremonial purposes, and more (USFS n.d.).

Action R&I 1.15: Develop Additional Fuel Treatment Methods

CDFW will coordinate with California Department of Forestry and Fire Protection (CAL FIRE) and others on developing additional fuel treatment methods for western Joshua tree habitat, including manual and mechanical treatment methods. Once developed, these treatment methods could eventually be included in the minimization measures in Section 5.2.1, above.



Source: Shryock et al. 2025; adapted by Ascent in 2024.

Figure 5-2 Potential Assisted Migration Areas Where Natural Migration is Unlikely

5.2.5 Education and Awareness

Education and awareness programs will enhance public understanding of western Joshua tree ecology, foster community pride and ownership of western Joshua tree conservation, connect people with their natural world, and inspire people to care about western Joshua tree and its habitat so they will support conservation of the species. A key priority will be ensuring that underserved and overburdened communities have access to—and can engage in—education and awareness programs and opportunities.

MANAGEMENT ACTION E&A 1: SUPPORT EDUCATION AND OUTREACH

Education and outreach programs that increase awareness and appreciation of the cultural, biological, and ecological value of western Joshua tree may provide long-term benefits for conservation of the species. Education and outreach programs can also promote opportunities for all communities to be involved with western Joshua tree appreciation, stewardship, and conservation.

Action E&A 1.1: Support Tribal-Led Educational Outcomes

CDFW will work with Tribes to support tribal priorities for education and outreach to their communities. The following are examples of undertakings or materials that may be developed to support tribal-led and tribal-designed efforts:

- ethnobotanical studies,
- lesson plans and curricula for various age groups,
- professional certification programs (e.g., for tribal cultural monitors, TEK practitioners, fire and restoration specialists),
- printed materials designed to strengthen cultural knowledge, and
- workshops.

Action E&A 1.2: Develop Publicly Distributed Information

CDFW will work with partners to develop accessible informational items for distribution to the public in multiple languages. The informational items may be handouts, brochures, presentations, digital materials, surveys, interactive web pages, or other outreach tools. Materials should be made available to communities throughout western Joshua tree's range in California with a dedicated focus on reaching underserved communities. Informational items may include the following materials:

- a handout describing how to care for western Joshua tree with information on:
  - o watering (none unless they show signs of heat/drought stress),
  - o invasive plant removal,
  - o nurse plant species to incorporate into landscaping, and
  - o signs of pests and solutions for pest infestations;
- science kits, handouts, and web-based western Joshua tree activities for schools to educate young citizens about western Joshua tree and its need for conservation such as:
  - o coloring and activity sheets focused on western Joshua tree “fun facts” and biology;
  - o a western Joshua tree junior ranger program based on collecting information about the species; and/or
  - o a science kit developed in collaboration with local scientists and educators that includes hands-on activities through storytelling, art, or field trips, focusing on western Johsua tree and climate change impacts and solutions, such as a traveling trunk for Climate Kids with the Climate Science Alliance;

Source: Amita Bubb.

- materials and opportunities for the public to participate in western Joshua tree conservation efforts and education, such as:
  - o a calendar of volunteer events (e.g., seed collection and restoration) and educational webinars,
  - o iNaturalist citizen science project information, and/or
  - o Information on recreating outdoors with western Joshua trees responsibly (see Action A&M 2.8, “Minimize Impacts from OHV Use and Outdoor Recreation”);
- collaborations to fund and open a western Joshua tree art gallery or exhibit that could be made available to the public within the geographic focus area of this Conservation Plan and virtually online; and/or
- interactive, web-based ArcGIS StoryMaps for western Joshua tree conservation and education.

Action E&A 1.3: Establish a Tree Adoption Program

CDFW will reach out to partners to encourage organizations to develop opportunities for an adopt-a-Joshua tree program. This program may include the following activities:

- establishing a program in which members of the public can "adopt" western Joshua trees salvaged from development sites and replant them on their private property, and/or
- providing signage that landowners can place on their property to identify "adopted" western Joshua trees.

Action E&A 1.4: Explore Authorizing a Specialized Interest License Plate

CDFW or other organizations may coordinate with the California Department of Motor Vehicles to develop a specialized western Joshua tree interest license plate. Monies generated from sales of the license plates could be added to the Conservation Fund.

Action E&A 1.5: Support Media Promotion

CDFW will coordinate with partner organizations to encourage development of newsletters and conduct western Joshua tree–focused social media campaigns.

Action E&A 1.6: Support Volunteer Opportunities

Cattle sheltered by western Joshua trees.

CDFW will support and encourage volunteer opportunities by promoting them on their website, social media, and printed media (e.g., handouts, newsletters). Special focus will be given to providing opportunities for underserved (i.e., communities that have historically received inadequate investment, resources, or services) and overburdened (i.e., communities that are disproportionately affected by pollution, environmental hazards, and health risks) communities and young people to participate in and benefit from. This includes connecting these communities with natural areas containing iconic western Joshua trees.

The following volunteer programs may benefit western Joshua tree:

- National Park Service Volunteers-In-Parks (VIP) program,
- California State Parks Volunteer in Parks Program,
- Mojave Desert Land Trust volunteer programs,
- Transition Habitat Conservancy volunteer programs,

- CDFW-led seed collection/banking efforts,
- Yucca weevil tracking projects, such as Mojave Desert Land Trust's 2023 Yucca Weevil Watch hosted on iNaturalist, and
- western Joshua tree flowering/masting tracking projects hosted on iNaturalist.

Action E&A 1.7: Develop Guidance for Grazing Practices

CDFW will coordinate with agricultural organizations to encourage development of guidance regarding grazing best practices in western Joshua tree habitat and make it available to ranchers, rangeland managers, and others in the grazing community.

Action E&A 1.8: Encourage Urban Conservation and Recovery

CDFW will coordinate with local governments to encourage the development of educational materials for private residential and other property owners with western Joshua trees to participate in urban conservation and recovery efforts.

5.3 EFFECTIVENESS CRITERIA

The management actions described in this chapter are necessary to achieve the vision, purpose, and objectives of the Conservation Plan. WJTCA requires that the Conservation Plan include objective, measurable criteria to assess the effectiveness of management actions. This section presents preliminary effectiveness criteria to help CDFW and the Commission measure how effective the management actions are in conserving western Joshua tree. These criteria are divided into two sets. One set of criteria is related to the overall conservation of western Joshua tree in California, and the other set of criteria is related to the effectiveness of the Conservation Plan and the use of the Western Joshua Tree Conservation Fund in making progress toward the vision of this Conservation Plan. Although these two sets of criteria are interrelated, the former set is more relevant to the Commission's decision-making authority under the California Endangered Species Act (CESA), and the latter is more relevant for assessing the effectiveness of this Conservation Plan and the Western Joshua Tree Conservation Fund as implemented by CDFW. The metrics needed to evaluate some of the effectiveness criteria will be informed by future research described in Section 5.2.4, and therefore will be refined in future Conservation Plan updates.

5.3.1 Effectiveness Criteria for Conservation of Western Joshua Tree in California

- By 2033, when the Commission must reconsider whether listing western Joshua tree is warranted (Fish & G. Code, § 1927.9), a large and genetically representative distribution of western Joshua tree is permanently protected and managed to maximize ecological function for the species and its co-occurring native species. This criterion is dependent on science regarding western Joshua tree population genetics described in Action R&I 1.1, "Identify Genetic Structure and Distinct Populations" and on models of the predicted climate refugia category. The target for this criterion is 70 percent of priority conservation lands, as identified through Management Action LC&M 1, "Identify Priority Conservation Lands," across the full range of western Joshua tree in California.

- A program to monitor and assess western Joshua tree population status based on science has been developed and adopted, as described in Action R&I 1.2, "Collect and Analyze Range-Wide Demographic Information" and based on Actions R&I 1.1, 1.3, "Develop Refined Species Distribution Models", 1.4, "Assess Adaptive Genetic Variation", 1.5, "Study Yucca Moth", and 1.13, "Study Basal Sprout Survival and Vulnerabilities", and assessments under this program demonstrating that western Joshua tree is sustainable in California for the foreseeable future, per R&I 1.10, "Research Long-Term Climate Effects."
- Cooperative multiagency strategies are in place to reduce fire risk, aggressively fight wildland fires that threaten western Joshua trees, and fully fund restoration plans that will be implemented in response to wildland fires that kill a demographically significant number of western Joshua trees as identified by Management Action A&M 3, "Minimize Impacts from Wildland Fire and Fire Management" Management Action LC&M 4, "Restore and Enhance Habitat," and informed by Action R&I 1.15, "Develop Additional Fuel Treatments."

Source: Anna Cirimele, National Park Service.

- Ninety (90) percent of land within the predicted climate refugia category that is ecologically core, ecologically intact, or moderately degraded when conservation lands are identified, as determined through Management Action LC&M 1, is permanently protected and managed to maximize ecological function for the species and its co-occurring native species (see implementation approaches in Action LC&M 2.1, "Implement Priority Conservation Land Protection"). For the purposes of this criterion, land within the predicted climate refugia category shall be any area predicted to be suitable for the species under low (SSP 2-4.5), moderate (SSP 3-7.0), or high (SSP 5-8.5) emissions modeling scenarios for the 2071 through 2100 timeframe, as it is defined in Section 4.4. The measurable details of this criterion should be science-based and informed by the research actions in Section 5.2.4 and climate refugia models, and therefore may change as relevant information improves.

5.3.2 Effectiveness Criteria for the Conservation Plan and the Western Joshua Tree Conservation Fund

- Initial draft priority conservation areas have been identified by December 2025.
- Every 2 years, beginning in 2026 (Fish & G. Code, § 1927.8, subd. (a)), the acreage of priority conservation lands preserved in perpetuity is greater than in the prior 2-year review period. CDFW will first focus on protecting priority conservation lands identified via Management Action LC&M 1, "Identify Priority Conservation Lands." CDFW will seek to protect an additional 3 to 5 percent of occupied western Joshua tree range every 2 years until the effectiveness criteria related to land protection for conservation of western Joshua tree in California are achieved.
- Conservation lands that are protected via the Conservation Fund have an endowment that is sufficient to fund management to maximize ecological function for the species and its co-occurring native species in perpetuity.
- At least one USFWS- and CDFW-approved written MOU or other written collaboration agreement has been established on federal land that protects and safeguards priority conservation lands representing at least 10 percent of occupied western Joshua tree range by 2033.
- At minimum, one written MOU or other written collaboration agreement incorporating co-management principles has been established between CDFW or other land managers and California Native American tribes by 2028.
- As measured every 2 years, more local jurisdictions have incorporated the Conservation Plan's A&M measures into adopted plans and policies.
- CDFW, local fire departments, CAL FIRE, and federal agencies have developed and implemented guidelines for avoiding direct impacts on western Joshua trees during wildland fire suppression and control activities, for fuel treatment implementation, and for preventing accidental ignition of fires during other activities, such as construction and recreation. Local fire departments in the geographic focus area, CAL FIRE, and federal agencies have entered into agreements with CDFW to implement the guidance. The number of jurisdictions implementing the guidelines increases every 2 years.

The preliminary criteria listed above are intended to help CDFW evaluate whether management actions are resulting in long-term conservation of the species. If they are not, it may be necessary to determine if and how the management actions should be modified or replaced.

As ongoing research develops metrics for demonstrating long-term persistence of western Joshua tree in California in the face of climate change, some effectiveness criteria may be modified or added when the Conservation Plan is reviewed and updated.

These initial effectiveness criteria help determine how successful implementing these important actions have been to conserve the species. These criteria will be used to determine if administration of the Western Joshua Tree Conservation Fund, development and execution of written interagency agreements or written MOUs with land management entities, and other actions are effective at achieving the vision, purpose, and objectives of the Conservation Plan.

5.4 PRIORITY MANAGEMENT ACTIONS FOR MANAGEMENT UNITS

Management units are outlined and delineated in Section 4.4 based on criteria for expected climate conditions, quality of habitat, existing management authorities, and land ownership. Organizing the landscape into management units based on these characteristics of the landscape will help guide the application of the Conservation Plan's management actions.

Although the management actions described in this chapter (which are summarized in Table 5-2 below) could apply to any management unit, certain management actions are recommended as priorities for specific management units (Table 5-3). For example, regardless of habitat conservation value, the management actions in Tribal Land units will prioritize establishing co-management principles and mutually defining elements of co-management. Some management actions could be applied throughout the species range without prioritization by management units. For example, conducting research and gathering information will help inform management in all management units in the future. Conducting education and outreach will similarly help educate the public and improve management in all management units.

Table 5-2 Summary of Management Actions

Management Action Abbreviation	Management Action Title
A&M 1	Avoid Direct and Indirect Impacts
A&M 2	Minimize Direct and Indirect Impacts
A&M 3	Minimize Impacts from Wildland Fire and Fire Management
LC&M 1	Identify Priority Conservation Lands
LC&M 2	Protect Priority Conservation Lands
LC&M 3	Manage Conservation Lands
LC&M 4	Restore and Enhance Habitat
LC&M 5	Establish Seed Banks and Nurseries
TCM 1	Establish Co-Management Principles
TCM 2	Mutually Define Elements of Co-Management
R&I 1	Continue Research and Information Development
E&A 1	Support Education and Outreach

Source: Compiled by Ascent in 2024.

Table 5-3 Priority Management Actions for Western Joshua Tree Management Units by Conservation Value Category and Predicted Climate Refugia Category

Management Unit Type[1]	Ecologically Core and Intact	Predicted Climate Refugia Category [2] in Ecologically Core and Intact	Moderately Degraded and Highly Converted	Predicted Climate Refugia Category in Moderately Degraded and Highly Converted
Wilderness	A&M 3[3] LC&M 3[3] LC&M 4[3]	A&M 3[3]	LC&M 3[3] LC&M 5[3]	LC&M 1[4] LC&M 3[3] LC&M 5[3]
Preservation with Light Recreation/ Other Use	A&M 1 A&M 2 A&M 3 LC&M 3 LC&M 4 LC&M 5	A&M 1 A&M 2 A&M 3	LC&M 3 LC&M 4 LC&M 5	LC&M 1[4] LC&M 3 LC&M 4 LC&M 5 A&M 1 A&M 2 A&M 3
Defense	LC&M 1 LC&M 2 LC&M 3 LC&M 4 LC&M 5 A&M 1 A&M 2 A&M 3	LC&M 1[4] LC&M 2 LC&M 3 LC&M 4 LC&M 5 A&M 1 A&M 2 A&M 3	LC&M 1 LC&M 2 LC&M 3 LC&M 4 LC&M 5	LC&M 1[4] LC&M 2 LC&M 3 LC&M 4 LC&M 5 A&M 1 A&M 2 A&M 3

Management Unit Type[1]	Ecologically Core and Intact	Predicted Climate Refugia Category [2] in Ecologically Core and Intact	Moderately Degraded and Highly Converted	Predicted Climate Refugia Category in Moderately Degraded and Highly Converted
Tribal Land	TCM 1 TCM 2 A&M 1 A&M 2 A&M 3 LC&M 3 LC&M 4 LC&M 5	TCM 1 TCM 2 A&M 1 A&M 2 A&M 3	TCM 1 TCM 2 LC&M 3 LC&M 4 LC&M 5	TCM 1 TCM 2 LC&M 1[4] LC&M 3 LC&M 4 LC&M 5 A&M 1 A&M 2 A&M 3
Mixed Use	LC&M 1 LC&M 2 LC&M 3 LC&M 4 LC&M 5 A&M 1 A&M 2 A&M 3	LC&M 1[4] LC&M 2 LC&M 3 LC&M 4 LC&M 5 A&M 1 A&M 2 A&M 3	LC&M 1 LC&M 2 LC&M 3 LC&M 4 LC&M 5	LC&M 1[4] LC&M 2 LC&M 3 LC&M 4 LC&M 5 A&M 1 A&M 2 A&M 3
Little or No Protection	LC&M 1 LC&M 2 LC&M 3 LC&M 4 LC&M 5 A&M 1 A&M 2 A&M 3	LC&M 1[4] LC&M 2 LC&M 3 LC&M 4 LC&M 5 A&M 1 A&M 2 A&M 3	LC&M 1 LC&M 2 LC&M 3 LC&M 4 LC&M 5 E&A 1	LC&M 1[4] LC&M 2 LC&M 3 LC&M 4 LC&M 5 A&M 1 A&M 2 A&M 3

[1] Although actions described in this chapter can be applied to any management unit, the actions listed in this table identify the highest priority management actions for each unit.

[2] Recommendations for the predicted climate refugia category can be applied to any unoccupied future suitable habitat category that is identified.

[3] Management activities on conservation lands may be allowed in wilderness areas or may be limited by the administering agency to protect wilderness values.

[4] If priority conservation lands are identified in the predicted climate refugia category that is present within moderately degraded or highly converted land, management should prioritize avoiding and minimizing impacts.

Source: Compiled by Ascent in 2024.

In ecologically core and intact habitat that currently have land protections (i.e., Wilderness, Preservation with Light Recreation/Other Use), avoiding and minimizing impacts should be prioritized. Because management actions in wilderness areas are limited to protecting wilderness values, coordination with BLM, USFS, and NPS will be imperative. In addition, these areas should prioritize identifying, protecting, restoring, and managing priority conservation lands (Actions LC&M 3, LC&M 4, and LC&M 5), including collecting seed when appropriate. In Tribal Land units, management should follow recommendations for Wilderness and Preservation with Light Recreation/Other Use units, as well as implementing tribal focused management actions. In ecologically core and intact habitat that do not currently have protection or have minimal land protections (i.e., Little to No Protection, Mixed Use, and

Defense), management should focus on identifying, protecting, and managing priority conservation lands and avoiding and minimizing impacts.

Although some lands are classified as ecologically core and intact habitat in the ecoregional assessment, there may be opportunities in these areas to benefit from restoration based on finer-scale and site-specific assessments for specific projects or site-scale planning decisions (Randall et al. 2010). This would be determined on a site-by-site basis.

Source: Jeb Bjerke, California Department of Fish and Wildlife.

Within the moderately degraded or highly converted habitat that have minimal to no land protections (i.e., Little to No Protection, Mixed Use, Defense units), management should focus on identifying, protecting, managing, and restoring priority conservation lands and avoiding and minimizing impacts. For the Little to No Protection units categorized as moderately degraded or highly converted habitat, education and awareness should also be prioritized. In areas of moderately degraded or highly converted habitat that have land protections (i.e., Wilderness, Preservation with Light Recreation/Other Use), management should focus on identifying, protecting, managing, and restoring priority conservation lands and avoiding and minimizing impacts. To protect wilderness values, some actions may not be allowed or may be limited in Wilderness units by the administering agency. In Tribal Land units, management should follow recommendations for Wilderness and Preservation with Light Recreation/Other Use units, as well as implementing tribal focused management actions.

Management of land in the predicted climate refugia category within ecologically core or intact habitat that have minimal or no protections (i.e., Little to No Protection, Mixed Use, and Defense units) should prioritize identifying, protecting, managing, and restoring priority conservation lands. Management units containing land in the predicted climate refugia category in ecologically core or intact habitat with land protections (i.e., Wilderness, Preservation with Light Recreation/Other Use) should prioritize avoidance or minimizing impacts to the greatest extent feasible. In Tribal Land units, management should follow recommendations for Wilderness and Preservation with Light Recreation/Other Use units, as well as implementing tribal focused management actions.

There may be areas that are degraded but have land in the predicted climate refugia category, so it should be determined whether restoring these areas would further the conservation of the species. Management should prioritize avoiding and minimizing impacts on any priority conservation lands within degraded areas, or priority conservation lands that contain minimal or no protections that are also within the predicted climate refugia category. The recommendations for areas in the predicted climate refugia category also apply to land within modeled climate refugia in the buffered climate refugia category and the unoccupied future suitable habitat category where western Joshua trees could naturally disperse (Shryock et al. 2025).

Within unoccupied habitat in the buffered climate refugia category that is modeled as climate refugia and the unoccupied future habitat category, as defined in Section 4.4, areas should be managed to avoid impacts and preserve functioning ecosystems so that western Joshua tree can potentially occupy them in the future. Further study is needed to test the effectiveness of assisted migration of western Joshua tree and to determine how it can be done cost effectively and without adverse effects to the receiving ecosystems. Assisted migration of western Joshua tree in areas in which the species is likely to naturally migrate and is likely to be valuable for conserving the species over the long term, as described in Action LC&M 4.4, but should be implemented carefully and should not be considered an alternative to protecting occupied climate refugia.

Opportunities for assisted migration in areas to which the species is unlikely to naturally migrate and that are currently unoccupied by western Joshua tree but would potentially be suitable for the species in the future (i.e., modeled as future climate refugia) should receive further evaluation if scientific evidence supports its feasibility and effectiveness. Assisted migration may have conservation value if questions about its effectiveness for species conservation are resolved, costs become feasible, and the owners and managers of receiving land are supportive.

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6 IMPLEMENTATION

6.1 INTRODUCTION

> *"During nights in the open, lying in a snug sleeping-bag, I soon learned the charm of a Joshua Forest... The desert with its elusive beauty...possessed me, and I constantly wished that I might find some way to preserve its natural beauty."*
>
> *— Minerva Hamilton Hoyt*

This chapter describes key mechanisms for Conservation Plan implementation, the roles of the implementing parties, and the ongoing implementation monitoring and adaptive management features of the Conservation Plan. Pursuant to the Western Joshua Tree Conservation Act (WJTCA), CDFW must implement the Conservation Plan in collaboration with the Commission, governmental agencies, California Native American tribes (Tribes), and the public (Fish & G. Code, § 1927.6, subd. (a)). Elements of Conservation Plan implementation are summarized below. Details supporting some of the implementation elements are provided in the appendices to the Conservation Plan. Western Joshua tree take permitting under the WJTCA and other parts of the Fish and Game Code are also described in this chapter. Additional permitting information and guidance is available on CDFW's western Joshua tree website.

6.2 ROLES OF IMPLEMENTING PARTIES

6.2.1 California Department of Fish and Wildlife

CDFW is responsible for developing and implementing the Conservation Plan, managing the expenditures and accounting of the Western Joshua Tree Conservation Fund (Conservation Fund), and implementing the permitting processes set forth in WJTCA. These responsibilities include the following:

- Working with collaborators to conserve western Joshua tree and to complete the management actions described in Chapter 5, “Conservation Management Actions and Effectiveness Criteria,” of the Conservation Plan.
- Expending monies from the Conservation Fund to acquire, conserve, and manage western Joshua tree conservation lands and to complete other activities to conserve western Joshua tree.
- Periodically reporting on the efficacy of management actions and other outcomes to the Commission and California State Legislature (Legislature).
- Implementing the permitting programs set forth in WJTCA in a manner that supports meeting the conservation needs of western Joshua tree.

In addition, CDFW will continue to consult with Tribes and federal, state, and local agencies to plan and implement activities consistent with western Joshua tree conservation; identify opportunities to conserve western Joshua tree on CDFW-owned lands; integrate protective measures for western Joshua tree into CDFW guidelines and regulations for public use and into land management plans; implement restoration or enhancement of western Joshua tree habitat; receive relocated western Joshua trees; and manage wildland fire risk.

6.2.2 California Fish and Game Commission

The Commission is responsible for review and approval of the Conservation Plan. WJTCA requires the Commission to take action on the Conservation Plan by June 30, 2025. Prior to taking action, as part of its review of the Conservation Plan, the Commission conducted a public process, which is described on the Commission’s website. As a discretionary action by a public agency that would result in changes to the physical environment, compliance with California Environmental Quality Act (CEQA) is necessary. The Commission is the lead agency under CEQA for approval of the Conservation Plan.

After initial approval, CDFW and the Commission shall, if necessary, periodically update the Conservation Plan to achieve conservation of western Joshua tree. The Commission will review the status of western Joshua tree and the effectiveness of the Conservation Plan at a public meeting beginning in 2026 and at least every 2 years thereafter. The Commission and the Legislature will receive annual reports from CDFW assessing the conservation status of western Joshua tree and overall implementation of WJTCA.

In addition, the Commission must assess the impact and effectiveness of the Conservation Plan, WJTCA, and related information when determining whether listing western Joshua tree under California Endangered Species Act (CESA) is warranted, as described in Chapter 2, “Planning Influences.”

6.3 COLLABORATION

Source: National Park Service.

A purpose of the Conservation Plan is to guide the conservation of western Joshua tree in California by focusing attention on the most urgent and important management actions informed by science including Traditional Ecological Knowledge (TEK), and principles of co-management with California Native American tribes. As outlined in Section 1.3, "Collaboration, Outreach, and Public Review," collaboration between CDFW and Tribes, public agencies, organizations, and the general public is essential for the conservation of western Joshua tree and for implementation of the Conservation Plan. Collaborators will include California Native American tribes, and may include state and federal government agencies, local jurisdictions, landowners/neighbors, nongovernmental organizations, businesses, and academic institutions. Various agencies, organizations, and others are already implementing actions that are described in, or are similar to, those described in the Conservation Plan. Identifying these existing actions; gaining the benefit of these entities' input, knowledge, and experience; and developing new written agreements will all help to achieve the vision, purpose, and objectives of the Conservation Plan. In addition to engaging with Tribes as described in Section 1.3.2, "California Native American Tribes," and Appendix C, "Tribal Input Summary Memo," CDFW conducted local, state, and federal agency outreach as described in Section 1.3.1, "Local, State, and Federal Government Agencies," and sent agencies and organizations a feedback questionnaire (Appendix A, "Agency Feedback Questionnaire"). This outreach helped CDFW understand what Tribes and other agencies and organizations are already doing to conserve western Joshua tree.

Collaborators can help conserve western Joshua tree by incorporating aspects of the Conservation Plan into their existing projects, operations, and land management activities. Collaborators may also choose to implement projects designed to achieve or align with the vision of the Conservation Plan. Relationships with collaborators may be established through a written memorandum of understanding (MOU) or other agreement.

6.3.1 Federal Agencies

Because the majority of western Joshua trees' distribution is on land managed by federal agencies, collaboration with federal agencies will be important for achieving the purpose and vision of the Conservation Plan. As mentioned in Action LC&M 3.2, "Prioritize Management of

State and Federal Lands for Western Joshua Tree" (see also Management Action LC&M 3, "Manage Conservation Lands," in Section 5.2.2, "Land Conservation and Management"), federal collaboration could help achieve many of the management actions described in the Conservation Plan, such as protecting western Joshua trees on federal lands, planting or relocating trees to suitable but degraded federal lands, establishing avoidance buffers, and restoring and enhancing western Joshua tree habitat. Federal agencies may also consider designating western Joshua tree as a sensitive or protected species under applicable agency policies, management plans, or regulations. A designation may facilitate the implementation of many impact avoidance and minimization actions described in the Conservation Plan.

CDFW may enter into written MOUs or other written agreements with one or more federal agencies related to the conservation and management of western Joshua tree, similar to the durability agreements described in Section 2.2.2, "Federal Listing Status." Even in the absence of such an agreement, CDFW may collaborate with federal agencies informally through meetings, research programs, information sharing, and other ongoing management activities. CDFW consulted with federal resource and land management agencies during the development of the Conservation Plan by distributing a feedback questionnaire to discuss western Joshua tree conservation measures being undertaken on federal land. CDFW will continue to collaborate with interested federal agencies to coordinate management actions and share conservation information. The extent and type of federal lands in the Conservation Plan's geographic focus area are described in more detail in Section 2.3.3, "Federal Land Management." A summary of responses from potential federal agency collaborators to outreach meetings and the questionnaire is provided below:

- **US Fish and Wildlife Service (USFWS)** may recommend measures and conditions to minimize impacts to western Joshua tree when it reviews federal projects proposed on public lands, even though western Joshua tree is not currently a federally listed species. USFWS is a key partner in the USFWS interagency Joshua Tree Biological Working Group and is helping to implement management actions on federal lands. USFWS has played a key role in the development of the Conservation Plan as a research and ecological science partner, sharing with CDFW knowledge gained in its conservation activities on federal land. USFWS does not own or manage lands within the Conservation Plan geographic focus area. CDFW will prioritize the execution of a written MOU or other agreement with USFWS to document shared goals and aspirations for conservation of western Joshua tree.
- **National Park Service (NPS)** may include in its strategic plans and resource stewardship strategies, management actions designed to aid in the conservation of western Joshua tree that are identical or similar to those in Chapter 5 and Appendix D, "Avoidance and Minimization Best Management Practices and Guidelines," of this Conservation Plan. NPS may also protect existing western Joshua trees on NPS lands, conduct comprehensive

restoration and enhancement projects, and conduct monitoring or research related to western Joshua tree. Agreeable terms could be negotiated and finalized in a conservation agreement, written MOU, or other agreement. NPS lands within the Conservation Plan geographic focus area consist of Joshua Tree National Park and Death Valley National Park.

- **Department of Defense (DOD)** may implement management actions for the protection of natural resources, including western Joshua tree. A written MOU or other agreement may be executed to coordinate actions with DOD resource managers. DOD lands within the Conservation Plan geographic focus area consist of Edwards Air Force Base, Marine Air Ground Task Force Training Command and Marine Corps Air Ground Combat Center Twentynine Palms, Marine Corps Logistics Base Barstow, National Training Center and Fort Irwin, and Naval Air Weapons Station China Lake.
- **Bureau of Land Management (BLM)** may include protections for western Joshua tree in land management plans for protecting existing trees on BLM lands, accepting relocated trees, allowing or supporting restoration efforts, and managing lands for a specific conservation focus through written durability agreements. Agreeable terms could be negotiated and finalized in a written MOU or other agreement. BLM's Bakersfield, Barstow, Bishop, Palm Springs–South Coast, and Ridgecrest field offices each administer western Joshua tree lands within the Conservation Plan geographic focus area.
- **US Forest Service (USFS)** may evaluate the addition of western Joshua tree to the species of conservation concern list for national forests within the Conservation Plan geographic focus area, implement special management considerations for western Joshua trees on USFS lands with an emphasis on climate refugia, reduce wildland fire risk in western Joshua tree habitat, establish avoidance buffers around western Joshua trees, limit western Joshua tree removal, relocate western Joshua trees when avoidance is not possible, limit ground disturbance in western Joshua tree habitat, restore degraded habitat, enhance western Joshua tree habitat (e.g., science-based assisted gene flow), host range-wide monitoring plots, and accept and manage adjacent or in-held western Joshua tree lands purchased using the Conservation Fund. Agreeable terms could be negotiated and finalized in a written MOU or other agreement. USFS lands within the Conservation Plan geographic focus area include all or portions of Angeles National Forest, Inyo National Forest, Sequoia National Forest, and San Bernardino National Forest.

In addition to these federal agency collaborators, the Mojave Desert Sentinel Landscapes Partnership's mission, as described in Section 2.3.3, includes conserving natural resources and enhancing resilience to climate change, which align with the goals of the Conservation Plan. CDFW has initiated communication with the Sentinel Landscapes Partnership in acknowledgement of these shared goals as they relate to western Joshua tree conservation and will seek collaborative opportunities to implement restoration and enhancement activities.

6.3.2 State Agencies

Collaboration with state agencies could help achieve many of the management actions described in the Conservation Plan, particularly on state-owned or managed lands (see Action LC&M 3.2, "Prioritize Management of State and Federal Lands for Western Joshua Tree," in Section 5.2.2). Examples of management actions that collaboration with state agencies could facilitate on state-owned lands include relocating western Joshua trees; minimizing impacts to western Joshua tree; conducting monitoring; implementing management actions; implementing habitat restoration or enhancement activities; managing wildland fire risk and acquiring conservation lands; minimizing grazing conflicts; and establishing buffers around western Joshua trees.

Source: Jessie Quinn, Ascent.

CDFW has coordinated with state resource agencies throughout the development of the Conservation Plan and will continue to collaborate on Conservation Plan updates, as needed. Potential collaboration between CDFW and other state agencies is described in more detail below and could be guided by written MOUs or other written agreements. Collaborative management actions could also be conducted through existing agency permits or management plans. Other state agencies that may collaborate on the conservation of western Joshua tree in the future include the California Conservation Corps, California Energy Commission, California High-Speed Rail Authority, California Public Utilities Commission, and California Department of Transportation.

- **California State Parks (CSP)** has been collaborating with CDFW to identify ways to implement management actions for western Joshua tree in State Park units. Examples include potentially receiving relocated western Joshua trees, when appropriate and consistent with CSP Department Operations Manual Policy 0310.4.1 on genetic integrity in revegetation and relocation efforts; hosting range-wide monitoring plots for western Joshua tree, its pollinator, and nurse plants; and receiving and managing priority conservation lands. Planning for any of these actions could be led by CSP in collaboration with CDFW and could be guided by written MOUs or other written agreements, State Park unit general plans, or applicable management plans.

- **California Department of Forestry and Fire Protection (CAL FIRE)** could implement management actions to conserve western Joshua tree together with its land management activities to protect human safety and infrastructure from wildland fires. CAL FIRE works with CDFW staff to review CAL FIRE fuel treatment projects in western Joshua tree habitat and to develop treatments that are protective of western Joshua tree and its habitat, as described Action R&I 1.15, “Develop Additional Fuel Treatment Methods” (see Section 5.2.4, “Research to Inform Long-Term Conservation”).
- **California State Lands Commission (CSLC)** could require implementation of management actions in leases of State Lands to promote the protection of western Joshua trees. CSLC, in its capacity as landowner in trust for the people of California, could also undertake measures similar to those of CSP, such as limiting impacts to western Joshua trees, implementing habitat restoration activities, managing wildland fire risk, establishing buffers around western Joshua trees, and accepting relocated western Joshua trees on CSLC lands.

6.3.3 Local Agencies

Collaboration with local agencies, such as cities, counties, and special districts, could help implement Conservation Plan management actions. Local agencies can adopt policies and ordinances for avoidance and minimization of impacts through land use planning and efficient permitting processes. In addition, Regional Conservation Investment Strategies (RCISs) and Natural Community Conservation Plans (NCCPs) can include actions to conserve the species. Local agencies can also identify tree relocation receiver sites, monitor western Joshua tree populations, and conduct education and outreach for landowners and the public.

CDFW consulted with local agencies in the development of the Conservation Plan and will continue to collaborate with local agencies to implement the Conservation Plan and incorporate new or updated information, adjusted management actions, fees, or permitting processes into Conservation Plan amendments. CDFW continues to welcome feedback from the agencies on issues, successes, and ideas for improving western Joshua tree conservation efforts. CDFW will also seek feedback on aspects of the permitting process and written delegation agreements, ways to foster public awareness and engagement in western Joshua tree conservation in their communities, and creative solutions for specific projects to promote consistency with the conservation of western Joshua tree and WJTCA. In addition, counties and cities may adopt and enforce plans, policies, or ordinances that require, as a condition of approving a project, more protective measures for western Joshua tree conservation than those described in the Conservation Plan (Fish & G. Code, § 1927.11). Local agencies may also conserve western Joshua tree within their jurisdictions, such as by enacting additional local ordinances (e.g., western Joshua tree preservation ordinance), establishing county or city general plan policies (e.g., avoid or minimize impacts on western Joshua tree), preserving trees within protected open space, and developing other conservation initiatives related to protection of western Joshua tree. Delegation of western Joshua tree take permitting authority to local governments per WJTCA (Fish & G. Code, §1927.3, subd. (c)) is described further in Section 6.5.1 below.

6.3.4 Public

GENERAL PUBLIC, UTILITIES, AND BUSINESSES

The public plays an important role in the protection of western Joshua tree. Private landowners, utilities, and businesses can protect existing trees on private lands through avoidance and minimization of impacts, beneficial land use practices, planting trees on their lands, and accepting relocated trees. Landowners may also protect in perpetuity western Joshua tree populations and habitats on their lands by recording conservation easements. The public may also organize or participate in volunteer opportunities that support conservation, research, and monitoring (e.g., local tree counts), as discussed in Section 5.2.5, “Education and Awareness.”

Utilities, other businesses (e.g., energy companies, land developers), and private mitigation bank operators can implement business-oriented or voluntary actions for conservation of western Joshua tree. There are currently two CDFW-approved, privately owned mitigation banks that have created western Joshua tree credits for purchase. Mitigation banks protect habitat for the species in perpetuity, often through a conservation easement. Additional western Joshua tree mitigation banks, ideally within climate refugia or buffered climate refugia, are in process and may be approved in the future. The purchase of approved mitigation credits is one option for mitigating take of western Joshua tree.

NONGOVERNMENTAL ORGANIZATIONS

Nongovernmental organizations (NGOs), such as land conservancies, nonprofit conservation organizations, and land trusts, may voluntarily protect existing trees or plant trees on their lands. The Conservation Fund is a potential source of funding for these types of NGO activities (see Section 6.6 below for more detail). Examples of NGOs that currently play a role in western Joshua tree conservation, or may in the future, are National Fish and Wildlife Foundation (NFWF), through administration of the Conservation Fund; Center for Biological Diversity, which petitioned the species for listing under CESA; and Native American Land Conservancy, Mojave Desert Land Trust, and Transition Habitat Conservancy, through land acquisition and stewardship, public outreach, and seed banking. The Mojave Desert Land Trust has also received grant funding from the Wildlife Conservation Board to convene interested parties including, but not limited to, public agencies, Tribes, academic research partners, and nongovernmental conservation organizations. The Mojave Desert Land Trust is leading the development of a Joshua Tree Conservation Coalition to provide input to inform Joshua tree conservation efforts.

RESEARCHERS

Organizations and agencies currently conducting research related to western Joshua tree include, but are not limited to, US Geological Survey; NPS; BLM; CSP; California State Parks Foundation; Mojave Desert Land Trust; Transition Habitat Conservancy; Willamette University; California State University, Northridge; University of California, Riverside; University of California, Santa Cruz; and Reed College. CDFW can help identify and support priority research efforts by working with universities, the USFWS-led Joshua Tree Biological Working Group of land management agency scientists, the Joshua Tree Conservation Coalition, and other research-oriented groups. CDFW can also help identify and support funding opportunities through CDFW and other agency grant opportunities.

6.4 TRIBAL CO-MANAGEMENT

The type of written agreements CDFW and California Native American tribes may co-develop and implement include written MOUs, memoranda of agreement, commitment letters, and conservation agreements. An example of a successful conservation strategy implemented through tribal co-management is an agreement between CDFW and the Winnemem Wintu Tribe in Northern California to fund co-management for restoration of the winter-run Chinook salmon population in the McCloud River Watershed (CDFW and Winnemem Wintu Tribe 2023). The agreement, which acknowledged the Tribe as a co-equal decision-maker with CDFW and the National Marine Fisheries Service, laid the foundation for the Tribe to apply its Traditional Ecological Knowledge and practical understanding of the species to specific management actions for its recovery. The co-management allowed the agencies to "…expand and accelerate our efforts to restore and recover Chinook salmon" (Cathy Marcinkevage, assistant regional administrator for National Oceanic and Atmospheric Association Fisheries West Coast Region) (Traverso 2023).

As an example of a coalition of Native American tribes establishing a co-management agreement with agencies, the Hopi, Navajo, Uintah and Ouray Ute, Ute Mountain Ute, and

Zuni tribes formed the Bears Ears Inter-Tribal Coalition to propose the creation of Bears Ears National Monument in Utah in 2015. The proposal included a legal basis and implementation strategy for collaborative management between the coalition, BLM, and USFS, leading to the development of an intergovernmental cooperative agreement (Bears Ears National Monument Cooperative Agreement 2022). The cooperative agreement established commitments to cooperative planning and program development, regularly scheduled meetings and agendas, confidentiality and protection guidelines for sensitive tribal information, and involvement of the coalition in land management, among other initiatives. Under the agreement, the Native American tribes in the Bears Ears Inter-Tribal Coalition advanced their own National Environmental Policy Act (NEPA) alternative for the Bears Ears National Monument Draft EIS and co-created the proposed Resources Management Plan, both of which were released to the public in March 2024.

The following provides additional examples of tribal co-management implementation.

- Establish programs and facilities that allow tribal members to engage in co-management. This could include establishment of a Tribe-led conservation corps, training for tribal members to become arborists and co-managers with CDFW in maintaining and monitoring existing and relocated western Joshua trees, and support for tribal facilities related to western Joshua tree conservation (e.g., nurseries or restoration work facilities) on tribal lands.
- Establish opportunities for ongoing collaboration and information sharing between CDFW and California Native American tribes while respecting Tribes' right to safeguard their traditional knowledge and cultural identities. Establish preferences in how information is shared between CDFW and Tribes for effective communication and respecting capacity of partners.
- Establish written agreements to notify Tribes of opportunities for western Joshua tree relocations.
- Mutually develop and document tribal and CDFW conflict resolution processes.
- Seek out and apply for grants to support the tribal co-management process, which would include compensation for participation in this process.
- Use available funding sources to support tribal co-management implementation.
- Clearly articulate the level of measurable support (e.g., capacity, time, expertise needed) for specific actions (e.g., grant application, accessibility) that CDFW can provide California Native American tribes to support implementation of co-management and provide said level of support.

6.5 PERMITTING AND REGULATIONS

WJTCA provides a framework for authorizing take of western Joshua tree through the issuance of permits (Fish & G. Code, § 1927.3, subd. (a)). Pursuant to this framework, permittees may elect to pay fees in lieu of completing mitigation obligations. These fees are deposited into the Conservation Fund, which is the primary source of funds available to CDFW for implementation of the management actions in the Conservation Plan. This permitting process is authorized by WJTCA, not by the Conservation Plan. It is nevertheless described below as an important component of both western Joshua tree conservation and the provision of renewable energy and housing.

Other permitting avenues outside of the WJTCA framework are available for incidental take of western Joshua tree and are outlined below. The decision for the type of permit to pursue is the choice of the applicant based on individual project needs.

Each permit for take of western Joshua tree that is incidental to an otherwise lawful activity includes conditions and requirements that must be met for avoidance, minimization, and mitigation of impacts to western Joshua tree. These permit conditions are tailored to each project and are developed in consideration of available information regarding the efficacy of measures for the protection of the species (see Section 5.3, "Effectiveness Criteria"). The relocation protocol for western Joshua tree is provided in Appendix E, "Relocation Guidelines and Protocols." The various types of permits that may be issued for take of western Joshua tree are described below.

6.5.1 WJTCA Permitting

INCIDENTAL TAKE PERMITS ISSUED UNDER FISH AND GAME CODE SECTION 1927.3

Take of western Joshua tree may be authorized pursuant to WJTCA (Fish & G. Code, § 1927.3, subd. (a)). A WJTCA incidental take permit (ITP) may be issued when an applicant wishes to remove, trim, relocate, or work within the applicable avoidance buffer of one or more western Joshua trees for the purpose of completing a project. The applicant pays statutorily prescribed in-lieu fees to the Conservation Fund to mitigate and must also avoid and minimize take and impacts to western Joshua tree to the maximum extent practicable (Fish & G. Code, § 1927.3, subd. (a)(2)). The in-lieu fee amount is based on the location, number, and size classes of trees to be taken and is paid prior to CDFW issuing the ITP. Reduced fees are available for impacts to western Joshua trees in areas designated by WJTCA (Fish & G. Code, § 1927.3, subds. (d)(1)(A) and (B)). A map of the reduced fee area will be maintained on CDFW's Western Joshua Tree Conservation Permitting website (CDFW n.d.).

WJTCA ITP applications must include a description of the project, quantification of impacts to western Joshua tree, and a description of CEQA compliance for the project. ITPs issued under WJTCA must include a census of western Joshua trees on the project site with size-class information for and photographs of each individual tree. Project-specific permit conditions are included in a WJTCA ITP and could include avoidance and minimization measures, such as relocation of western Joshua tree, avoidance buffers, seed collection, limits on pesticide use, and use of desert native plant specialists, as defined in Section 5.2.1, "Impact Avoidance and Minimization," as well as monitoring and reporting. The permittee is responsible for following the relocation protocol for western Joshua tree provided in Appendix E and implementing measures to ensure the survival of the relocated western Joshua trees. Landowners that agree to allow western Joshua trees to be relocated onto land they own will not be liable for survival of the relocated trees or changes to land use practices unless specified in written agreement with the permittee (Fish & G. Code, § 1927.3, subds. (g)(1) and (2)).

HAZARD MANAGEMENT PERMITS ISSUED UNDER FISH AND GAME CODE SECTION 1927.4

Under WJTCA, CDFW may also issue permits to authorize the removal or trimming of dead western Joshua trees or the trimming of live western Joshua trees, provided certain conditions are met (Fish & G. Code, § 1927.4). Pursuant to these permits, property owners and their agents may remove detached dead western Joshua trees and detached limbs of western Joshua tree, whereas all other removals or trimmings (i.e., attached trees or limbs) must be completed by a desert native plant specialist. Trimming of a live western Joshua tree pursuant to a hazard management permit cannot result in the death of the tree (e.g., trimming a tree so that no live branches remain).

Western Joshua trees create hazards by falling on power lines or structures.

CDFW may issue hazard management permits without requiring the payment of fees or other mitigation, provided that the dead western Joshua trees and any limbs to be removed have fallen over and are within 30 feet of a structure, are leaning against an existing structure, or create an imminent threat to public health or safety.

For the purposes of Fish and Game Code section 1927.4, a western Joshua tree must meet at least one of the following criteria to be considered dead:

- Has not burned and has no green leaves, no new growth on the main stem, and no basal sprouts.
- Has partially or fully burned at least 18 months prior and otherwise meets the above-listed criteria.
- Has fallen and is completely detached from its roots or has fallen and its roots are no longer in contact with the soil.

INCIDENTAL TAKE AND HAZARD PERMITS ISSUED BY COUNTIES AND CITIES PURSUANT TO DELEGATION AGREEMENTS

WJTCA allows CDFW to enter into an agreement with any county or city to delegate the ability to authorize, by permit, the taking of a western Joshua tree associated with developing single-family residences, multifamily residences, accessory structures, and public works projects, provided certain conditions are met (Fish & G. Code, § 1927.3, subd. (c)). Section 1927.3, subdivision (c)(3) of the Fish and Game Code specifies limits on the number of individual western Joshua trees that a project may take pursuant to a permit issued under a county's or city's delegated authority, depending on the project type, and requires CDFW's concurrence that certain projects have avoided and minimized the take of western Joshua trees to the maximum extent practicable. To receive this limited delegation of authority, a county or city must adopt an ordinance requiring the satisfaction of all requirements in section 1927.3 as a condition of approval for any take permit issued under such authority (Fish & G. Code, § 1927.3, subd. (c)(1)).

WJTCA ITPs may be issued by a county or city under a delegation agreement if the applicant is seeking take authorization for a maximum of 10 trees for a multifamily, single-family, or accessory structure project or for a maximum of 40 trees for a public works project, within the county's or city's jurisdiction. CDFW's written concurrence is needed prior to authorizing the take of more than 20, but no more than 40, individual western Joshua trees for a public works project. Delegation agreements must include the following conditions:

- The county or city must adopt an ordinance that mandates, as a condition of any WJTCA ITP issued by the county or city, satisfaction of the requirements of WJTCA.

- The county or city collects in-lieu fees for permits issued and remits them quarterly for deposit into the Conservation Fund.
- The county or city may impose a reasonable fee to cover the administrative costs of issuing the permit.
- CDFW retains express authority to suspend or revoke the county's or city's delegated authority to issue WJTCA ITPs.
- The county or city will submit quarterly reports to CDFW documenting the number of permits issued under this authority, photographs and other evidence demonstrating that take and other impacts were avoided and minimized to the maximum extent practicable, the number and size class of western Joshua trees authorized to be taken, the number of western Joshua trees relocated, the amount of fees collected, and other information required by CDFW.
- The county or city will conduct annual assessments, pursuant to guidance developed by CDFW, of the status of the local western Joshua tree population within the county or city and will submit the assessments to CDFW.

CDFW may also enter into an agreement with any county or city to delegate the ability to authorize, by permit, the removal or trimming of dead western Joshua trees or the trimming of live western Joshua trees that pose a risk to structures or public health and safety, provided certain conditions are met (Fish & G. Code, § 1927.4, subd. (b)). To receive this limited delegation of authority, counties and cities must ensure the requirements of Fish and Game Code section 1927.4, subdivision (a) are met and must comply with specific reporting requirements (Fish & G. Code, § 1927.4, subd. (b)).

6.5.2 California Endangered Species Act Permitting

SCIENTIFIC, EDUCATIONAL, AND MANAGEMENT PERMITS ISSUED UNDER FISH AND GAME CODE SECTION 2081, SUBDIVISION (a)

CDFW may, through permits or written MOUs, authorize import, export, take, or possession of species protected under CESA, including candidate species, such as western Joshua tree, for scientific, educational, or management purposes pursuant to Fish and Game Code section 2081, subdivision (a). These permits may also be issued to California Native American tribes for certain cultural purposes. CDFW may issue these permits for research and recovery actions for state-listed plant species, including seed banking, reintroduction efforts, and habitat restoration projects.

INCIDENTAL TAKE PERMITS ISSUED UNDER FISH AND GAME CODE SECTION 2081, SUBDIVISION (b)

Authorization for take of state-listed or candidate species can also be obtained through a Fish and Game Code section 2081, subdivision (b) permit, commonly referred to as a "CESA Incidental Take Permit or ITP." These permits may be issued to applicants whose projects will take state-listed or candidate species, including western Joshua trees that need to be removed, trimmed, or relocated incidentally to the purpose of completing a project. Such take must be incidental to an otherwise lawful activity, rather than the purpose of the project. These permits are most commonly issued for residential and renewable energy development, utility, transportation, and other infrastructure-related projects.

CDFW may only issue a CESA ITP if (1) the take is incidental to an otherwise lawful activity; (2) the impacts of the authorized take are minimized and fully mitigated; (3) the applicant ensures adequate funding to implement the permit measures, monitor compliance with those measures, and monitor the effectiveness of the measures; and (4) issuance of the permit will not jeopardize the continued existence of the species. The "fully mitigated" standard may be met through the purchase of conservation bank credits (when available) or through the conservation of habitat management lands. Minimization measures could include, but are not limited to, tree relocation, seed collection, limits on pesticide use, use of designated biologists, and reporting.

6.5.3 Natural Community Conservation Planning Act

As discussed in Section 2.3.1, "Natural Community Conservation Planning Program," NCCPs provide a framework to protect, enhance, and restore the natural resources in a specific area while streamlining incidental take permitting for CESA-listed and other covered species for activities covered under the NCCP. Priority conservation and mitigation areas are identified during plan development, prior to impacts occurring. Mitigation for activities covered under an NCCP is typically achieved through establishment of habitat reserves. Working with landowners, environmental organizations, and other interested parties, an implementing agency is responsible for implementing activities under an NCCP. CDFW is the state agency overseeing the NCCP program.

6.5.4 Restoration Management Permit Act

The Restoration Management Permit Act (Fish & G. Code, § 1670 et seq.) was enacted in September 2024 (AB 1581, Statutes of 2024). It authorizes CDFW to issue a Restoration Management Permit to allow the take, possession, import, or export of any species or subspecies of fish, wildlife, or plants, including western Joshua tree, in association with a management or propagation project that, among other things, has the primary purpose of restoring native fish, wildlife, plants, or their habitat. A qualifying project must also result in a substantial net benefit to native fish, wildlife, or plants, or their habitats.

6.6 CONSERVATION FUND AND IN-LIEU FEES

6.6.1 Conservation Fund

Pursuant to WJTCA, monies in the Conservation Fund are continuously appropriated to CDFW for the purpose of acquiring, conserving, and managing western Joshua tree conservation lands and completing other activities to conserve the species (Fish & G. Code, § 1927.5). Expenditures from the Conservation Fund may include but are not limited to, land acquisition or conservation easement costs, monitoring costs, restoration costs, transaction costs, and costs of endowments for land management or easement stewardship. All fees remitted to CDFW in lieu of completing mitigation activities under WJTCA ITPs will be deposited into the Conservation Fund. The WJTCA (Fish and Game Code 1927.5(c)) allows the Conservation Fund to receive other funding to support the conservation of the western Joshua tree. This other funding may come in as fines, penalties, or fees associated with unauthorized impacts to western Joshua tree or western Joshua tree habitat as well as voluntary monetary donations.

CDFW will oversee all expenditures from the Conservation Fund and ensure funding is only allocated to eligible activities and entities. CDFW will prioritize expenditures and mitigation activities on properties with the highest conservation value to western Joshua tree, determined using a model-based land prioritization framework and mapping tool developed primarily by CDFW and NFWF. The tool will evaluate land conservation opportunities by assigning weighted values to criteria discussed in Section 5.2.2, Action LC&M 1, "Identify Priority Conservation Lands." Once CDFW has determined a proposed expenditure is eligible for monies from the Conservation Fund, NFWF, as the administrator of the Conservation Fund, will enter into a funding agreement with the entity receiving the monies. The funding agreement will require regular reporting on monies spent.

Annual reporting on the in-lieu fee program and status of mitigation activities funded with monies from the Conservation Fund, includes the number, location, and quality of the acres conserved; the amount of fees paid; the amount of all expenditures from the Conservation Fund; the projects and actions funded by expenditures from the Conservation Fund; and the adequacy of the in-lieu fees to conserve western Joshua tree. Reports will be submitted to the Commission and the Legislature for review, and once approved, will be posted on CDFW's website.

6.6.2 In-lieu Fees

Under WJTCA, a permittee may pay a fee to take each individual tree based on the size of tree in lieu of completing mitigation obligations on its own. As a result, the total fees assessed for a project increase with the number and size of trees taken. WJTCA also established a two-tier fee structure, where per-tree in-lieu fees are nominally larger within a specified geographic area.

WJTCA requires annual adjustments of in-lieu fees for the issuance of WJTCA ITPs (Fish & G. Code, § 1927.8, subd. (b)). Fees must be annually adjusted using the implicit price deflator, which is a price index that measures changes in the prices of goods and services produced in the United States. In addition, by December 31, 2026, and every 3 years thereafter, CDFW is required to adopt and subsequently amend regulations adjusting the in-lieu fees imposed under WJTCA as necessary to ensure the conservation of the species. CDFW will use total cost accounting when determining the adequacy of the fees for ensuring conservation of the species. Total cost accounting is a method of calculating not just direct costs, but also indirect and overhead costs associated with providing a service over the life of the service to allow a more accurate view of the service's full costs and efficiency. In the case of the Conservation Fund, evaluation of costs includes "ensuring sufficient funds for land acquisition or conservation easement costs, monitoring costs, restoration costs, transaction costs, and the amount of endowments for land management or easement stewardship costs" for long-term management necessary to conserve western Joshua tree (Fish & G. Code, § 1927.8, subd. (b)).

CDFW acknowledges that in-lieu fees may disproportionately affect low-income residents and single-family homeowners, an issue CDFW is seeking to help address.

6.7 LAND ACQUISITION PROTOCOLS

WJTCA requires CDFW to prioritize actions and the acquisition and management of lands as appropriate for western Joshua tree conservation (Fish & G. Code, § 1927.6, subd. (c)). Land acquisitions will occur in stages so CDFW can approve each stage before the land acquisition moves forward. CDFW will identify western Joshua tree lands that are available from willing sellers for fee title or conservation easement acquisition (Fish & G. Code, § 1927.6, subd. (d)(1)). Lands meeting the criteria listed in Section 5.2.2 will be prioritized for acquisition. Fee title and conservation easement acquisitions will only occur from willing sellers.

If CDFW determines land proposed for acquisition or conservation contains habitat for western Joshua tree, then reports, including preliminary title reports, a Phase I environmental site assessment report, and a mineral risk opinion, will be prepared or obtained to allow CDFW to identify any issues with the property (e.g., easements, access, litigation, liens, leases, mineral rights) and any potential conflicts with conservation goals, as described in Chapter 5.

If CDFW determines land is eligible for acquisition or protection, CDFW will work with the landowner to prepare a lands package consisting of real estate documents and land surveyor products (e.g., boundary, improvements or encumbrances maps, deed, preliminary title report). For lands requiring conservation easement acquisitions, CDFW will evaluate and approve an easement holder (grantee), land manager, and endowment holder to ensure compliance with Civil Code sections 815–816 and Government Code sections 65965–65968.

Source: Bill Bjornstad, National Park Service.

In the final stage of the land acquisition process, the real estate transaction will be completed (e.g., coordinate escrow, title, closing). The transaction will be funded with monies from the Conservation Fund, as directed by CDFW.

If the conservation easement or land acquisition includes restoration, enhancement, translocation, interim management, long-term land management, or monitoring, CDFW must review and approve a plan outlining these activities to ensure they are completed. For western Joshua tree habitat that is already legally protected and would benefit from enhancement, restoration, management, or monitoring, CDFW will review potential enhancement and restoration projects for those lands, in accordance with the process shown in the CDFW Western Joshua Tree Conservation Act Enhancement and Restoration Projects Assessment (see Appendix H, “Enhancement and Restoration Prioritization Assessment”).

Long-term management and monitoring will be funded through the Conservation Fund, as directed by CDFW (see Appendix I, “Land Acquisition Flow Chart”).

6.8 MONITORING, SPECIES STATUS REVIEWS, PLAN AMENDMENT, AND ADAPTIVE MANAGEMENT

As mentioned in Section 1.5, "Western Joshua Tree Conservation Adaptive Management Framework," and consistent with WJTCA, the Conservation Plan is designed to be a living document to be updated and amended at regular intervals, as needed (Fish & G. Code, § 1927.8). As conditions evolve, this document may be amended to respond to changes and incorporate new information so that it can continue to provide effective guidance. The framework for monitoring, reviews, amendments, and adaptive management is described below.

6.8.1 Monitoring and Reporting

MONITORING

Monitoring the effectiveness criteria, as detailed in Section 5.3, is essential to evaluate whether management actions are achieving their desired result over time, and if not, to determine if and how the measures should be modified. This will involve collection of western Joshua tree data to monitor and assess the species' population status. CDFW will also evaluate metrics that measure the effectiveness of the management actions and assist with developing new or more refined effectiveness criteria as new information (e.g., biological data collected as a result of Management Action R&I 1, "Continue Research and Information Development" [see Section 5.2.4]) is gathered.

ANNUAL REPORTING

CDFW is required by WJTCA (Fish & G. Code, § 1927.7, subd. (a)) to provide annual reports to the Commission and the Legislature. These annual reports will document metrics related to the performance of the permitting and mitigation framework included in WJTCA and described above in Section 6.5, as well as metrics related to the conservation status of western Joshua tree, including the following information:

- Number of permits and the size-class and number of trees taken.
- Number and location of trees relocated.
- Acreage and location of Joshua tree woodland (dominated by western Joshua tree) developed.
- Type, scope, and scale of mitigation measures undertaken by permittees.
- Acreage, quality, and location of Joshua tree woodland (dominated by western Joshua tree) conserved.

- The amount of fees paid, the amount of all expenditures from the Conservation Fund, and the adequacy of the fees to conserve western Joshua tree.
- A summary of the information provided by counties and cities pursuant to written delegation agreements.

Data from annual reporting can be used to evaluate how mitigation is compensating for permitted take of western Joshua trees, participation and compliance levels with permit conditions and written delegation agreements, and progress toward reaching conservation goals.

6.8.2 Species Status Review

CDFW will prepare an updated status review report for western Joshua tree and submit it to the Commission no later than January 1, 2033. The Commission will then determine whether western Joshua tree should be listed as endangered or threatened pursuant to CESA. The status review report will incorporate scientific information relevant to the status of the species developed or acquired by CDFW after it conducted the last status review in 2022. The report will also include an evaluation of the effectiveness of the conservation and management efforts to date (Fish & G. Code, § 1927.9). In determining whether listing western Joshua tree under CESA is warranted, the Commission will consider all the following:

- The effectiveness of conservation measures for western Joshua tree funded through expenditures of in-lieu fees.
- The Conservation Plan.
- Annual reports submitted to the Commission since adoption of the Conservation Plan.
- Any recommendations submitted by CDFW to the Commission for western Joshua tree.
- Fee adjustments, if any.
- The updated status review report described above (Fish & G. Code, § 1927.2, subd. (c)) (see Chapter 5 for more detail).

6.8.3 Plan Amendments and Adaptive Management

In accordance with WJTCA, starting in 2026 and at least every 2 years thereafter, the Commission will review the effectiveness of the Conservation Plan in conserving the species (Fish & G. Code, § 1927.8). CDFW will make recommendations to the Commission concurrent with the Commission's review of the status of western Joshua tree. As part of this review, CDFW will recommend proposed amendments to the Conservation Plan, if needed. Any Conservation Plan amendments must be reviewed and adopted by the Commission.

CDFW developed the Conservation Plan based on the best available information at the time of preparation, consisting of "credible science" as defined in the California Fish and Game Code section 33; TEK; collaboration with Tribes; collaboration with federal, state, and local government agencies; and public feedback. New information from ongoing research, monitoring, and other sources will become available over time, and adjustments will be required to keep the Conservation Plan up to date. Data will be collected at various scales, from site-specific to range-wide within California. As described in Chapter 1, “Introduction,” an adaptive management approach allows for implementing management actions, closely monitoring and evaluating outcomes of management, and reevaluating and adjusting decisions as more information is learned. The Conservation Plan anticipates that CDFW, in collaboration with Tribes, governmental agencies, and other entities, will continue to monitor the outcomes of management actions and will adjust future actions accordingly. CDFW will also continue to seek input from the general public regarding implementation of the Conservation Plan and its effectiveness in conserving western Joshua tree.

Source: Alessandra Puig-Santana, National Park Service.

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The Western Joshua Tree Conservation Plan was prepared through the collaborative efforts of staff listed below from the California Department of Fish and Wildlife, the Native American Land Conservancy, Ascent Environmental, Inc. dba Ascent, ASM Affiliates, Piñon Heritage Solutions, and California Native American tribes listed in Chapter 3, Section 3.1 "California Native American Tribes Collaborating on the Conservation Plan" and Appendix C, "Tribal Input Summary Memo."

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8 GLOSSARY OF TERMS

A

abiotic factors. Nonliving parts of an ecosystem.

acquisition. The term "acquisition" as used in the Western Joshua Tree Conservation Plan (Conservation Plan) is the process of obtaining land dedicated to a specific use or uses by purchase, exchange, donation, or condemnation.

adaptive genetic variation. Genetic variation within a species that allows it to adapt to changes in environmental conditions.

adaptive management. A structured process that allows for implementing management actions, that is based on closely monitoring and evaluating outcomes, and reevaluating and adjusting decisions as more information is learned.

arbuscular mycorrhizal fungi. Soil microorganisms that can form mutualistic relationships with most terrestrial plants.

assisted migration. Human-assisted movement of species in response to climate change.

B

bajadas. A broad slope of alluvial material at the foot of an escarpment or mountain.

basal sprouts. New vegetative growth that sprouts from buds on the base of a tree.

biological soil crusts. Soil surface layers that include bacteria, cyanobacteria, algae, mosses, liverworts, fungi, or lichens and that can be major components of undisturbed desert ecosystems. These are also known as "biotic soil crusts" or "biocrusts."

biotic factors. Living parts of an ecosystem.

C

California Native American tribes. Collective reference to federally recognized Native American tribes and any non-federally recognized tribes located in California that are on the contact list maintained by the California Native American Heritage Commission for the purposes of cultural resources assessment and protection.

candidate species. A native species or subspecies of a bird, mammal, fish, amphibian, reptile, or plant that the California Fish and Game Commission (Commission) has formally noticed as being under review by the California Department of Fish and Wildlife (CDFW) for addition to either the list of endangered species or the list of threatened species, or a species for which the Commission has published a notice of proposed regulation to add the species to either list (Fish & G. Code, § 2068).

climate refugia. Areas that remain relatively buffered from contemporary climate change over time enabling persistence of valued physical, ecological, and sociocultural resources.

conservation easement. A legal agreement that protects land by permanently limiting some uses that would compromise the conservation values of the property.

Conservation Fund. The Western Joshua Tree Conservation Fund as described in Section 1927.5 (Fish & G. Code, § 1927.1, subd. (g)), which states in part, that any moneys in the fund are continuously appropriated to the department solely for the purposes of acquiring, conserving, and managing western Joshua tree conservation lands and completing other activities to conserve the western Joshua tree (Fish & G. Code, § 1927.5, subd. (a)).

conservation land. Land that is identified as appropriate for western Joshua tree conservation by CDFW.

conserve. The terms “conserve” and “conservation” as stated in WJTCA and used in this Conservation Plan apply to the use of methods and procedures that are necessary to bring species listed pursuant to the California Endangered Species Act (CESA) (Fish & G. Code, § 2050 et seq.) to the point at which the measures provided pursuant to CESA are no longer necessary, and for species that are not listed to maintain or enhance the condition of the species so that listing will not become necessary (Fish & G. Code, § 1927.1, subd. (c)).

D

dead western Joshua tree. a dead western Joshua tree is one that meets at least one of the following criteria: (1) has not burned and has no green leaves, no new growth on the main stem, and no basal sprouts; (2) has partially or fully burned at least 18 months prior and otherwise satisfies criteria 1; (3) has fallen and is completely detached from its roots or has fallen, and its roots are no longer in contact with the soil (Fish & G. Code, § 1927.1, subd. (d))).

delegation agreements. An agreement with any city or county delegating to the local agency the ability to authorize take of western Joshua tree associated with developing single-family residences, multifamily residences, accessory structures, and public works projects or to authorize the removal or trimming of dead western Joshua trees or trimming of live western Joshua trees that have fallen over and are within 30 feet of a structure, are leaning against an existing structure, or creating an imminent threat to public health or safety (Fish & G. Code, §§ 1927.3, subd. (c), 1927.4, subd. (b)).

desert native plant specialist. An arborist certified by the International Society of Arborists, or an individual with at least 5 years of professional experience with relocation or restoration of native California desert vegetation (Fish & G. Code, § 1927.1, subd. (e)).

direct effects. Actions or changes in an organism's environment that occur as a direct result of human activity and that have a physical effect on the organism. Examples may include dust from equipment landing on leaves; damage to stems, roots, or seeds; or killing and removal of trees.

distribution. The actual sites where individuals and populations of the species occur within the species' range. It is often impossible to have the perfect knowledge necessary to know the true distribution of individuals of a species, and this term is therefore often used conceptually.

E

ecoregion. Ecoregions are delineated based on associations of biotic factors (i.e., living parts of an ecosystem) and environmental factors that affect energy, moisture, and nutrient gradients, which regulate the structure and function of ecosystems, and environmental factors, including climate, physiography, water, soils, air, hydrology, and potential natural communities.

endangered species. A native species or subspecies of a bird, mammal, fish, amphibian, reptile, or plant that is in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change in habitat, overexploitation, predation, competition, or disease (Fish & G. Code, § 2062).

endowment. Financial assets that are structured so the initial amount invested (i.e., the principal, capital, or corpus) remains intact, and only the interest or investment gains are withdrawn.

enhancement. Habitat enhancement involves the modification of certain characteristics of a site with the goal of increasing specific habitat functions based on management objectives, such as increasing habitat suitability for a particular species.

environmental justice. The fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies (Gov. Code § 65040.12, subd. (e)).

F

fee. The elective fee described in subdivisions (d) and (e) of Section 1927.3, which is to be deposited into the Western Joshua Tree Conservation Fund (Fish & G. Code, § 1927.1, subd. (f)).

fire return interval. Time between fires.

G

generation length. Time from seedling establishment to reproductive maturity.

geographic focus area. The general location of current and potential future suitable western Joshua tree habitat referenced in the Western Joshua Tree Conservation Plan.

H

habitat. An area that provides the necessary resources for a species or population to survive and reproduce. Habitat for a species may be occupied or unoccupied by the species.

herbivory. The consumption of plant material by animals. Herbivory is a key ecosystem process that reduces biomass and density of plants or plant materials, transfers mass and nutrients to the soil or water column, and affects habitat and resource conditions for other organisms.

I

implicit price deflator. The ratio of current dollar value of a series, such as gross domestic product (GDP), to a constant dollar value. It is used as a measure of inflation.

in-lieu fee. A payment of a specified fee by a project proponent to an agency in place of implementing mitigation for environmental impacts.

indirect effects. Actions or changes in an organism's environment that occur as an indirect result of human activity and that do not necessarily have an immediate physical effect on the organism. Examples may include changes in hydrology from human activities elsewhere, removal of unoccupied habitat, spread of invasive species or creation of conditions that are favorable for their spread, pollution, greenhouse gas emissions, or effects to other organisms on which a species relies.

inflorescence. Group or cluster of flowers on one main stem on a plant.

J

Joshua tree. Western Joshua tree (*Yucca brevifolia*) or eastern Joshua tree (*Yucca jaegeriana*). This term shall be used to mean both western Joshua tree and eastern Joshua tree collectively, or it may be used when the information presented is not known to be specific to one of the two species.

K

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L

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M

masting. Mast seeding is the intermittent production of many seeds by many individuals of a species at the same time in the same region.

memorandum of understanding. A memorandum of understanding (MOU) is an agreement between two or more parties/institutions/governments. MOUs serve to document each collaborator's expectations or intentions.

mutualism. An ecological relationship in which two different species benefit one another.

N

natural community conservation plan. A plan that identifies and provides for the measures necessary to conserve and manage natural biological diversity within the plan area while allowing compatible and appropriate economic development, growth, and other human uses (Fish & G. Code, § 2805, subd. (h)).

nurse plant. A plant that facilitates the growth and development of other plant species beneath its canopy.

O

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P

pollinator. An animal that moves pollen from the anther (male part) of one flower to the stamen (female part) of another flower to allow fertilization and seed and fruit production.

population resiliency. A population's ability to recover from impacts.

public works project. A project involving the erection, construction, alteration, repair, or improvement of any public structure, building, road, or other public improvement of any kind. (Fish & G. Code, § 1927.1, subd. (i)).

prescribed herbivory. Intentional use of domestic livestock to remove, rearrange, or convert vegetation.

Q

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R

range. The general geographic area in which individuals of a species occur during their lifetime. For purposes of this Conservation Plan, the range of western Joshua tree is considered to be approximately 13,088 square kilometers (5,053.3 square miles) and is illustrated in Figure 4-1.

reburns. Fires burning in a recent fire scar.

recruitment. The process by which new individuals are added to a species' population

relocate. The terms "relocate" and "relocation" mean the removal of a living western Joshua tree and a sufficient portion of its root mass from the ground and transplanting it (Fish & G. Code, § 1927.1, subd. (j)).

restoration. Habitat restoration is the act of recreating characteristics of a site to bring it back to a condition that existed under the stewardship of California Native American tribes or before it was damaged or degraded by natural or human disturbances post-colonization.

S

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T

take. Hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill. (Fish & G. Code, § 86).

threatened species. A native species or subspecies of a bird, mammal, fish, amphibian, reptile, or plant that, although not presently threatened with extinction, is likely to become an endangered species in the foreseeable future in the absence of the special protection and management efforts (Fish & G. Code, § 2067).

tribal lands. Tribal lands include lands meeting the definition of "Indian country" in 18 US Code Section 1151 held in trust by Tribes (rancherias/reservations) or tribal members (individual allotments usually within rancherias/reservations); fee lands held by Tribes (land purchased and owned by a Tribe typically outside of rancherias/reservations); or fee lands held by tribally-led nonprofits (e.g., Native American Land Conservancy) or nonprofits formed by non-Federally recognized Tribes to act on the Tribe's behalf as a vehicle to hold land.

Traditional Ecological Knowledge. Also known as TEK, Traditional Ecological Knowledge refers to the evolving knowledge acquired by Native and indigenous peoples over hundreds or thousands of years through direct contact with the environment. Traditional Ecological Knowledge is an accumulating body of knowledge, practices, and beliefs, evolving by adaptive processes and handed down through generations by cultural transmission, about the interconnected relationships of living beings (human and non-human) with one another and the environment. Traditional Ecological Knowledge encompasses the world view of Native people, which includes ecology, spirituality, human and animal relationships, and more.

U

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V

vegetation communities. Groups of plant species that tend to co-occur and repeat across the landscape (e.g., Joshua tree woodland alliance).

W

western Joshua tree. The common name for *Yucca brevifolia*; an evergreen, tree-like plant that has been treated as a member of the asparagus family (Asparagaceae) (Fish & G. Code, § 1927.1, subd. (l)).

wildland fire. Wildland fire is an environmental and human health and safety hazard where unplanned and uncontrolled fire burns on the landscape.

wildland-urban interface. Zone of transition between unoccupied land and human development. It is the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels.

X

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Y

yucca moth. One of many moth species in the genera *Tegeticula* or *Parategeticula*, which are specialized pollinators for yucca plant species. The obligate pollinator for western Joshua tree is *Tegeticula synthetica.*

Z

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CHAPTER 3 TRADITIONAL VALUES AND USES OF WESTERN JOSHUA TREE BY CALIFORNIA NATIVE AMERICAN TRIBES

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CHAPTER 4 SUMMARY OF RESOURCE CONDITIONS

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CHAPTER 5 CONSERVATION MANAGEMENT ACTIONS AND EFFECTIVENESS CRITERIA

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CHAPTER 6 IMPLEMENTATION

Bears Ears Commission (Hopi Tribe, Navajo Nation, Ute Mountain Ute Tribe, Ute Indian Tribe of the Uintah and Ouray Reservation, and the Pueblo of Zuni), US Bureau of Land Management, and US Forest Service (Bears Ears National Monument Cooperative Agreement). 2022. Inter-Governmental Cooperative Agreement between the Tribal Nations whose representatives comprise the Bears Ears Commission, the Hopi Tribe, Navajo Nation, Ute Mountain Ute Tribe, Ute Indian Tribe of the Uintah and Ouray Reservation, and the Pueblo of Zuni and the United States Department of the Interior, Bureau of Land Management and the United States Department of Agriculture, Forest Service for the Cooperative Management of the Federal Lands and Resources of the Bears Ears National Monument. Available from: https://www.blm.gov/sites/default/files/docs/2022-06/Bears%20Ears%20National%20Monument%20Inter-Governmental%20Cooperative%20Agreement%202022.pdf (Accessed: 19 August 2024).

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