STAFF SUMMARY FOR APRIL 15-16, 2020

19. WESTERN JOSHUA TREE CESA PETITION (CONSENT)

Today's Item **Information ☐** **Action ☒**

Receive 90-day evaluation from DFW on the petition to list western Joshua tree as a threatened or endangered species under the California Endangered Species Act (CESA).

Summary of Previous/Future Actions

• Received petition	Oct 21, 2019
• FGC transmitted petition to DFW	Nov 1, 2019
• Published notice of receipt of petition	Nov 22, 2019
• Public receipt of petition and approved DFW's request for 30-day extension	Dec 11-12, 2019; Sacramento
• **Today receive DFW's evaluation of petition**	**Apr 15-16, 2020; Teleconference**
• Take action to determine if listing is warranted	Jun 24-25, 2020; Santa Ana

Background

On Oct 21, 2019, FGC received a petition from the Center for Biological Diversity to list western Joshua tree (*Yucca brevifolia*) as endangered under CESA. On Nov 1, 2019, FGC staff transmitted the petition to DFW for review. A notice of receipt of petition was published in the California Regulatory Notice Register on Nov 22, 2019.

California Fish and Game Code Section 2073.5 requires that DFW evaluate the petition and submit a written evaluation with a recommendation to FGC within 90 days of receiving the petition; under this section, DFW may request an extension of up to 30 days to complete the evaluation. FGC received the evaluation and recommendation from DFW on Mar 16, 2020 (exhibits 1-2). Written comments received by DFW are included as Exhibit 3.

Based on the petition and other information provided, possessed or received, DFW has determined that there is sufficient scientific information available to indicate that the petitioned action may be warranted and recommends that the petition be accepted and considered. However, this meeting is not intended for FGC discussion and FGC cannot consider the petition at this meeting. Fish and Game Code Section 2074 requires that consideration of the petition be scheduled not sooner than 30 days after receipt of the petition and public release of the evaluation report; however, under the Bagley-Keene Open Meeting Act, FGC must allow public comment on this item if requested.

FGC is scheduled to determine if listing may be warranted at its Jun 24-25, 2020 meeting. If FGC determines in Jun that listing may be warranted, DFW will review the status of the species and provide FGC a written, peer-reviewed report before FGC makes a final determination about whether to list the species.

Significant Public Comments

1. During its petition evaluation, DFW received an analysis from a concerned citizen against listing western Joshua tree as threatened or endangered (Exhibit 3).

Recommendation

FGC staff: Receive the DFW petition evaluation under a motion to adopt items 15-22 on the consent calendar and accept any public comment.

DFW: Accept and consider the petition.

Exhibits

1. DFW memo, received Mar 16, 2020
2. DFW 90-day evaluation report, received Mar 16, 2020
3. Public comment from Robert Brown to DFW, received Mar 16, 2020

Motion/Direction

Moved by _____ and seconded by _____ that the Commission adopts the staff recommendations for items 15-22 on the consent calendar.

State of California
Department of Fish and Wildlife

Original on file.
Received March 16, 2020

M e m o r a n d u m

Date: March 11, 2020

To: Melissa Miller-Henson
Executive Director
Fish and Game Commission

From: Charlton H. Bonham
Director

Subject: **Initial Evaluation of the Petition to List Western Joshua Tree (*Yucca brevifolia*) as Threatened under the California Endangered Species Act**

The Department of Fish and Wildlife (Department) has completed its initial evaluation of the Petition to list western Joshua tree (*Yucca brevifolia*) as a threatened species under the California Endangered Species Act, Fish and Game Code section 2050 et seq. The Fish and Game Commission (Commission) received the Petition from Brendan Cummings of the Center for Biological Diversity on October 21, 2019. Pursuant to Fish and Game Code section 2073, the Commission referred the Petition to the Department on November 1, 2019. On December 11, 2019, the Commission officially received the Petition and approved a Department request for a 30-day extension to further analyze the Petition and complete its evaluation report in accordance with Fish and Game Code section 2073.5, subdivision (b).

The Department completed the attached Petition evaluation report as required by Fish and Game Code section 2073.5. (See also Cal. Code Regs., tit. 14, § 670.1, subd. (d)(1).) The Department's evaluation report delineates the categories of information required in a petition, evaluates the sufficiency of the available scientific information regarding each of the Petition components, and incorporates additional relevant information that the Department possessed or received during the review period. Based upon the information contained in the Petition and other relevant information in the Department's possession, the Department has determined that there is sufficient scientific information available at this time to indicate that the petitioned action may be warranted. The Department recommends that the Petition be accepted and considered.

If you have questions or need additional information, please contact Chad Dibble, Deputy Director, Ecosystem Conservation Division at (916) 653-6956 or by email at Chad.Dibble@wildlife.ca.gov.

Attachment

ec: Department of Fish and Wildlife

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State of California
Natural Resources Agency
Department of Fish and Wildlife

REPORT TO THE FISH AND GAME COMMISSION

EVALUATION OF A PETITION FROM THE CENTER FOR BIOLOGICAL DIVERSITY TO LIST WESTERN JOSHUA TREE (*YUCCA BREVIFOLIA*) AS THREATENED UNDER THE CALIFORNIA ENDANGERED SPECIES ACT

Photo of *Yucca brevifolia* by Jeb McKay Bjerke

Prepared by
California Department of Fish and Wildlife

February 2020

I. EXECUTIVE SUMMARY

The Center for Biological Diversity (Petitioner) submitted a petition (Petition) to the Fish and Game Commission (Commission) to list the western Joshua tree (*Yucca brevifolia*) as threatened under the California Endangered Species Act (CESA). The Commission referred the Petition to the Department of Fish and Wildlife (Department) and the Department prepared this evaluation report (Petition Evaluation) to assess the scientific information discussed and cited in the Petition in relation to other relevant and available scientific information possessed or received by the Department during the evaluation period.

Western Joshua trees are evergreen tree-like plants that occur on flats and slopes in the Mojave Desert. The Petition does not present an estimate of western Joshua tree population size, nor does it provide evidence of a range-wide population trend; nevertheless, the Petition does provide information showing that some populations of western Joshua tree are declining, particularly within Joshua Tree National Park. Although a reliable estimate of western Joshua tree population size is not available, information available to the Department indicates that western Joshua tree is currently relatively abundant. Western Joshua tree likely relies on particular temperature and precipitation ranges, which in turn restricts the range of the species, and the habitat suitable for its survival. The Petition provides a significant amount of scientific information on factors affecting the ability of western Joshua tree to survive and reproduce. The Petition states that climate change is the greatest threat to the continued existence of western Joshua tree, with wildfires, invasive species, habitat loss due to human development, and predation as additional contributing factors that collectively threaten the continued viability of the species. Information in the Petition suggests that western Joshua tree is already being affected by threats, and these threats are likely to intensify significantly by the end of the century. The Petition describes the limitations of existing regulatory mechanisms as they relate to the factors affecting the ability of western Joshua tree to survive and reproduce.

After reviewing the Petition and other relevant information, the Department determined that the Petition contains sufficient information on population trend, range, distribution, abundance, life history, kind of habitat necessary for survival, factors affecting the ability to survive and reproduce, degree and immediacy of threat, impact of existing management efforts, suggestions for future management, and availability and sources of information, and also includes a detailed distribution map.

In completing its Petition Evaluation, the Department has determined the Petition provides sufficient scientific information to indicate that the petitioned action may be warranted for western Joshua tree. Therefore, the Department recommends the Commission accept the Petition for further consideration under CESA.

II. INTRODUCTION

A. Candidacy Evaluation

The Commission has the authority to list certain “species” or “subspecies” as threatened or endangered under CESA. (Fish & G. Code, §§ 2062, 2067, and 2070.) The listing process is the same for species and subspecies. (Fish & G. Code, §§ 2070-2079.1.)

CESA sets forth a two-step process for listing a species as threatened or endangered. First, the Commission determines whether to designate a species as a candidate for listing by evaluating whether the petition provides “sufficient information to indicate that the petitioned action may be warranted.” (Fish & G. Code, § 2074.2, subd. (e)(2).) If the petition is accepted for consideration, the second step requires the Department to produce, within 12 months of the Commission’s acceptance of the petition, a peer reviewed report based upon the best scientific information available that indicates whether the petitioned action is warranted. (Fish & G. Code, § 2074.6.) Finally, the Commission, based on that report and other information in the administrative record, determines whether the petitioned action to list the species as threatened or endangered is warranted. (Fish & G. Code, § 2075.5.)

A petition to list a species under CESA must include “information regarding the population trend, range, distribution, abundance, and life history of a species, the factors affecting the ability of the population to survive and reproduce, the degree and immediacy of the threat, the impact of existing management efforts, suggestions for future management, and the availability and sources of information. The petition shall also include information regarding the kind of habitat necessary for species survival, a detailed distribution map, and any other factors that the petitioner deems relevant.” (Fish & G. Code, § 2072.3; see also Cal. Code Regs., tit. 14, § 670.1, subd. (d)(1).) The range of a species for the Department’s petition evaluation and recommendation is the species’ California range. (*Cal. Forestry Assn. v. Cal. Fish and Game Com.* (2007) 156 Cal.App.4th 1535, 1551.)

Within 10 days of receipt of a petition, the Commission must refer the petition to the Department for evaluation. (Fish & G. Code, § 2073.) The Commission must also publish notice of receipt of the petition in the California Regulatory Notice Register. (Fish & G. Code, § 2073.3.) Within 90 days of receipt of the petition (or 120 days if the Commission grants an extension), the Department must evaluate the petition on its face and in relation to other relevant information and submit to the Commission a written evaluation report with one of the following recommendations:

- Based upon the information contained in the petition, there is not sufficient information to indicate that the petitioned action may be warranted, and the petition should be rejected; or

- Based upon the information contained in the petition, there is sufficient information to indicate that the petitioned action may be warranted, and the petition should be accepted and considered.

(Fish & G. Code, § 2073.5, subds. (a)-(b).) The Department's candidacy recommendation to the Commission is based on an evaluation of whether the petition provides sufficient scientific information relevant to the petition components set forth in Fish and Game Code Section 2072.3 and the California Code of Regulations, Title 14, Section 670.1, subdivision (d)(1).

In *Center for Biological Diversity v. California Fish and Game Commission* (2008) 166 Cal.App.4th 597, the California Court of Appeals addressed the parameters of the Commission's determination of whether a petitioned action should be accepted for consideration pursuant to Fish and Game Code Section 2074.2, subdivision (e), resulting in the species being listed as a candidate species. The court began its discussion by describing the standard for accepting a petition for consideration previously set forth in *Natural Resources Defense Council v. California Fish and Game Commission* (1994) 28 Cal.App.4th 1104:

> As we explained in *Natural Resources Defense Council*, "the term 'sufficient information' in section 2074.2 means that amount of information, when considered with the Department's written report and the comments received, that would lead a reasonable person to conclude the petitioned action may be warranted." The phrase "may be warranted" "is appropriately characterized as a 'substantial possibility that listing could occur.'" "Substantial possibility," in turn, means something more than the one-sided "reasonable possibility" test for an environmental impact report but does not require that listing be more likely than not.

(*Center for Biological Diversity*, *supra*, 166 Cal.App.4th at pp. 609-10 [internal citations omitted].) The court acknowledged that "the Commission is the finder of fact in the first instance in evaluating the information in the record." (*Id.* at p. 611.) However, the court clarified:

> [T]he standard, at this threshold in the listing process, requires only that a substantial possibility of listing could be found by an objective, reasonable person. The Commission is not free to choose between conflicting inferences on subordinate issues and thereafter rely upon those choices in assessing how a reasonable person would view the listing decision. Its decision turns not on rationally based doubt about listing, but on the absence of any substantial possibility that the species could be listed after

> the requisite review of the status of the species by the Department under [Fish and Game Code] section 2074.6.

(*Ibid*.)

CESA defines the "species" eligible for listing to include "species or subspecies" (Fish and G. Code, §§ 2062, 2067, and 2068), and courts have held that the term "species or subspecies" includes "evolutionarily significant units." (*Central Coast Forest Assn. v. Fish & Game Com.* (2018) 18 Cal.App.5th 1191, 1236, *citing Cal. Forestry Assn.*, *supra*, 156 Cal.App.4th at pp. 1542 and 1549.)

B. Petition History

Recent studies separate Joshua tree into two groups: western Joshua tree (*Yucca brevifolia* or *Yucca brevifolia* var. *brevifolia*) and eastern Joshua tree (*Yucca jaegerana* or *Yucca brevifolia* var. *jaegerana*). Both western Joshua tree and eastern Joshua tree were considered for listing under the federal Endangered Species Act (ESA), but on August 15, 2019, the U.S. Fish and Wildlife Service (USFWS) found that listing of the Joshua tree as a threatened or endangered species was not warranted (USFWS 2019).

On October 21, 2019, the Commission received a Petition to list any of the following as threatened under CESA: (1) the western Joshua tree (*Yucca brevifolia*) throughout its California range; or, in the event the Commission determines that listing of *Yucca brevifolia* throughout its California range is not warranted, (2) the western Joshua tree population within the northern part of western Joshua tree's California range (YUBR North), or (3) the western Joshua tree population within the southern part of western Joshua tree's California range (YUBR South). On November 1, 2019, the Commission referred the Petition to the Department for evaluation. At its meeting on December 11, 2019, the Commission officially received the Petition and approved a request from the Department for a 30-day extension to further analyze the Petition and complete its Petition Evaluation pursuant to Fish and Game Code Section 2073.5, subdivision (b).

The Department evaluated the scientific information presented in the Petition as well as other relevant information the Department possessed at the time of review. The Department received information from two people during the petition evaluation period pursuant to Fish and Game Code Section 2073.4. This Petition Evaluation includes copies of this information as Appendix 1, pursuant to Fish and Game Code Section 2073.5, subdivision (c). Pursuant to Fish and Game Code Section 2072.3 and Section 670.1, subdivision (d)(1), of Title 14 of the California Code of Regulations, the Department evaluated whether the Petition included sufficient scientific information regarding each of the following petition components to indicate that the petitioned action may be warranted:

- Population trend;
- Range;
- Distribution;
- Abundance;
- Life history;
- Kind of habitat necessary for survival;
- Factors affecting the ability to survive and reproduce;
- Degree and immediacy of threat;
- Impact of existing management efforts;
- Suggestions for future management;
- Availability and sources of information; and
- A detailed distribution map.

C. Overview of Western Joshua Tree Ecology

Western Joshua trees are evergreen, tree-like plants that have recently been treated as members of the asparagus family (Asparagaceae) (APG 2016, ITIS 2019). Western Joshua trees typically have a 5 to 15 meter (m) (16 to 50 feet (ft)) main stem with extensive branching on older plants. The tallest known western Joshua tree was 25 m (82 ft) tall, although trees exceeding 10 m (33 ft) are rare (Gucker 2006, Cummings 2019). Western Joshua tree is found in many different plant communities occurring on flats and slopes in the Mojave Desert at elevations between 400 and 2200 m (1300 to 7200 ft) (Turner 1982, Hess 2012, USFWS 2018, CNPS 2019). Lenz (2001) reports that Joshua tree plants tolerate temperatures of -25°C to 51°C (-13°F to 124°F) and annual precipitation ranges of 98 to 268 mm (3.9 to 10.6 inches (in)).

Western Joshua trees are capable of both sexual reproduction, and asexual reproduction via growth of rhizomes, branch sprouts, and/or basal sprouts. Significant examples of western Joshua tree asexual reproduction have been observed, with some clumps of plants being entirely clonal (Gucker 2006, DeFalco et al. 2010, Harrower and Gilbert 2018).

Western Joshua trees can reproduce sexually resulting in seed production. Flowering of western Joshua trees is considered episodic and rare, generally only occurring in wetter years (Gucker 2006). Flowers of Joshua trees are exclusively pollinated by specialized yucca moths (Trelease 1893, Pellmyr 2003, Pellmyr and Segraves 2003, Godsoe et al. 2008). In California, western Joshua tree is pollinated by one species of moth, *Tegeticula synthetica*. Female moths transfer pollen between western Joshua tree flowers in specialized mouthparts, inject eggs into the floral ovaries using a bladelike ovipositor, and then actively apply pollen to the stigmatic surface to fertilize the flower (Trelease 1892, Pellmyr 2003). As a western Joshua tree flower develops into a fruit,

the moth eggs hatch and emerging larvae eat a portion of the developing seeds. These moths are the sole pollinators of western Joshua trees in California, and in turn, Joshua tree seeds are the only food source for these moths (Pellmyr and Segraves 2003, Yoder et al. 2013). This relationship represents an obligate mutualism, where each species relies on the other for survival of its own species. Western Joshua tree relies on the yucca moth for pollination, but in turn has to sacrifice some seeds to the developing moth larvae.

Once pollinated, fruits form in early summer and seeds are mature in mid-summer (Waitman et al. 2012). Mature fruits contain 30 to 50 black seeds, which are flat to thickened with a smooth to shallowly bumpy surface.

Western Joshua tree seeds germinate readily in laboratory conditions and do not require any pretreatment (Wallace and Romney 1972, Alexander et al. 2008, Reynolds et al. 2012, Waitman et al. 2012). Seeds do not appear to be long-lived in the soil and are therefore unlikely to form a soil seed bank (Reynolds et al. 2012). Joshua tree seeds are harvested by rodents directly from fruits in the tree canopy and gathered quickly from the ground, and these seeds have been found in caches up to 57 m (190 ft) away from the source plant (Vander Wall et al. 2006, Waitman et al. 2012). Seeds that have been buried in soil have a much greater chance of establishing seedlings than those left on the soil surface, but seed caches are also consumed and moved to different caches by rodents; therefore Joshua tree and dispersing rodents may form a mutualism (Vander Wall et al. 2006, Reynolds et al. 2012, Waitman et al. 2012). Western Joshua tree seedling emergence was most successful for seeds planted one centimeter (cm) (0.4 in) deep (Waitman et al. 2012), and the greatest seedling emergence occurs during spring and summer, when increased soil moisture is accompanied by warm soil temperatures (Reynolds et al. 2012).

It can take many years for western Joshua tree seedlings to reach reproductive maturity. Esque et al. (2015) monitored a cohort of 53 western Joshua tree seedlings beginning in May of 1989, and found that ten of them (19 percent) were still living after 22 years, with an average height of 100 cm (39 in), but these ten plants had yet to reproduce. Growth rates appear to be dependent on factors including age, precipitation, presence of nearby plants that help seedlings establish, temperature and (at least in the laboratory) photoperiod (Gucker 2006).

III. SUFFICIENCY OF SCIENTIFIC INFORMATION TO INDICATE THE PETITIONED ACTION FOR WESTERN JOSHUA TREE MAY BE WARRANTED

The Petition components are evaluated below, pursuant to Fish and Game Code Section 2072.3 and Section 670.1, subdivision (d)(1), of Title 14 of the California Code of Regulations.

A. Population Trend

1. Scientific Information in the Petition

The Petition discusses population trends for western Joshua tree on pages 19 and 20 under the heading “Abundance and Population Trends”.

The Petition acknowledges that a reliable estimate of western Joshua tree population size is not available and that no range-wide population trends have been documented. The Petition therefore relies on studies indicating that western Joshua tree density is negatively correlated with increasing temperature, the species range is contracting at lower elevations, recruitment is limited, and plant mortality is increasing.

The Petition cites a study by DeFalco et al. (2010) that examined the mortality of western Joshua tree across several study sites five years after a fire in Joshua Tree National Park burned nearly 5700 hectares (22 square miles (mi^2)) in May 1999. The study found that approximately 80 percent of western Joshua trees that were burned by the fire died by 2004, and approximately 26 percent of the unburned trees died as well, with drought a likely contributing factor.

The Petition cites a study by Harrower and Gilbert (2018) that found strong positive relationships between western Joshua tree abundance, size, abundance of its pollinating moth, and reproductive success at Joshua Tree National Park. The study found that peak performance of both western Joshua tree and its pollinating moth occurs at intermediate elevations of approximately 1200 to 1400 m (4,000 to 4,600 ft). The study also found that the proportion of infertile western Joshua tree seeds increased at the margins of its range in Joshua Tree National Park, with the observation that Joshua trees appear to be dying back at low elevations, but do not appear to be expanding their range into higher elevations.

The Petition cites a study by St. Clair and Hoines (2018) that found a positive relationship between temperature and greater production of western Joshua tree flowers and seeds, but a negative relationship between temperature and western Joshua tree stand density, which suggests that there may be constraints of warmer temperatures on western Joshua tree establishment success.

The Petition also cites studies summarized by Cornett (2014) that describe declining western Joshua tree populations at three study sites in Joshua Tree National Park over an approximately 20-year period.

2. Other Relevant Scientific Information

The Department received additional information on western Joshua tree population trend during the Petition Evaluation period pursuant to Fish and Game Code Section

2073.4. The Department received two reports on western Joshua tree populations at Edwards Air Force Base. One of these reports describes a geographic information system (GIS) based analysis that was conducted to determine population trends for western Joshua tree at Edwards Air Force Base between 1992 and 2015 (USAF 2017a). The report suggests that western Joshua tree populations on the base were stable to increasing; however, the report describes several issues that increase the uncertainty of the results. The second report describes a GIS analysis, literature review, and field survey conducted of a 1999 fire area on Edwards Air Force Base to evaluate western Joshua tree survivorship and/or regeneration (USAF 2017a). The report used aerial photography taken in 1992 to count all identifiable western Joshua trees present in two areas prior to the 1999 fire and compared this information with the results of a 2017 field survey that identified all western Joshua trees in these same two areas. This report concludes that Joshua tree populations were stable in the sampled areas of the fire area from 1992 to 2017.

3. Conclusion

The Petition does not present an estimate of western Joshua tree population size, nor does it provide evidence of a range-wide population trend; nevertheless, the Petition does provide information showing that some populations of western Joshua tree are declining, particularly within Joshua Tree National Park. The Petition provides sufficient information on the population trend of western Joshua tree for the Department to make the recommendation in Section IV of this Petition Evaluation.

B. Geographic Range

1. Scientific Information in the Petition

The Petition discusses the geographic range of western Joshua tree on pages 16 through 19, under the heading “Current and Historical Distribution”. The Petition extensively cites the range information summarized in the Joshua Tree Status Assessment prepared by the USFWS (2018).

As described in Section II(B) of this Petition Evaluation, recent studies separate Joshua tree into two groups: western Joshua tree (*Yucca brevifolia* or *Yucca brevifolia* var. *brevifolia*) and eastern Joshua tree (*Yucca jaegerana* or *Yucca brevifolia* var. *jaegerana*). Western Joshua tree and eastern Joshua tree are distinguished by genetic and morphological differences, and by different yucca moth pollinators. Considered collectively, the Petition describes the range of western Joshua tree and eastern Joshua tree as extending from northwestern Arizona to southwestern Utah, and west to southern Nevada and southeastern California at elevations between 600 and 2200 m (2000 to 7200 ft) and between 34° to 38° latitude. The ranges of both western Joshua tree, eastern Joshua tree, and populations of those two species are presented in the

Petition on page 17 as Figure 8. Western Joshua tree is described as comprising two geographically separate populations named YUBR South and YUBR North in the Petition, and the map showing these populations has been duplicated as Figure 1.

The Petition describes western Joshua tree as occurring almost exclusively in the Mojave Desert in unevenly distributed populations, with a small portion of its northern extent occurring within the Great Basin Desert. The southern extent of western Joshua tree's range is in the Little San Bernardino Mountains of Joshua Tree National Park, and the northern extent of its range is near Alkali, Nevada. The western extent is near the Hungry Valley State Vehicular Recreation Area near Gorman, California. The eastern extent of its range is in Tikaboo Valley, Nevada, where the species co-occurs with eastern Joshua tree (USFWS 2018).

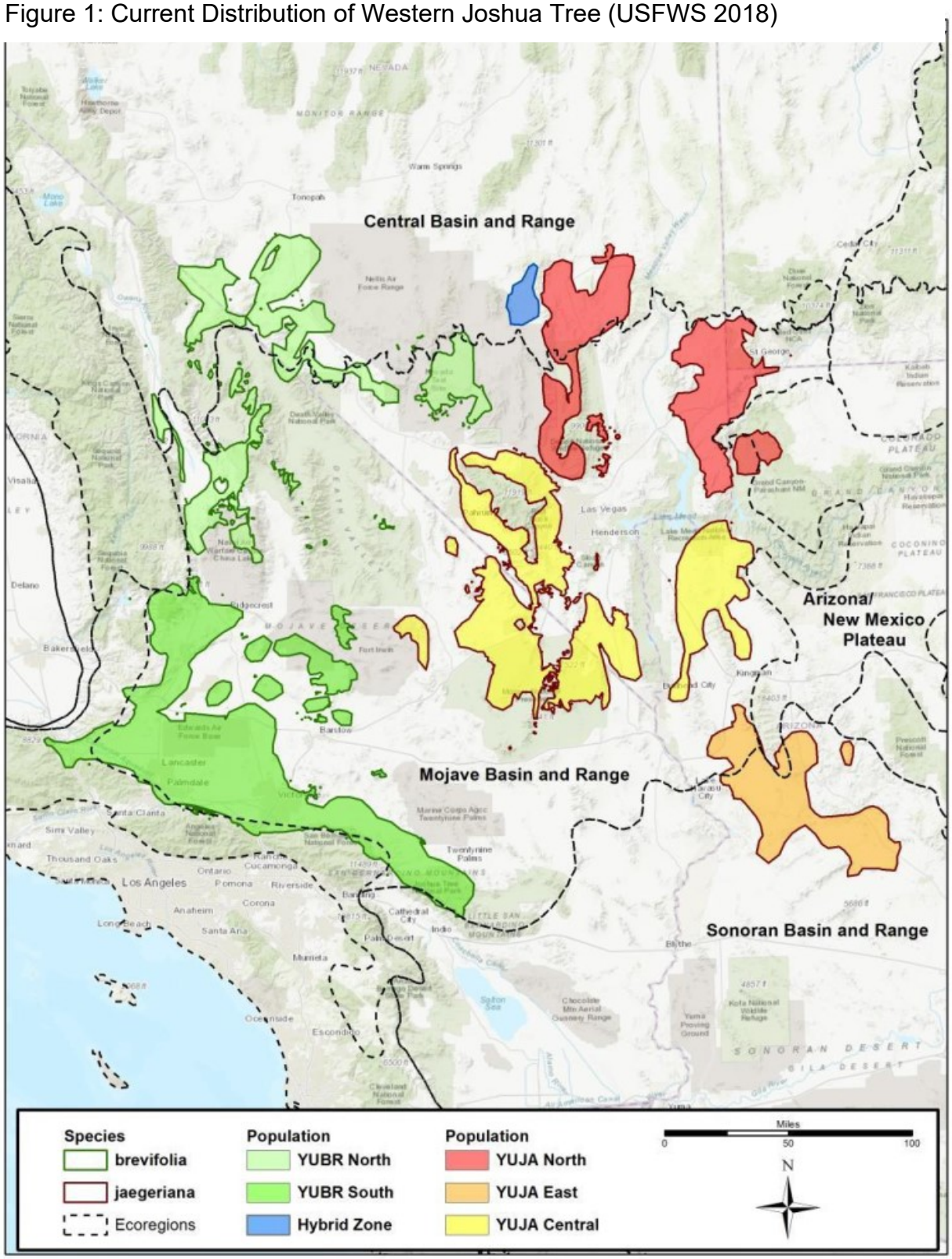
The Petition cites a study by Cole et al. (2011) that compiled locations and ages of late Pleistocene (22,000 to 13,000 years ago) Joshua trees from fossil packrat (*Neotoma* spp.) waste piles and Shasta ground sloth (*Nothrotheriops shastensis*) dung, and compared them with the current Joshua tree distribution. The study shows that as the climate rapidly warmed 11,700 years ago, the range of Joshua tree contracted, leaving only the populations near what had been its northernmost limit. Climate models for the next 60 to 90 years project a climate warming of a similar pace and magnitude to that which occurred in the early Holocene, approximately 11,700 years ago. The Cole et al. (2011) study includes models that project the future elimination of Joshua tree throughout most of the southern portions of its current range, with only a few populations within the current range predicted to be sustainable. Several models also project significant potential future expansion into new areas to the north and east of its current range and outside of California, but the species' historical and current rates of dispersal may conceivably prevent natural expansion into these new areas.

The Petition also cites a study by Holmgren et al. (2010) that examines the long-term vegetation history of Joshua Tree National Park via examination of fossil plants found in animal waste piles. Joshua tree is identified as a species that arrived fairly early in Joshua Tree National Park, about 13,880 years ago, and was stable in the Park throughout the Holocene (approximately 11,700 years ago to present).

2. Other Relevant Scientific Information

The Department possesses vegetation maps that cover a large portion of the California deserts where western Joshua tree generally occurs (Thomas 2002, Agri Chemical and Supply Inc. 2008, CDFW and USGS 2014, CDFW and Chico State University 2015, CDFW et al. 2017, CDFW and AIS 2019a, 2019b, and 2019c, CDFW 2019, NPS 2019). The *Yucca brevifolia* vegetation alliance is mapped with an approximate accuracy of 95

Figure 1: Current Distribution of Western Joshua Tree (USFWS 2018)



percent in the vegetation maps related to the Desert Renewable Energy Conservation Plan, and these maps also denote the cover of Joshua tree canopy in all vegetation polygons by cover class (0, >0-1%, >1-5%, and >5%) (VegCAMP 2013). Vegetation maps in the Department's possession may contribute to a relatively high-resolution western Joshua tree distribution map in many areas of California. These vegetation maps are likely to improve the current understanding of western Joshua tree's range.

3. Conclusion

The Petition provides sufficient information on the geographic range of western Joshua tree for the Department to make the recommendation in Section IV of this Petition Evaluation.

C. Distribution

1. Scientific Information in the Petition

The Petition discusses the distribution of western Joshua tree on pages 16 through 19, under the heading "Current and Historical Distribution". The Petition primarily relies on distribution information summarized in the Joshua Tree Status Assessment prepared by the USFWS (2018). The Petition describes western Joshua tree as comprising two geographically separate populations named YUBR South and YUBR North.

YUBR South is described as being entirely within California, and extending from Joshua Tree National Park, north to near Ridgecrest in Kern County. YUBR South is located on alluvial plains, fans, and bajadas of the major valleys lying between scattered mountain ranges. The elevation range of the YUBA South population is between 750 and 2200 m (2500 to 7200 ft), with creosote bush (*Larrea tridentata*) shrubland as the primary vegetation type. USFWS (2018) estimates that 3,255,088 acres within the YUBR South population distribution area are suitable for Joshua trees based on soils and other habitat factors; however, western Joshua trees have a patchy and disjunct distribution and do not occupy this entire area. Just over 50 percent of the YUBR South population is on private land, 48 percent is on federal land, and just under 2 percent is under state, county, or local ownership.

The YUBR North population occurs in the area north of Inyokern in Kern County, along the west and north margins of Death Valley, to Goldfield, Nevada, and east to the Nevada National Security Site (formerly the Nevada Test Site). The elevation range of western Joshua tree in the YUBR North population is between 1500 and 2200 m (4900 to 7200 ft), and the vegetation occurring nearby this higher and cooler population often includes singleleaf pinyon pine (*Pinus monophylla*), Utah juniper (*Juniperus osteosperma*), and big sagebrush (*Artemisia tridentata*) (USFWS 2018). The YUBR North population is about evenly split between California and Nevada. USFWS (2018)

estimates that approximately 1,941,701 acres of the distribution area of the YUBR North population is suitable for western Joshua tree, and approximately 96 percent of the YUBR North population is on federal land (USFWS 2018).

2. Other Relevant Scientific Information

As described in Section III(B)(2) of this Petition Evaluation, the Department possesses vegetation maps that cover a large portion of the California deserts where western Joshua tree occurs, and these maps may contribute to a relatively high-resolution western Joshua tree distribution map in many areas of California. These vegetation maps are likely to improve the current understanding of western Joshua tree's distribution.

3. Conclusion

The Petition provides sufficient information on the distribution of western Joshua tree for the Department to make the recommendation in Section IV of this Petition Evaluation.

D. Abundance

1. Scientific Information in the Petition

The Petition discusses the abundance of western Joshua tree on pages 19 and 20 under the heading "Abundance and Population Trends". The Petition states that western Joshua tree has a patchy distribution and a variable population density of 4 to 840 trees per acre (10 to 2,070 trees per hectare) and cites USFWS (2018). The discussion of western Joshua tree's "Current and Historical Distribution" on pages 16 through 19 of the Petition includes information demonstrating that western Joshua tree currently has a relatively widespread distribution in southern California. The Petition acknowledges that a reliable estimate of western Joshua tree population size is not available.

2. Other Relevant Scientific Information

As described in Section III(B)(2) of this Petition Evaluation, the Department possesses vegetation maps that cover a large portion of the California deserts where western Joshua tree occurs. It may be possible to use cover estimates from these maps as a rough proxy for western Joshua tree abundance; however, the Department does not possess this information for the entire western Joshua tree distribution in California. The range, distribution, and density information available to the Department indicates that the abundance of western Joshua tree is currently relatively high.

3. Conclusion

The Petition acknowledges that a reliable estimate of western Joshua tree population size is not available; however, information available to the Department indicates that the

abundance of western Joshua tree is currently relatively high. The Petition provides sufficient information on the abundance of western Joshua tree for the Department to make the recommendation in Section IV of this Petition Evaluation.

E. Life History

1. Scientific Information in the Petition

The Petition discusses the life history of western Joshua tree on pages 3 through 15 under the heading “Life History”. The Petition describes several aspects of western Joshua tree life history, including asexual reproduction, flowering, pollination, seed production, seed predation, seed dispersal, seed germination, and plant growth. In describing these aspects of western Joshua tree life history, the Petition cites several scientific studies and sources.

The Petition describes the ability of western Joshua tree to reproduce via asexual growth of rhizomes, branch sprouts, and/or basal sprouts. In discussing asexual reproduction, the Petition cites Webber (1953), Gucker (2006), DeFalco et al. (2010), and Harrower and Gilbert (2018).

The Petition describes the episodic and rare nature of western Joshua tree flowering events and the seasonal timing of flower production, and cites Gucker (2006), Hess (2012), Waitman et al. (2012), Esque et al. (2015), Cornett (2018), and Harrower and Gilbert (2018).

The Petition describes the obligate pollination mutualism between western Joshua tree and its specialized pollinating moth, *Tegeticula synthetica*, as well as the pollination mutualism between eastern Joshua tree and its pollinating moth, *Tegeticula antithetica*. The Petition also describes the narrow region in Nevada where western Joshua tree and eastern Joshua tree are sympatric and hybridize. The Petition describes the influence that two species of pollinating moth likely had on the morphological divergence of western Joshua tree and eastern Joshua tree. The Petition describes the formation and structure of western Joshua tree fruits. In discussing pollination and seed production, the Petition cites Pellmyr and Segraves (2003), Althoff et al. (2004), Gucker (2006), Godsoe et al. (2008), Smith et al. (2008a, 2008b), Smith et al. (2009), Waitman et al. (2012), Starr et al. (2013), Yoder et al. (2013), and Cole et al. (2017).

2. Conclusion

The Petition provides sufficient information on western Joshua tree life history for the Department to make the recommendation in Section IV of this Petition Evaluation.

F. Kind of Habitat Necessary for Survival

1. Scientific Information in the Petition

The Petition discusses the kind of habitat necessary for western Joshua tree survival on pages 14 and 15 under the heading “Habitat Requirements”.

The Petition describes Joshua trees as occurring in desert grasslands and shrublands in hot, dry sites on flats, mesas, bajadas, and gentle slopes in the Mojave Desert. Soils in Joshua tree habitats are described as silts, loams, and/or sands, variously described as fine, loose, well drained, and/or gravelly. The Petition describes temperature and precipitation ranges that have been reported for western Joshua tree, and states that these attributes are likely prime constraints on suitable habitat for the species and the species’ range. The Petition states that Joshua trees can be found in many different plant alliances throughout their range, and although they may not be limited by particular plant associations, Joshua trees require the presence of their obligate pollinator, rodents, to disperse and cache seeds, and nearby plants to shelter emerging seedlings for successful reproduction and recruitment.

In discussing the kind of habitat necessary for western Joshua tree survival, the Petition cites Went (1957), Turner (1982), Lenz (2001), Gucker (2006), Cole et al. (2011), Harrower and Gilbert (2018), and USFWS (2018).

2. Conclusion

The Petition provides sufficient information to support the conclusion that temperature and precipitation are likely critical for western Joshua tree survival and are likely prime constraints on suitable habitat for the species and the species’ range. The Petition provides sufficient information on the kind of habitat necessary for western Joshua tree survival for the Department to make the recommendation in Section IV of this Petition Evaluation.

G. Factors Affecting the Ability to Survive and Reproduce

1. Scientific Information in the Petition

The Petition discusses factors affecting the ability of western Joshua tree to survive and reproduce on pages 20 through 48 under the heading “Factors Affecting Ability to Survive and Reproduce”. The Petition identifies predation, invasive species, wildfires, climate change, and habitat loss to human development as the factors affecting the ability of western Joshua tree to survive and reproduce, stating that these factors are often related, synergistic, and collectively threaten the continued viability of the species. The information presented in the Petition for each of these factors is discussed separately below.

Predation

The Petition provides information on various impacts to western Joshua tree from predation and herbivory. Before dispersal, the larvae of the moth *Tegeticula synthetica* eat a portion of western Joshua tree's seeds. The Petition states that rodents cache and consume the vast majority of western Joshua tree seeds, with fewer than one percent of seeds germinating. Cattle have been observed grazing on the inflorescences of small western Joshua trees, and herbivory by black-tailed jackrabbits (*Lepus californicus*), pocket gophers (*Thomomys bottae*), white-tailed antelope squirrels (*Ammospermophilus leucurus*), and woodrats (*Neotoma* sp.) has been observed, which in some instances results in mortality of pre-reproductive plants. The Petition states that drought and fire result in increased herbivory on seedlings and pre-reproductive Joshua trees. The Petition acknowledges that predation alone is likely not presently a threat to western Joshua tree persistence, but the impact will be more significant as wildfire and drought frequency and intensity increase in the coming decades.

In discussing predation as a factor affecting the ability of western Joshua tree to survive and reproduce, the Petition cites Keeley et al. (1985), Vander Wall et al. (2006), DeFalco et al. (2010), Cole et al. (2011), Waitman et al. (2012), Borchert and DeFalco (2016), Esque et al. (2015), and Lybbert and St. Clair (2017).

Invasive Species

The Petition provides information on impacts to western Joshua tree from invasive species. Invasive plant species are widely established in the Mojave Desert throughout the range of western Joshua tree, and represent a large percentage of the biomass on the landscape. The abundance of invasive plant species in the Mojave Desert is positively correlated with disturbances such as livestock grazing, off-road vehicle use, fire, urbanization, roads, and agriculture. These invasive species are also aided by nitrogen deposition as a result of air pollution. Although it is possible that invasive plant species may compete with emergent western Joshua tree seedlings, the biggest impact to western Joshua tree from invasive plant species is through altered fire dynamics. Invasive plant species in the Mojave Desert have resulted in larger and more frequent fires that are killing a large number of western Joshua trees. The Petition describes this as a significant threat to western Joshua tree at the individual and population level.

In discussing invasive species as a factor affecting the ability of western Joshua tree to survive and reproduce, the Petition cites Brooks (2003), Brooks and Berry (2006), DeFalco et al. (2007), Allen et al. (2009), Allen and Geiser (2011), Pardo et al. (2011), Barrows and Murphy-Mariscal (2012), Reynolds et al. (2012), Bytnerowicz et al. (2016), Frakes (2017), and Brooks et al. (2018).

Wildfires

The Petition provides information on impacts to western Joshua tree from wildfire, and states that wildfire is one of the greatest threats to the persistence of the species, particularly as the species' range contracts in the face of climate change and as the frequency and severity of fire in the species' range increases.

Under the Wildfires section, the Petition first discusses western Joshua tree's response to fire. Although some early researchers suggested that western Joshua tree was well adapted to fire due to the ability of fire-damaged trees to resprout, longer-term studies have demonstrated that Joshua trees have relatively low post-fire survival rates, are slow to repopulate burned areas, and require sufficient precipitation in the years following fire for successful resprouting. Older and taller western Joshua trees are less affected by fire than younger, shorter trees. Post-fire mortality of western Joshua tree can be high due to drought and increased herbivory, particularly in areas that have been denuded of other vegetation that could serve as an herbivore food source. Post-fire sprouting of burned trees has been observed to prolong Joshua tree survival at high-elevation sites, when precipitation is sufficient. Joshua tree populations along the extreme western edge of the desert bioregion, near the Sierra Nevada and Transverse Ranges, appear to survive more readily after fire than those further east, resulting in dense unique clumps of clonal plants. Recruitment of new western Joshua trees into burned areas is infrequent and slow. The Petition states that blackbrush (*Coleogyne ramosissima*) is one of the most important plants for aiding western Joshua tree seedling establishment, but it is also one of the most vulnerable shrubs to fire and can take centuries to fully recover. The Petition states that due to western Joshua tree's inherently slow recruitment process, accelerated fire return intervals, and climate change, a return to pre-fire western Joshua tree density and abundance in burned areas may take centuries or may never occur.

In discussing western Joshua tree's response to fire as a factor affecting the ability of western Joshua tree to survive and reproduce, the Petition cites Webber (1953), Brittingham and Walker (2000), Loik et al. (2000), Gunter (2006), Abella et al. (2009), DeFalco et al. (2010), Vamstad and Rotenberry (2010), Reynolds et al. (2012), Esque et al. (2015), Wallace (2017), and Brooks et al. (2018).

Under the Wildfires section, the Petition also discusses the increasing wildfire frequency and intensity in the Mojave Desert. The Petition states that large fires have been historically infrequent in Joshua tree woodlands, and recent increases in fire size and frequency are partially due to invasion of non-native annual grasses. Winters with relatively high amounts of precipitation produce an increase in biomass of native and especially non-native annual plants that carry fire in invaded habitats, dramatically changing middle elevation shrublands dominated by creosote bush, blackbrush, and

western Joshua trees. Precipitation has been recognized as a primary driver of fire frequency and extent in the Mojave Desert, with wetter periods fostering the growth of invasive grasses which carry fire, and drier periods leading to fewer and smaller fires. Fires in the Mojave Desert are started by a mix of accidental and intentional human activities, as well as lightning. Most wildfires are human-caused and start along roadsides. Less frequent large fires typically start by lightning and occur in remote areas far from major roads. The Petition also notes the impact of fire on western Joshua tree seedling and juvenile survival is particularly exacerbated because fires tend to track the same heavy precipitation years that are most suitable for western Joshua tree seedling emergence.

In discussing the increasing wildfire frequency and intensity in the Mojave Desert as a factor affecting the ability of western Joshua tree to survive and reproduce, the Petition cites Brooks and Matchett (2006), Holmgren et al. (2010), Vamstad and Rotenberry (2010), Barrows and Murphy-Mariscal (2012), Jurand and Abella (2013), Esque et al. (2015), Tagestad et al. (2016), Klinger and Brooks (2017), Short (2017), Syphard et al. (2017), Brooks et al. (2018), Hopkins (2018), Maloney et al. (2019), Sweet et al. (2019), and Syphard et al. (2019).

Climate Change

The Petition provides information on impacts to western Joshua tree from climate change, and states that climate change represents the single greatest threat to the continued existence of the species. The Petition states that even under the most optimistic reduced-emission climate scenarios, western Joshua trees will be eliminated from significant portions of their range by the end of the century, and under warming scenarios consistent with current domestic and global emissions trajectories, the species will likely be close to being functionally extinct in the wild in California by the century's end.

Under the Climate Change section, the Petition has a subsection that discusses current and projected climate change in the range of western Joshua tree. A strong, international scientific consensus has established that human-caused climate change is causing widespread harm to human society and natural systems, and climate change threats are becoming increasingly dangerous. Climate change is causing increasing stress on species and ecosystems, and deserts have warmed and dried more rapidly over the last 50 years than other ecoregions, both globally and in the contiguous United States. Since 1895, the counties supporting western Joshua tree have already experienced annual temperature increases of 1.7 - 2.3°C (3.1 - 4.1°F). In addition, the Mojave Desert has experienced impacts to species and ecosystems, with bird occupancy and site-level species richness declining by about fifty percent over the past century, with this decline linked to increased cooling needs, necessitating more water

intake for survival. While all temperature projections predict that the Mojave Desert will become much hotter in the future, projections for future precipitation are less clear. Average annual rainfall is expected to be about the same, but interannual precipitation variability is expected to increase, as is the amount of winter precipitation.

In discussing current and projected climate change in the range of western Joshua tree as a factor affecting the ability of western Joshua tree to survive and reproduce, the Petition cites Warren et al. (2011), Scheffers et al. (2016), Tagestad et al. (2016), Wiens (2016), USGCRP (2017), Hopkins (2018), Iknayan and Beissinger (2018), IPCC (2018), Mufson et al. (2019), and Riddell et al. (2019).

Under the Climate Change section, the Petition has an additional subsection that discusses climate change impacts on western Joshua trees. Under this subsection, the Petition discusses six published models of future Joshua tree distribution: Thompson et al. (1998), Shafer et al. (2001), Dole et al. (2003), Cole et al. (2011), Barrows and Murphy-Mariscal (2012), and Sweet et al. (2019). Each of these models predict contractions of western Joshua tree at the western edge of its range. These six models are discussed separately in the following paragraphs.

Thompson et al. (1998) used temperature and precipitation data from the existing range of western and eastern Joshua tree to calculate potential future habitat under doubled carbon dioxide conditions. The Thompson et al. (1998) model predicted a retraction of Joshua tree range along its western edge in California, and predicted significant expansion of possible Joshua tree habitat extending as far north as Washington state, south into Mexico, and east into Texas; however this modeled projection of the future range of Joshua trees under changing climate conditions did not analyze other habitat variables or dispersal ability and used a model that poorly matched the current distribution of Joshua tree.

Shafer et al. (2001) carried out a similar modeling effort using three climate variables (mean temperature of the coldest month, a temperature index called growing degree days, and a moisture index) and a course grid scale. The results of this study were roughly consistent with the Thompson et al. (1998) model, but notably show an almost complete extirpation of western Joshua tree from California by 2090-2099 under several future climate scenarios.

Dole et al. (2003) also modeled the future range for Joshua trees under doubled carbon dioxide conditions, finding similarly to Thompson et al. (1998) models that a considerable portion of the current range of western Joshua tree will become climatically unfavorable for the species, although significant amounts of new habitat may become available. Like previous models, Dole et al. (2003) did not take dispersal ability into consideration and only focused on suitable habitat variables. This study also

noted that current climate conditions may already be detrimental to Joshua tree survival and/or reproduction, which was later confirmed by other subsequent research in the southern part of western Joshua tree's range.

Cole et al. (2011) built a sophisticated species distribution model with climate and habitat variables derived from a comprehensive dataset of presence/absence data throughout the current range of western and eastern Joshua tree. Late Pleistocene and Holocene (22,000 to years ago to present) records were also compiled to generate a map of past Joshua tree distribution. The study differed from previous models in its use of specific data points for presence and habitat variables for the species and the testing of models to simulate the current range of the species. All of the individual climate models, as well as an ensemble of 22 global circulation models (GCMs) utilized by Cole et al. (2011), project a severe (~90%) decline in the area of suitable climates for Joshua trees by 2070 to 2099, as the southern parts of its range become climatically unsuitable. Cole et al. (2011) also modeled areas where the species could potentially expand its range naturally in the future, as well as areas that might be suitable for relocation or assisted migration. The Cole et al. (2011) study considered the ability of Joshua tree to colonize new areas of potentially suitable habitat, which appears to be very limited.

Barrows and Murphy-Mariscal (2012) constructed a finer-scale model of western Joshua tree's current distribution within and surrounding Joshua Tree National Park, and then assessed the sensitivity of western Joshua tree to a gradient of climate change scenarios. Under the most severe climate scenario modeled (3°C increase in mean July maximum temperature), there was a 90 percent reduction in the current distribution of western Joshua tree in Joshua Tree National Park, but refugium of suitable western Joshua tree habitat still remained. A niche model for juvenile Joshua trees also provides support for the hypothesis that climate change has already had an impact on western Joshua tree recruitment within Joshua Tree National Park.

Similar to Barrows and Murphy-Mariscal (2012), Sweet et al. (2019) sought to identify the existence and extent of potential climate refugia for western Joshua tree within Joshua Tree National Park via species distribution models validated with field data. Sweet et al. (2019) used Joshua tree presence points, a database of nine environmental variables, and end-of-century (2070–2099) greenhouse gas emissions under highly mitigated, moderately mitigated, and unmitigated scenarios. Under highly mitigated and moderately mitigated greenhouse gas emissions scenarios, 18.6 percent and 13.9 percent, respectively, of current occupied western Joshua tree habitat remained as refugia. However, under the unmitigated greenhouse gas emissions scenario, which is closest to current emissions trajectories, suitable habitat for western Joshua tree was almost completely eliminated from Joshua Tree National Park, with only 15 hectares (37 acres), or 0.02 percent of western Joshua tree habitat remaining as refugia. Sweet et al. (2019) also used field data on distribution of juvenile western

Joshua trees (defined as smaller than 60 cm tall) to validate their modeling results as the current recruitment patterns may be foretelling of future changes in the population of western Joshua trees on the landscape.

In addition to the findings of the modeling efforts described above, the Petition presents information from other field studies that document the current impacts of warming, drought, invasive species, fire and other impacts on western Joshua tree survival and recruitment. The convergence of biotic and abiotic factors necessary for western Joshua tree recruitment results in successful establishment of new seedlings just a few times in a century, and the Petition reports that such recruitment has already largely stopped at the drier, lower elevational limits of western Joshua tree's range. Prolonged droughts are projected to occur with greater frequency and intensity over the coming decades and are likely to preclude recruitment across large areas of western Joshua tree's range. The droughts will also likely lead to higher adult mortality, either directly due to temperature and moisture stress or indirectly due to increased herbivory from rodents lacking alternative forage. Western Joshua trees also do not appear to be moving successfully into higher elevations. Where yucca moth population density is low, plants appear to only be reproducing via clonal growth. The areas where western Joshua trees are projected to be most likely to survive increasing temperatures and drying conditions are also at great risk of fire due to the prevalence of invasive grasses that increase the size and severity of fires. The Petition claims that absent protection of habitat and rapid and substantial reductions in greenhouse gas emissions, western Joshua tree will likely be extirpated from all or most of California within 80 years.

In discussing climate change impacts on western Joshua tree as a factor affecting the ability of western Joshua tree to survive and reproduce, the Petition cites Webber (1953), Thompson et al. (1998), Loik et al. (2000), Lenz (2001), Shafer et al. (2001), Pearson and Dawson (2003), Pellmyr and Segraves (2003), Cole et al. (2011), Dole et al. (2003), Godsoe et al. (2008), Fitzpatrick and Hargrove (2009), DeFalco et al. (2010), Barrows and Murphy-Mariscal (2012), Notaro et al. (2012), Reynolds et al. (2012), Esque et al. (2015), Borchert and Defalco (2016), Harrower and Gilbert (2018), Hopkins (2018), St. Clair and Hoines (2018), Sweet et al. (2019).

Habitat Loss to Development

The Petition provides information on impacts to western Joshua tree from habitat loss due to human development, and states that development presents a substantial threat to the species in a significant portion of its range.

The Petition acknowledges that much of western Joshua tree's distribution is on federal land and is therefore protected to some degree from development impacts. 96 percent of the geographic area in which the YUBR North population is located is federal land. 48

percent of the YUBR South population is located on federal land, but over 50 percent of the YUBR South population is on private land (see Figure 1). Western Joshua trees on private land have been the most impacted by human development and face the greatest threats from human development in the future. The cities and towns of Apple Valley, Hesperia, Lancaster, Palmdale, Ridgecrest, Victorville, and Yucca Valley, along with many other smaller communities have been built in western Joshua tree habitat in the YUBR South area, and these areas have grown rapidly in the past decades. Human population growth in these areas and consequent loss of Joshua tree woodlands is expected to continue in the coming decades.

In addition to urban growth, the Petition states that various other forms of human development threaten western Joshua tree habitat in California, including roads, highways, transmission lines, industrial facilities and large and small-scale renewable energy projects, and these developments have resulted in significant western Joshua tree habitat loss.

A possible scenario for western Joshua tree habitat loss due to human development by the year 2095 is presented in the Petition on page 47 as Figure 19. The Petition states that human development has already consumed hundreds of thousands of acres of habitat in the range of western Joshua tree, and that over the coming decades, more than a million additional acres will be destroyed or degraded for housing, roads, energy projects and assorted other development projects. Combined with threats to western Joshua tree under likely climate scenarios, the Petition states that the added loss of habitat and the genetic resiliency and connectivity that habitat provides will further push the species towards extirpation in California.

In discussing habitat loss due to human development and its effects on western Joshua tree survival and reproduction, the Petition cites USFWS (2018) and SCAG (2019).

2. Other Relevant Scientific Information

The Department received additional information on wildfires as a factor affecting the ability of western Joshua tree to survive and reproduce during the Petition Evaluation period pursuant to Fish and Game Code Section 2073.4. The Department received a report that describes a GIS analysis, literature review, and field survey of a 1999 fire area on Edwards Air Force Base to evaluate western Joshua tree survivorship and/or regeneration (USAF 2017a). The report used aerial photography taken in 1992 to count all identifiable western Joshua trees present in two areas prior to the 1999 fire and compared this information with the results of a 2017 field survey that identified all western Joshua trees in these same two areas. This report concludes that Joshua tree populations were stable in the sampled areas of the fire area from 1992 to 2017.

3. Conclusion

The Petition provides a significant amount of scientific information on factors affecting the ability of western Joshua tree to survive and reproduce. The Petition states that climate change is the greatest threat to the continued existence of western Joshua tree, with wildfires, invasive species, habitat loss from human development, and predation as additional contributing factors that collectively threaten the continued viability of the species. The Petition provides sufficient information on factors affecting the ability of western Joshua tree to survive and reproduce for the Department to make the recommendation in Section IV of this Petition Evaluation.

H. Degree and Immediacy of Threat

1. Scientific Information in the Petition

The Petition discusses the degree and immediacy of threats to western Joshua tree on page 48, under the heading “Degree and Immediacy of Threat”. The Petition states that while extirpation is likely decades away, the species is already suffering the impacts of climate change, with recruitment failure and adult mortality at the hotter, lower elevation edges of its range. The Petition states that invasive grass-fueled fires are already impacting populations of western Joshua tree, and half of the habitat refugia area in Joshua Tree National Park (modeled under a moderate global warming scenario) have already burned in recent decades. The Petition claims that impacts from current greenhouse gas emissions will continue for decades to come, with little time remaining to reduce emissions before climate warming drives western Joshua tree to unavoidable functional extinction.

In discussing the degree and immediacy of threats to western Joshua tree, the Petition cites Barrows and Murphy-Mariscal (2012), Harrower and Gilbert (2018), and Sweet et al. (2019). The Petition also references the preceding section of the Petition on pages 20 through 48 under the heading “Factors Affecting Ability to Survive and Reproduce”.

2. Conclusion

Information provided in the Petition suggests that western Joshua tree is already being affected by threats described in the Petition, and these threats are likely to intensify significantly by the end of the century. The Petition provides sufficient information on the degree and immediacy of threat to western Joshua tree for the Department to make the recommendation in Section IV of this Petition Evaluation.

I. Impact of Existing Management Efforts

1. Scientific Information in the Petition

The Petition discusses the impact of existing management efforts for western Joshua tree on pages 48 through 58, under the heading “Inadequacy of Existing Regulatory Mechanisms”, and also discusses the USFWS decision to not list Joshua tree under the federal Endangered Species Act on pages 58 through 62 under the heading “USFWS’s Flawed Endangered Species Act Determination”. The discussion of existing management efforts in the Petition is focused on regulatory mechanisms of government agencies. The Petition states that no existing regulatory mechanisms are currently in place at the international, national, state or local level that adequately address the threats facing western Joshua tree. The Petition goes on to discuss (1) regulatory mechanisms for greenhouse emissions reductions, (2) regulatory mechanisms to protect habitat from invasive species and fire, (3) state and local mechanisms to protect habitat from loss and degradation, and (4) federal mechanisms to protect habitat from loss and degradation. Information presented in the Petition for each of these will be discussed separately below.

Regulatory Mechanisms for Greenhouse Emissions Reductions

The Petition states that climate change is the greatest threat to the continued existence of western Joshua tree, and that the species cannot be saved absent global action to reduce greenhouse gas emissions. The Petition states that the United States has contributed more to climate change than any other country, and highlights recent rollbacks of federal climate policy. The Petition states that both domestically and globally, government policies, commitments and actions to avoid the worst impacts of climate change are inadequate, and that trends will lead to temperatures that are incompatible with reproduction and survival of western Joshua tree in its current range.

In discussing regulatory mechanisms for greenhouse emissions reductions, the Petition cites Rogelj et al. (2015), USEIA (2016a, 2016b), Erikson et al. (2017), Le Quéré et al. (2018), USGCRP (2018), CAT (2019), DiChristopher (2019), and OCI (2019).

Regulatory Mechanisms to Protect Habitat from Invasive Species and Fire

The Petition states that, to date, no legal, regulatory or management efforts have demonstrated effectiveness at addressing the severe threat that invasive plant species and consequent altered fire regimes pose to western Joshua trees. Immediate suppression of fires in western Joshua tree habitat can limit the spread of fires, but protection of the species from fire ultimately requires invasive plant species management to reduce fuel load. The Petition states that the spread and abundance of

invasive plant species are linked to both disturbance (e.g. roads, off road vehicles, cows, and urbanization) and nitrogen deposition, and therefore each of these contributing factors needs to be addressed. Although disturbance is limited in national parks, U.S. Bureau of Land Management (BLM), military, and private lands that compose the majority of western Joshua tree's range are often disturbed by projects and activities. It is also unlikely that nitrogen deposition will be adequately reduced throughout the range of western Joshua tree for at least several decades, if ever. The Petition states that even if disturbance and nitrogen deposition are reduced and the further spread of invasive species can be curtailed, no fully-effective treatments currently exist to reduce or eliminate the most harmful invasive plant species (e.g. *Bromus* spp., *Schismus* spp., *Erodium cicutarium*, *Brassica tournefortii*) that have already become established at a landscape scale in the range of western Joshua tree.

In discussing regulatory mechanisms to protect habitat from invasive species and fire, the Petition cites Brooks and Berry (2006), Allen et al. (2009), Allen et al. (2011), Pardo et al. (2011), Bytnerowicz et al. (2016), Brooks et al. (2018), USFWS (2018), BLM (2019), Sweet et al. (2019).

State and Local Mechanisms to Protect Habitat from Loss and Degradation

The Petition states that western Joshua tree stands to lose more than a third of its suitable habitat in California due to development over the coming decades, including over 40 percent of its habitat in the YUBR South region. Lands owned by the State of California make up less than one percent of western Joshua tree's range in the state, and the Petition states that protection of these lands alone is unlikely to prevent the decline and eventual extirpation of western Joshua tree.

The Petition discusses provisions of the California Desert Native Plants Act, which regulates commercial harvest of western Joshua tree. Commercial harvest was once considered a great threat to western Joshua tree and other desert plants. The Petition states that the California Desert Native Plants Act and various local laws and ordinances were ultimately passed to address this threat. These measures have been largely effective at reducing the commercial harvest of western Joshua tree, but have done little to slow the loss of western Joshua tree habitat from agricultural conversation and other human development. The Petition cites the California Fish and Game Commission's 2015 California Policy for Native Plants.

The Petition discusses the California Environmental Quality Act (CEQA). The Petition states that western Joshua tree is not a species of special concern or a candidate, threatened, or endangered species under CEQA, and therefore a project that has the potential to impact the species would not necessarily qualify as having a "significant

effect" under a lead agency's interpretation of CEQA. The Petition identifies other limitations in the ability of CEQA to protect western Joshua tree habitat from loss and degradation and concludes that CEQA, in practice, is inadequate to protect western Joshua tree.

The Petition discusses the Natural Community Conservation Planning Act but states that there are no finalized Natural Community Conservation Plans (NCCPs) that cover western Joshua tree. The Petition states that NCCPs may in the future provide some conservation benefit for western Joshua tree, but have not done so to date and consequently cannot be considered as providing adequate protection in lieu of CESA listing.

In discussing state and local mechanisms to protect western Joshua tree habitat from loss and degradation, the Petition cites Harrower and Gilbert 2018, USFWS 2018, and several state and local laws and regulations.

Federal Mechanisms to Protect Habitat from Loss and Degradation

The Petition states that management laws and plans governing federal lands are the primary federal regulatory mechanism with the potential to protect western Joshua trees. Almost all suitable habitat for YUBR North and about half of suitable habitat for YUBR South is on federal land. Consequently, management of these lands has an important role in determining the continued viability of western Joshua trees in California.

The Petition states that approximately ten percent of western Joshua tree habitat is on National Park Service lands that are generally well-managed, which should prevent significant habitat loss or degradation from activities such as off-road vehicle use, cattle grazing, road building or other forms of development. Approximately 12 percent of the mapped distribution of the YUBR South population falls within military installations and a roughly comparable amount of the YUBR North population falls within such lands. The Petition states that Integrated Natural Resource Management Plans for military installations incorporate some avoidance and minimization measures that could reduce impacts to western Joshua tree, but these measures largely consist of avoidance where feasible and transplantation when conflicts are unavoidable.

The majority of western Joshua tree habitat on federal lands is on BLM land, which is governed by BLM's California Desert Conservation Area (CDCA) Plan. The Northern and Eastern Mojave Plan and West Mojave Plan are amendments to the CDCA Plan that cover the California range of western Joshua tree. The 2016 Desert Renewable Energy Conservation Plan (DRECP) amendments also cover the entirety of western Joshua tree's range in California. The Petition states that these plans do not provide adequate protection for western Joshua tree because the species is not addressed in

the plans, the plans include weak or nonexistent avoidance and conservation measures, and/or the plans include activities that will actively degrade western Joshua tree habitat.

In discussing federal mechanisms to protect western Joshua tree habitat from loss and degradation the Petition cites BLM (2002, 2006, 2016, 2019), NPS (2012), USFWS (2018), and additional federal laws, regulations, and reports.

2. Conclusion

The Petition describes the limitations of existing regulatory mechanisms as they relate to the factors affecting the ability of western Joshua tree to survive and reproduce. The Petition provides sufficient information on the impact of existing management efforts on western Joshua tree for the Department to make the recommendation in Section IV of this Petition Evaluation.

J. Suggestions for Future Management

1. Scientific Information in the Petition

The Petition provides suggestions for future management of western Joshua tree on pages 64 through 65, under the heading “Recommended Management and Recovery Actions”. The Petition states that the most important recovery actions for western Joshua tree are those that lead to rapid and steep greenhouse gas emission reductions to minimize the additional warming that will occur in the climate system. The Petition also provides a list of ten additional recommendations for management and recovery of western Joshua tree. These additional recommendations include (1) declaration of a climate emergency and full decarbonization of California’s economy by 2045, (2) preparation of a state recovery plan for the species, (3) development of NCCPs, (4) management plans for western Joshua tree on California Department of Parks and Recreation land, (5) expansion and connection of existing state parks for protection and restoration of Joshua tree habitat, (6) expansion of cooperative work with federal agencies, (7) development of effective measures to control the spread of invasive grasses, (8) development of protocols for fire suppression activities that minimize ground disturbance and spread of invasive species, (9) establishment and maintenance of a western Joshua tree seed bank, and (10) assisted migration activities.

2. Conclusion

The Petition provides several suggestions for future management of western Joshua tree, although some of the suggestions are not within the Department’s jurisdiction. The Petition provides sufficient suggestions for future management of western Joshua tree for the Department to make the recommendation in Section IV of this Petition Evaluation.

K. Detailed Distribution Map

1. Scientific Information in the Petition

A distribution map is provided as Figure 8 on page 17 of the Petition. This distribution map was prepared by USFWS (2018) and includes a representation of the distribution of both western Joshua tree and eastern Joshua tree. This map has been duplicated as Figure 1 in this Petition Evaluation.

2. Other Relevant Scientific Information

As described in Section III(B)(2) of this Petition Evaluation, the Department possesses vegetation maps that cover a large portion of the California deserts where western Joshua tree occurs, and these maps may contribute to a relatively high-resolution western Joshua tree distribution map in many areas of California. These vegetation maps are likely to improve the current understanding of western Joshua tree's distribution.

3. Conclusion

The Petition provides a western Joshua tree distribution map that is sufficient for the Department to make the recommendation in Section IV of this Petition Evaluation.

L. Sources and Availability of Information

1. Scientific Information in the Petition

The Petition cites 114 scientific and administrative documents on pages 66 through 75, under the heading "References Cited". The Petitioner provided digital copies of these documents to the Commission, and they have been made available to the Department.

2. Other Relevant Scientific Information

The Department used additional sources of scientific information cited in this Petition Evaluation. The Department also received additional comments and information on the petitioned action from Mr. Robert R. Brown, Jr. and Mr. Larry Zimmerman, and these additional comments and information have been included as Attachment 1 to this Petition Evaluation.

3. Conclusion

The Petition provides sufficient information on the sources and availability of information used in the Petition for the Department to make the recommendation in Section IV of

this Petition Evaluation.

IV. RECOMMENDATION TO THE COMMISSION

Pursuant to Section 2073.5 of the Fish and Game Code, the Department has evaluated the Petition on its face and in relation to other relevant information the Department possesses or received. In completing its Petition Evaluation, the Department has determined there is sufficient scientific information to indicate that the petitioned action for western Joshua tree may be warranted. Therefore, the Department recommends the Commission accept the Petition for further consideration under CESA.

V. LITERATURE CITED

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APPENDIX 1: INFORMATION SUBMITTED TO THE DEPARTMENT

BEFORE THE CALIFORNIA FISH AND GAME COMMISSION

Concerned Citizen Comments regarding:

A Petition to List the Western Joshua Tree *(Yucca brevifolia)* as Threatened under the California Endangered Species Act (CESA)

Notice of Comment

Regarding The Center for Biological Diversity (Petitioner) request for action pursuant to Section 670.1, Title 14, California Code of Regulations (CCR) and Division 3, Chapter 1.5, Article 2 of the California Fish and Game Code (Sections 2070 *et seq*.) relating to listing and delisting endangered and threatened species of plants and animals.

I. SPECIES OF COMMENTS:

Species Name: Western Joshua tree (*Yucca brevifolia*) as either a full species, or as the subspecies *Yucca brevifolia brevifolia.*

II. RECOMMENDED ACTION: Do Not List as Threatened

The Center for Biological Diversity (Petitioner) submitted a petition to list the western Joshua tree (*Yucca brevifolia*) as Threatened pursuant to the California Endangered Species Act (California Fish and Game Code §§ 2050 et seq., "CESA").

These Comments demonstrate that the western Joshua tree is not eligible for and does not warrant listing under CESA based on the factors specified in the statute and implementing regulations.

- Petitioner recognized that the western Joshua tree is not *presently threatened with extinction*.
- Petitioner failed to demonstrate that the western Joshua tree "…is likely to become an endangered species in the foreseeable future in the absence of the special protection and management efforts . . ." Cal. Fish & Game Code § 2067.
- Petitioner failed to demonstrate *whether either of the two population clusters of the species (denoted as Y. brevifolia North [YUBR North] and Y. brevifolia South [YUBR South] in the petition) separately warrant listing as ecologically significant units (ESUs).*

The California Fish and Game Commission can review Joshua Trees under a normal budgetary and planning process if desired. The California Fish and Game Commission can review YUBR north and YUBR South as ESUs under a normal budgetary and planning process if desired.

III. Author of Comments

Robert R Brown Jr.
[redacted]

As a Concerned Citizen reviewing expert literature, these Comments make sense.

Table of Contents

Executive Summary

Documents
Joshua Tree Species Status Assessment (SSA) by the USFWS & A Petition to List the Western Joshua Tree (Petition) by the Center for Biological Diversity (Petitioner) were reviewed.

Habitat loss due to development
Per the SSA, developable lands only overlap 2% of YUBR South with little development in YUBR North. Developable lands typically have protection laws.

Habitat loss due to development is not likely to affect the Joshua Tree *at a population or species level.*

Climate Change
Petitioner claims that Climate Change, particularly rising temperatures, threatens the Joshua Tree. The highest temperature for raising trees in the lab is 113° F.

A review of NOAA graphs shows temperatures pausing from rising Climate Model predictions. Sample temperature lists within YUBR South show infrequent days of 113° F.

Habitat temperature records do not project an imminent threat to Joshua Trees.
National precipitation records do not project an imminent threat to Joshua Trees.

Wildfires
Lightning caused fires create loss of habitat plus destruction of the Joshua Tree locally.

Man-made fires can be minimized along roads. Man-made wilderness fires can be reduced with education.

National Park wildfire management will contribute to continued loss of Joshua Trees along with their habitat.

Wildfires do not pose a threat to the Joshua Tree at a population or specie level.

Grazing
Both the SSA and Petition speak of habitat loss due to grazing. Worldwide, the densest forest of Joshua Trees happens in YUJA Central with over a century of cattle grazing. Other herbivores include mule deer, bighorn sheep, and rabbit.

Grazing can benefit rather than pose an imminent threat to the Joshua Tree.

Conclusion

Petitioner recognizes that the western Joshua Tree is not threatened. Further, the Petitioner has failed to demonstrate that the western Joshua Tree is facing imminent threat.

CADFG must avoid an unnecessary listing of the western Joshua Tree as imminently threatened. A large percentage of developable lands would be subject to environmental shakedown lawsuits.

The USFWS and good science reject a listing of the western Joshua Tree as imminently threatened.

SSA: https://www.researchgate.net/publication/335600680_Joshua_Tree_Species_Status_Assessment/link/5d6f3f02299bf16522f32097/download
Petition: https://www.biologicaldiversity.org/species/plants/pdfs/CESA-petition-Western-Joshua-Tree-10-15-19.pdf

Development

Petitioner recognizes that the western Joshua Tree is not threatened but maintains that someday it might be threatened. Petitioner cites human population growth to cause habitat loss. Further, Petitioner wants to establish the geographies of YUBR North and YUBR South as ESUs.

YUBR North is 96% federally owned. YUBR South is approximately half under California jurisdiction. Only 2% of habitat is affected by community development.

A petition that the Joshua Tree may be imminently threatened in 75 years due to housing development has been made to the CADFG. The CESA need not be applied in this manner and is not needed.

Petitioner also wants YUBR North and South to be ESUs under California law. California law would affect about 4% of YUBR North territory and only about half of YUBR South. These efforts would place unnecessary but severe constraints on California development.

Worse, much of YUBR South habitat does not contain Joshua Trees. A request for development of a parcel within YUBR South would be subject to the geography related to Joshua Trees rather than a physical Joshua Tree.

Cities and towns within YUBR South have already enacted planning protections for the Joshua Tree. Their Counties can provide guidance.

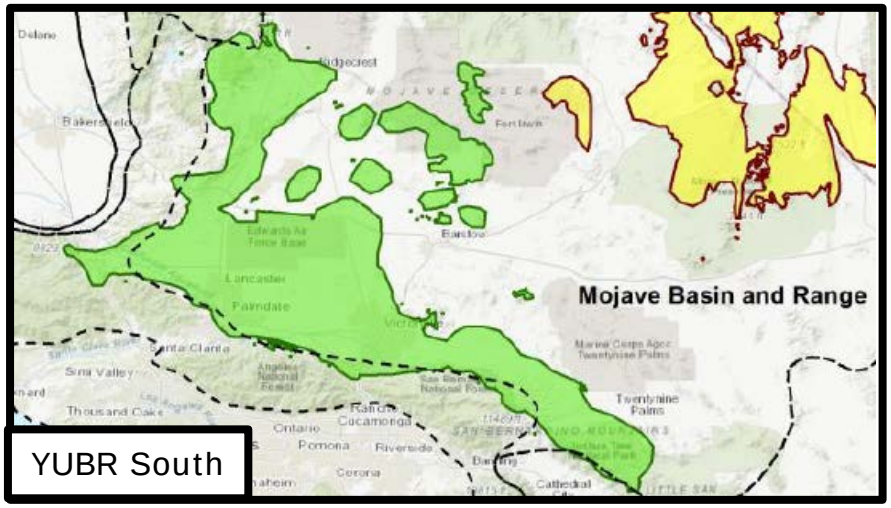
The gravity of unnecessarily listing a specie or geography designation must be weighed by the CADFG. During any development process this will add a step or checkoff.

Frequently these checkoffs will require mitigation even if a Joshua Tree is not on the property. Someday a Joshua Tree may want to live on that property.

One mitigation to continue a project involves paying an environmentally sensitive entity for the permission to continue. A payoff of this form amounts to a shakedown.

Another mitigation involves buying lands for a land flipper exchange to the federal government as habitat acreage. California effectively loses jurisdiction.

A CESA imminently threatened status for the Joshua Tree in these communities is harmful. ESU status for YUBR North and YUBR South is harmful.



FWS-R8-ES-2016-0088-0029 partial of Figure 4 map by Tony Mckinney

Joshua Tree protection can be mitigated in urban environments. However, a bogus listing as threatened would increase environmental lawsuits[1] plus nuisance and predatory lawsuits. Unnecessary threatened status would discourage development in small desert towns with complex but fragile economic systems. At worst, the legal and financial constraints could lead to primate colony collapse – Ghost Towns.

The Joshua Tree adapts well to residential, commercial, and industrial properties.

These photos are of properties in Yucca Valley.[2]

1. Center for Biological Diversity v. Town of Yucca Valley
2. History of Joshua Trees in sample views not researched.

Google Earth

Climate Change

Petitioner maintains that higher Climate Change (temp) and lower Climate Change (precip) requires the CADFG to list the western Joshua Tree as imminently threatened. Trends of temp in YUBR South and national precipitation do not support a listing.

A *Winter 2019 US Temperature Outlook* (p8) predicts warmer temperatures in the Mojave. Fall temperatures are making new lows nationally.

A high bump up of temperatures in the 1930s decade was refined-removed out of the NASA US temperature graph (p9). Following this warm bump, young Joshua Tree recruitment into the population was greatest. NASA has moved the warm bump to present, suggesting another good recruitment possibility to follow.

Models of global temperatures continue to predict much higher temperatures. Observed temperatures refined upward, still tag below the catastrophic models (p10).

113° F for extended periods stress the Joshua Tree. In YUBR South for the past 20 years, Victorville only had 9 days of short term spikes (p11). This YUBR South sample remained remarkably stable – not supporting a western Joshua Tree listing as imminently threatened.

California experienced a short term drought for several years. In 2018 drought conditions ceased. National trends for precipitation started climbing in the 1930s (p12).

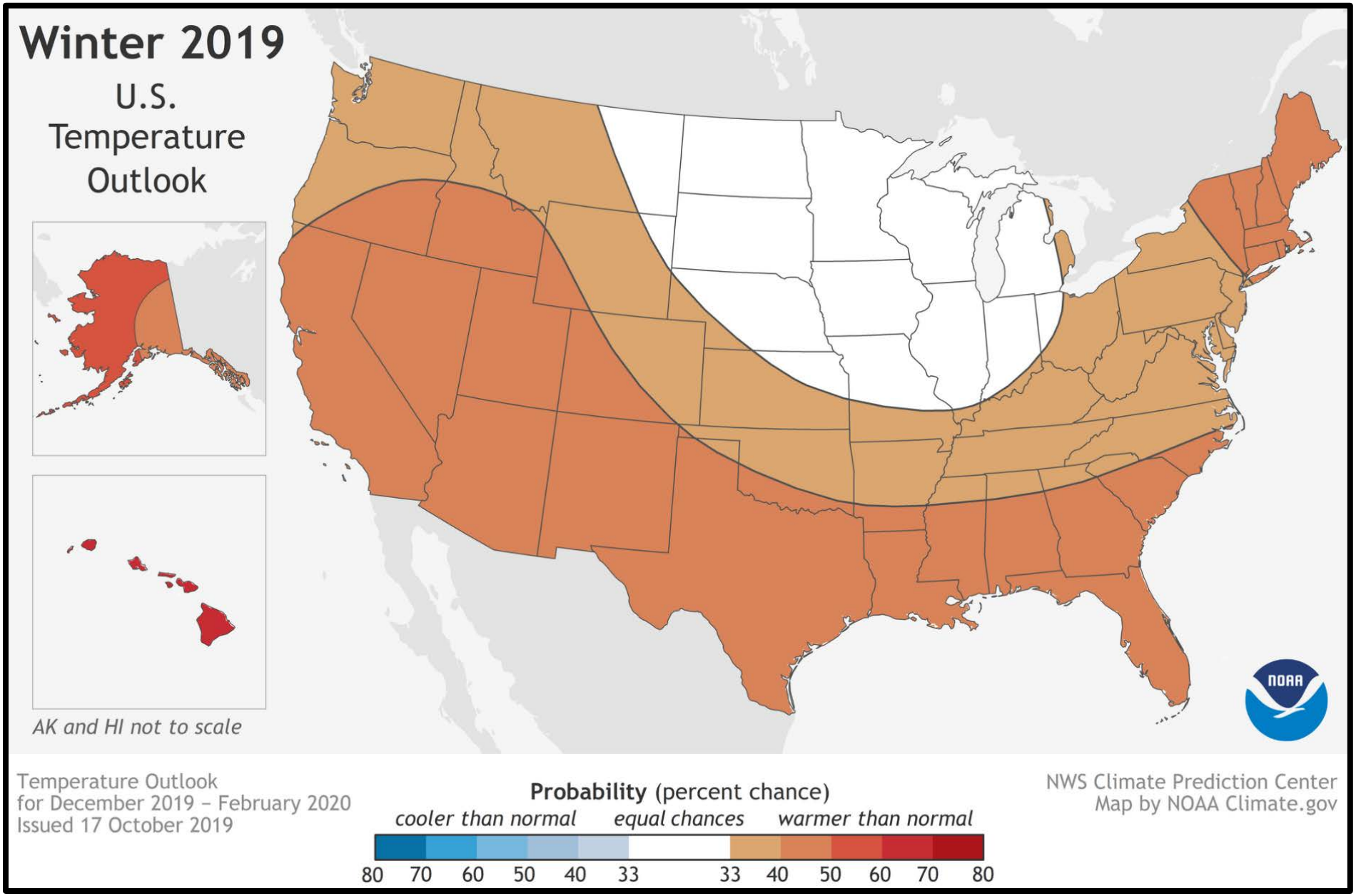
The CADFG is encouraged to review independent references prior to making a listing decision. The USFWS found that stressors to the Joshua Tree did not imminently threaten at a specie or population level.

Much of the Joshua Tree population resides on federal land. An unnecessary listing of the Joshua Tree as threatened under the CESA would only affect a subset of the population at best.

Congress may *make all needful Rules and Regulations respecting the Territory or other Property belonging to the United States.* At the national level, good science does not require a listing.

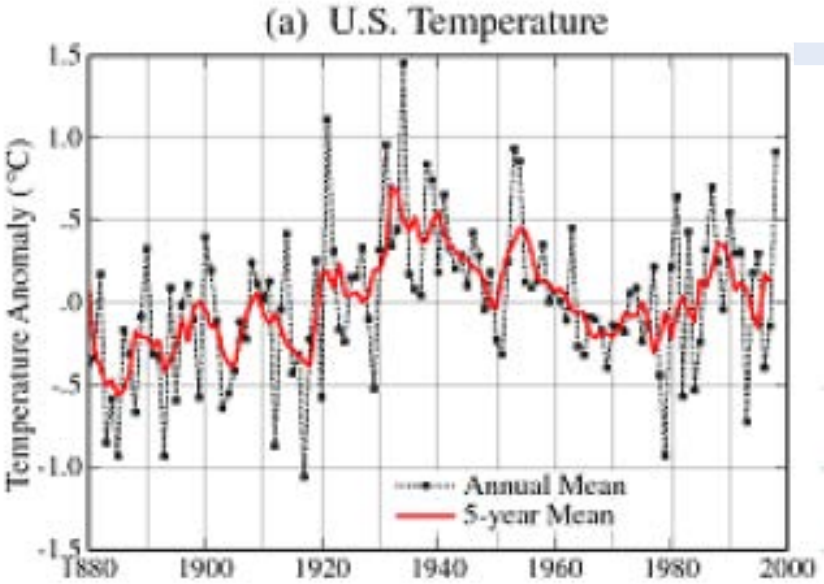
California should reject a listing of the western Joshua Tree as imminently threatened.

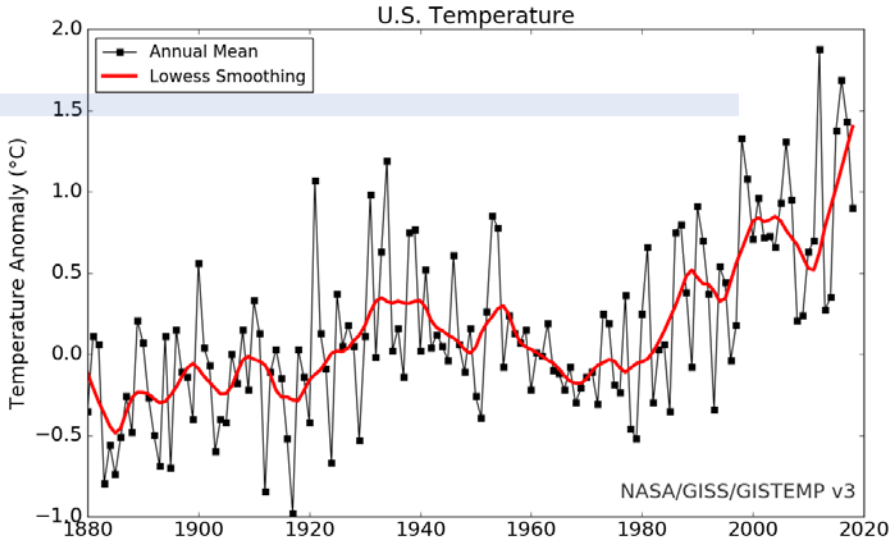
https://www.usgs.gov/media/galleries/geology-joshua-tree-national-park-gallery

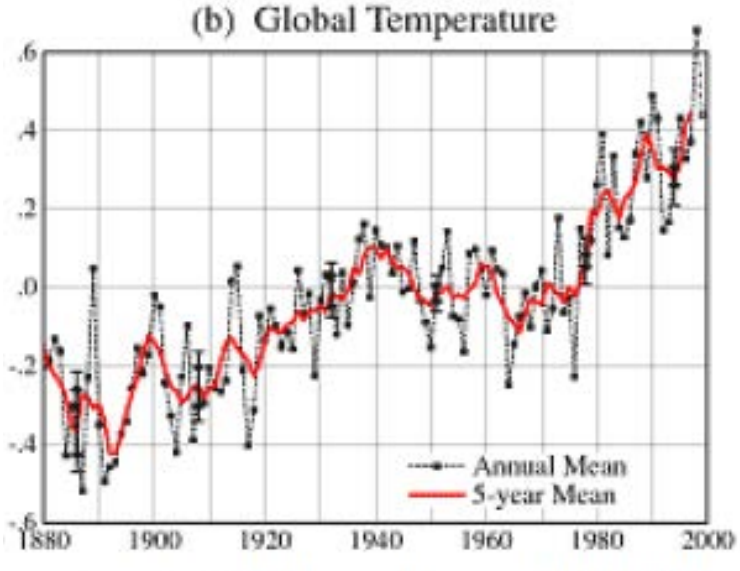


This map by NOAA suggest an over 50% probability that this winter will be warmer than normal for Joshua Tree habitat. Just 14 days later the Continental US recorded its coldest October in history. CADFG is encouraged to look at recorded temperature lists rather than “someday it might be warmer.”

Map: https://www.noaa.gov/media-release/winter-outlook-warmer-than-average-for-many-wetter-in-north







NASA temperature records of the US have been adjusted scientifically from the graph at upper left to the graph at upper right.

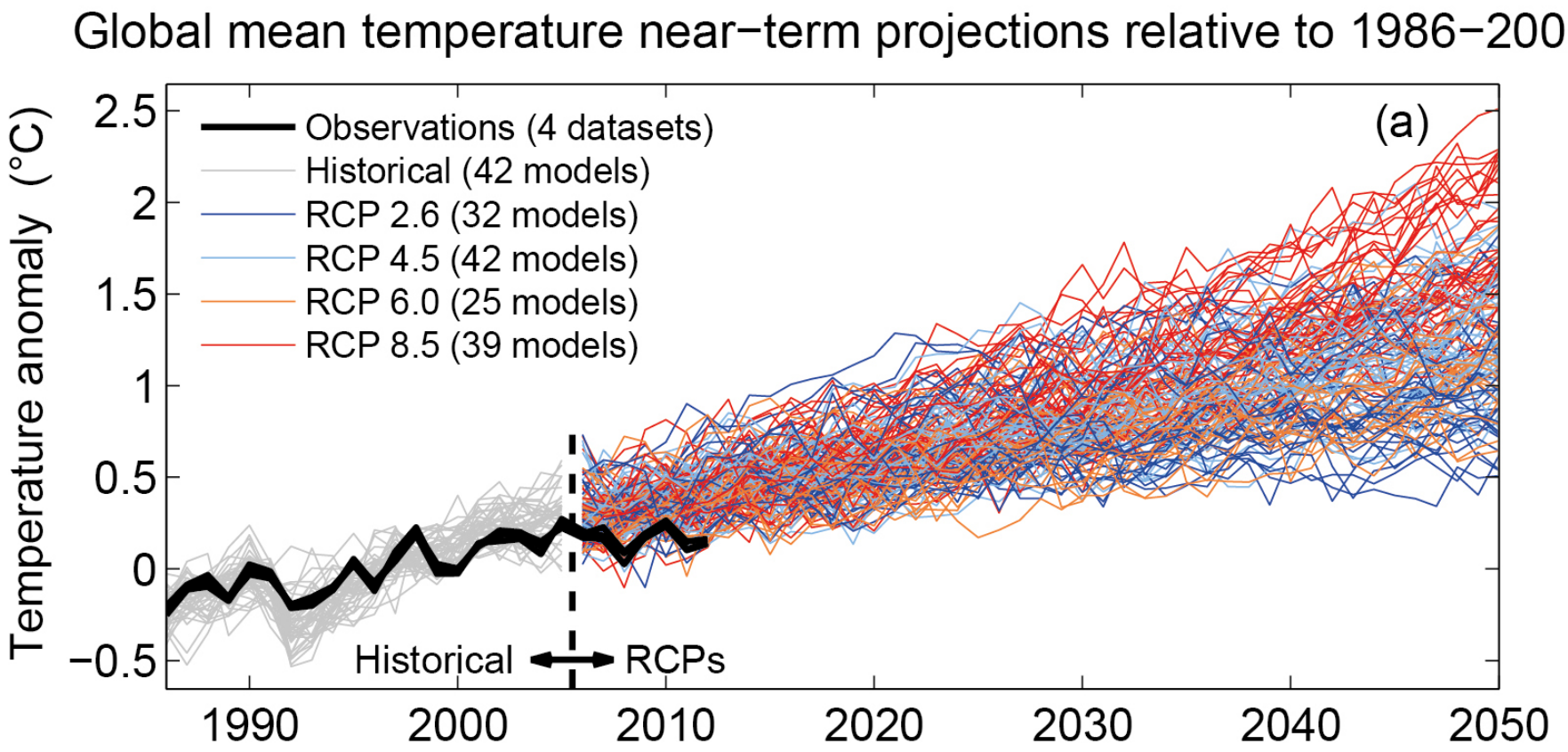
Prior to 1999 the 30s were clearly the warmest decade on record. The 2019 graph at upper right adjusts the 30s down and the 90s up. Now 1999 exceeds the peak warmth of the 30s.

The US record now conforms more closely to the Global Temperature graph at lower right.

Upper Left graph: Hansen et al (1999) https://www.giss.nasa.gov/research/briefs/hansen_07/

Upper Right graph: https://data.giss.nasa.gov/gistemp/graphs_v3/graph_data/U.S._Temperature/graph.png

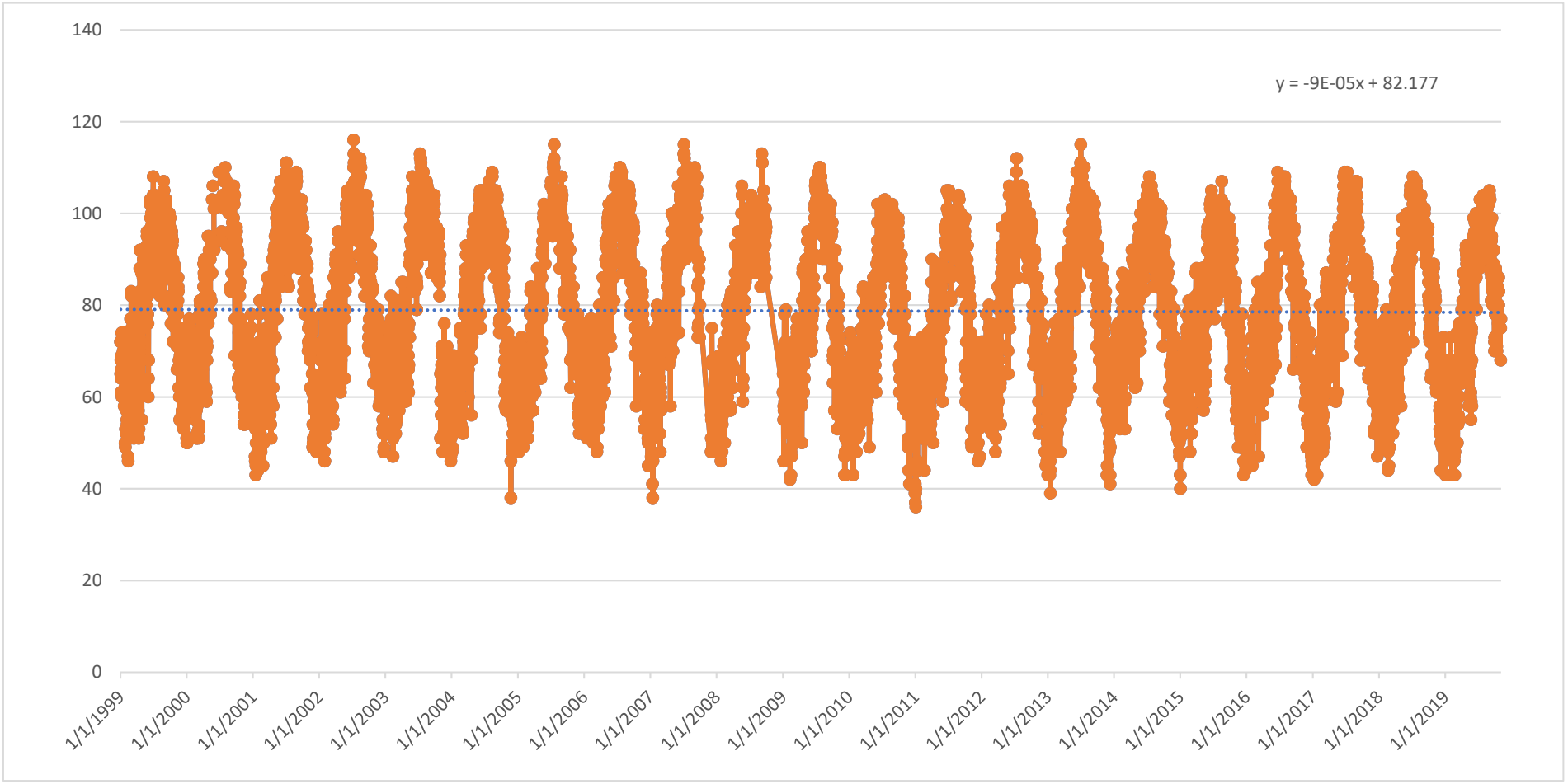
Lower Right graph: Hansen et al (1999) https://www.giss.nasa.gov/research/briefs/hansen_07/



From IPPC AR5 Climate Change Report

This graph shows temperatures scientifically adjusted upward, still tag along at the bottom of climate models. World-wide measured temperatures show little reason for assuming catastrophic warming. Joshua Tree habitat measured temperatures, adjusted upward, also show little reason to believe the Joshua Tree faces imminent threat.

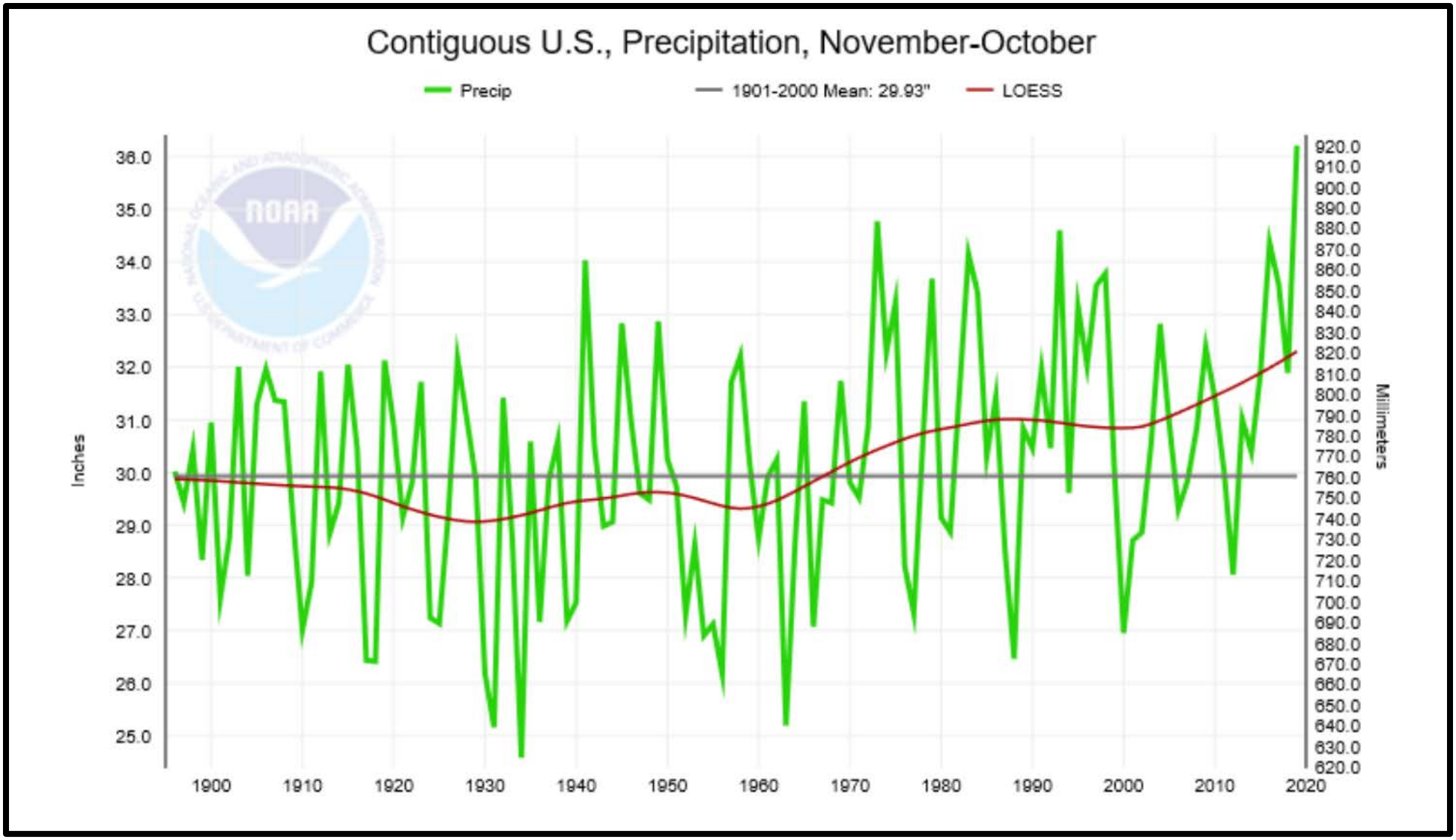
https://www.ipcc.ch/site/assets/uploads/2018/02/Fig11-25-1.jpg



Graph of Victorville TMAX temperatures for the past twenty years shows only nine days at 113 degrees or above. Flat to slightly negative down trending numbers; other sites showed zero to two days at 113 degrees or above. Temperature lists downloaded from https://www.ncdc.noaa.gov/cdo-web/search

Twenty Years YUBR South

Station	Station ID	above 113	Elevation ft
Joshua Tree National Park	GHCND:USR0000CLHO	0	4200
Yucca Valley	GHCND:USR0000CYUC	0	3260
Victorville	GHCND:USC00049325	9	2880
Palmdale	GHCND:USW00023182	2	2524



Although California went through drought years, the US has seen rising precipitation in general. The California drought ended in 2018. The Joshua Tree is not facing imminent threat from precipitation.

https://www.ncdc.noaa.gov/cag/national/time-series/110/pcp/12/10/1895-2019?base_prd=true&begbaseyear=1901&endbaseyear=2000&filter=true&filterType=loess

Wildfire

Nationally wildfire acreage has decreased from the 1930s (p14). Since 1983 when records were refined acreage has increased to leveling off this last decade.

Wildfires can be especially damaging to young Joshua Trees. The SSA states that fire return level for the trees can be greater than 300 – 500 years.

Both the USFWS and Petitioner recognized non-native grasses increasing the frequency and size of wildfires affecting the Joshua Tree. Other factors include a wet year followed by the common dry season as increasing the fuel load of all grasses.

Seasonal summer lightning also influences wildfires on a regular basis.

Man has increased the fire season to year round. Electric Utilities increase wildfires. Much effort is underway to reduce the risk.

Some studies note a Fourth of July spike. Petitioner noted that transportation corridors can be seen on wildfire maps.

Another problem less noted involves NPS wildfire management. The Mojave Preserve issued a Fire Plan in 2004. The very next year dry lightning burned over 70 thousand acres in the Preserve.

Parts of the Preserve have a no-grazing and active fire suppression policy. Some of the wildlands fall under a wildland fire use. Wildlands typically do not have active fire suppression, no retardant, and no grazing (p15).

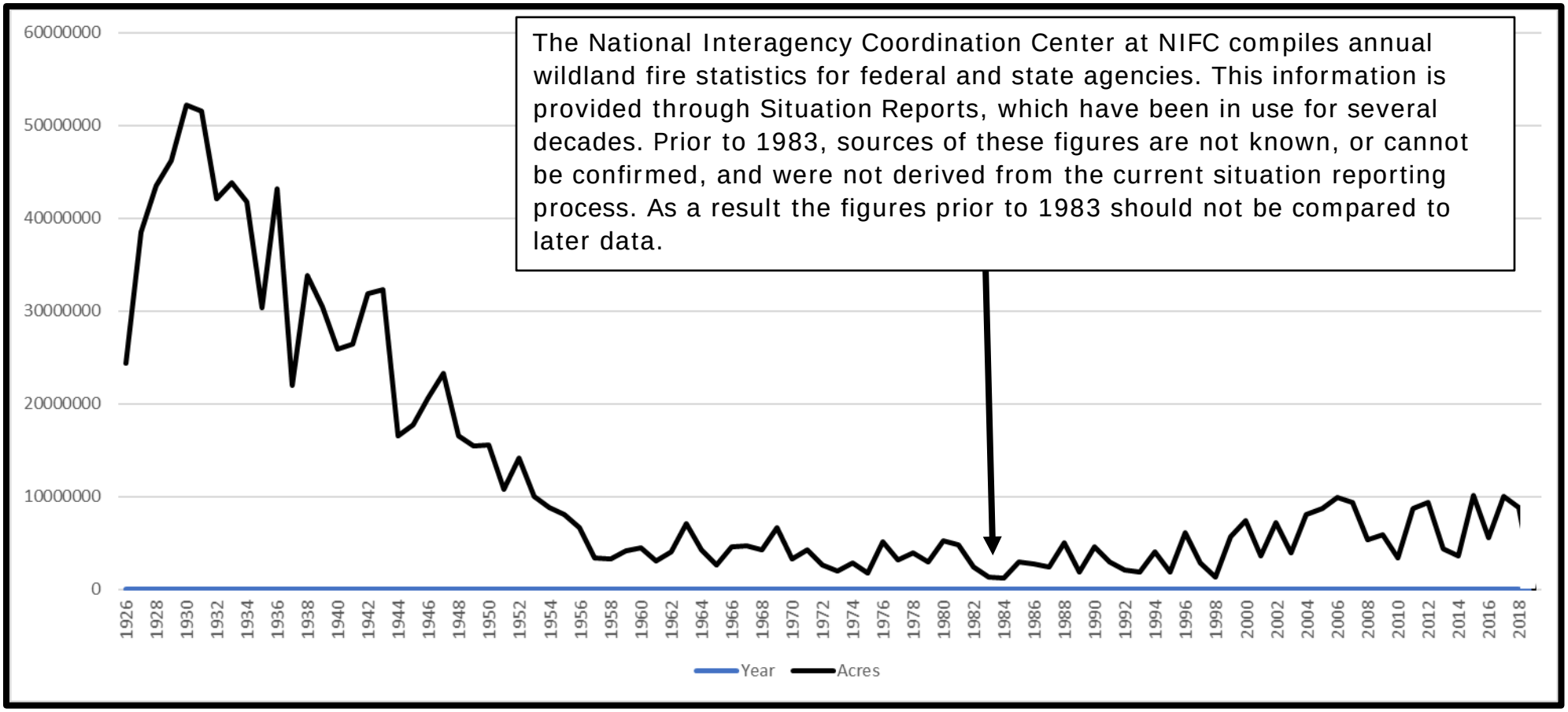
The start of the Hackberry Complex of fires coincides with a wildland fire use strategy (p16). Lore has it that a resident did a fire drop to save a home; the NPS threatened the resident with prison.

Not limited to the Preserve, transportation corridors can be a risk to the Joshua Tree. As shown (p17) Joshua Tree acreage burned along the Morningstar Mine Road. For fires that start along these corridors, a buffer zone of reduced fuel load would greatly reduce the risk.

Petitioner considers grazing as a threat to Joshua Trees. The USFWS remained nearly neutral. Substantial documentation can be found where the soils, plants, fire suppression and other animals benefit (p18).

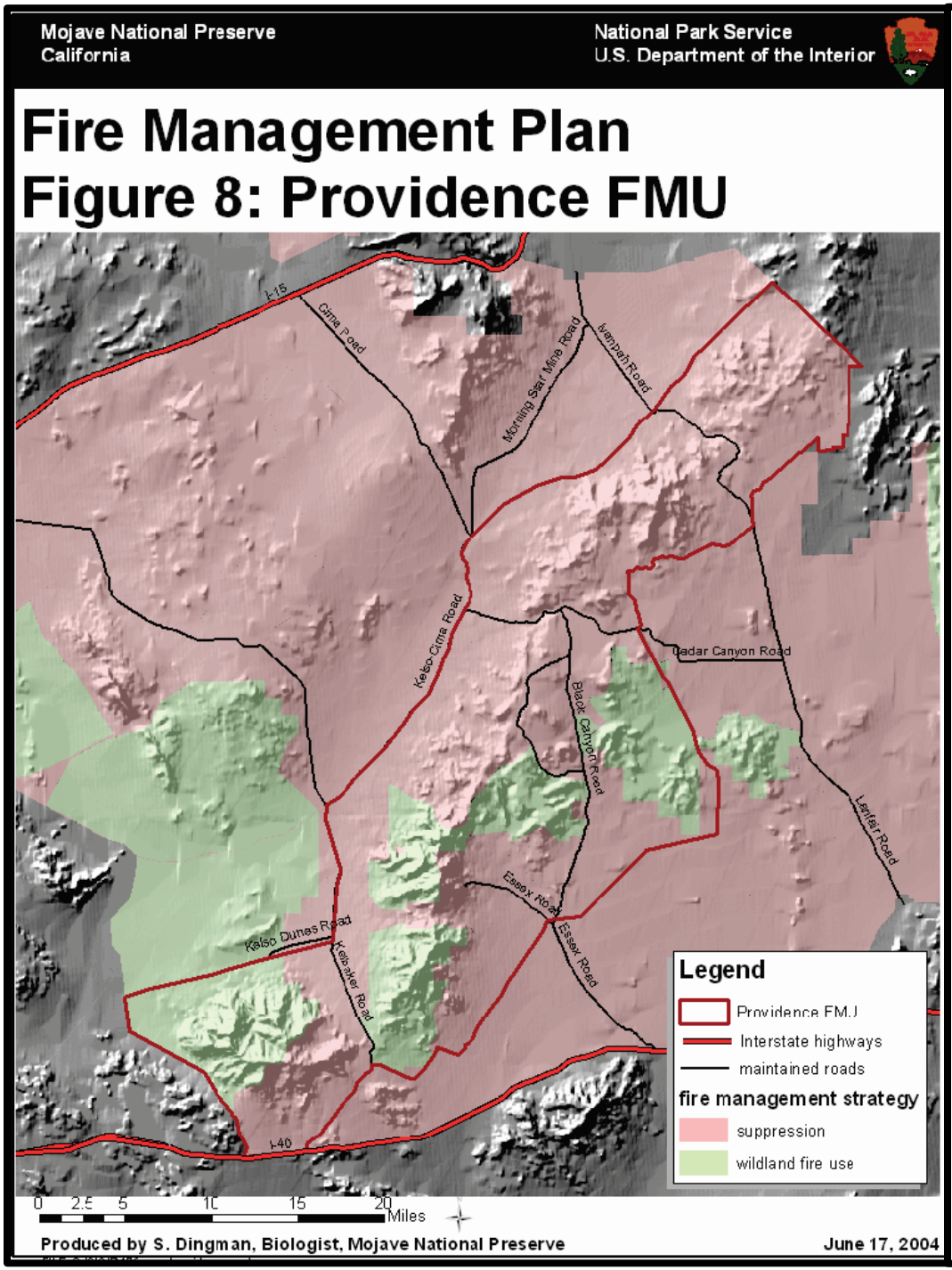
Much of the Joshua Tree habitat is government owned. Management within National Parks, wilderness areas, BLM lands and transportation corridors can leave behind old biases to reduce fire.

Wildfire management can greatly reduce Joshua Tree loss and habitat loss. An imminently threatened listing is not needed under the CESA.



Total Wildland Fire Acreage (1926-2018) Data plotted from table to Excel:

https://www.nifc.gov/fireInfo/fireInfo_stats_totalFires.html



The Providence Fire Management Unit is south of Cima.

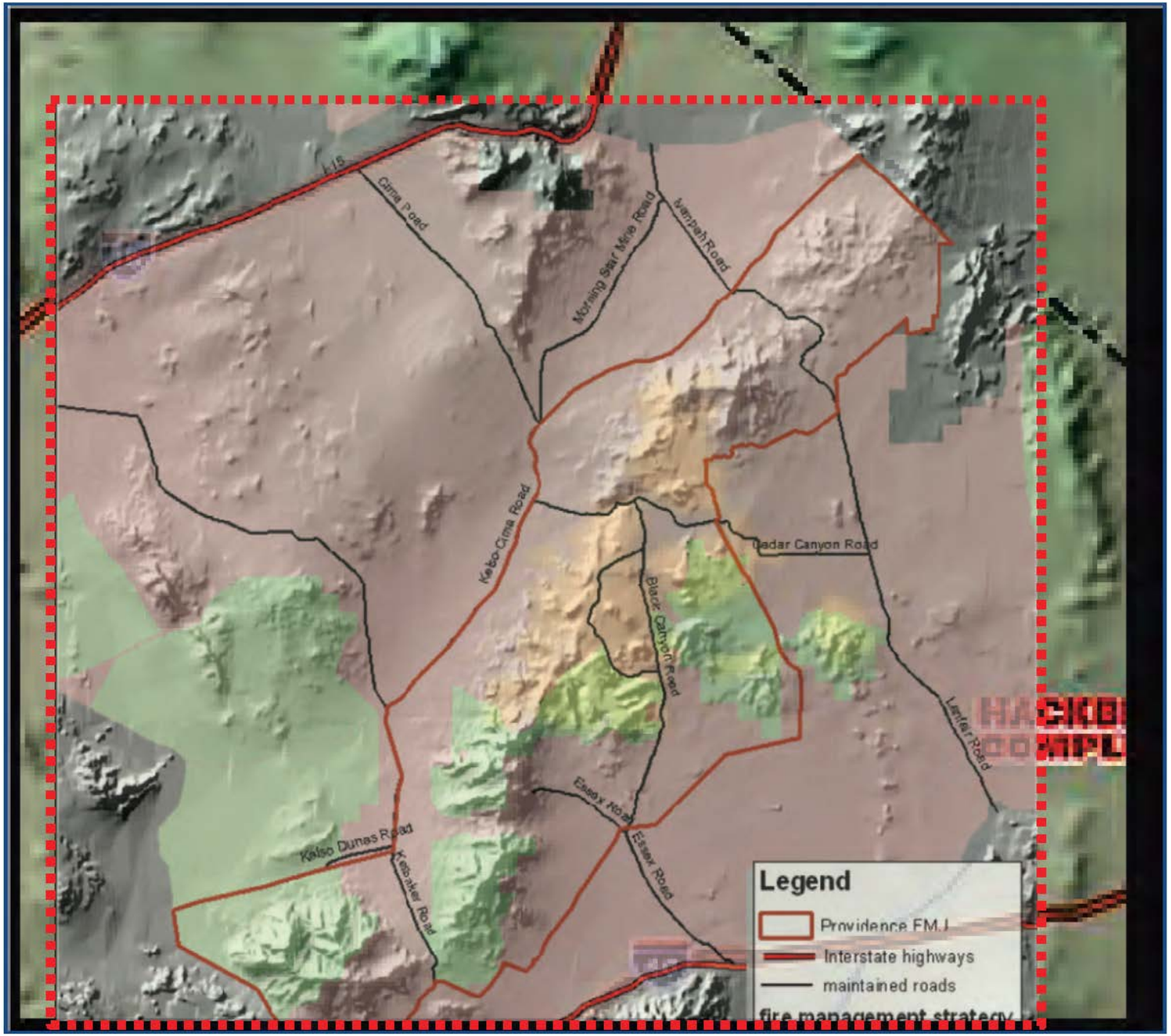
Mojave Preserve strategy for these lands consists of no-grazing and active fire suppression. Wildland fires are left to burn.

State wide concern has grown that this policy results in dangerous accumulations of underbrush.

Following the Hackberry Complex of fires, local residents expressed outrage over NPS policies and fire suppression capability.

Many residents lost everything. An on-site water supply helped one resident. From the Fire Management Plan:

4) Fire regime alteration: Over a century of continuous cattle grazing may have altered the vegetation community structure in the lower elevations of this unit, favoring the establishment of shrubs. In turn, an increased number of shrubs provide more “nurse plants” required for Joshua tree seedling establishment. Research is underway to assess the current vegetation communities within the Preserve and to measure changes over time that may result from the removal of livestock grazing. While the structure and composition of the vegetation types within this unit is believed to have been modified, there is no mutual agreement that the fire regime has changed as well.



Providence FMU superimposed over Hackberry Complex fire map. Early start of fire area coincides with wilderness fire management strategy in green.

Petitioner's Report documents fires along transportation corridors between 1990-2010.

Above is shown 2019 fire damage in the Mojave Preserve along the Morningstar Mine Road north of Cima.

Grazing

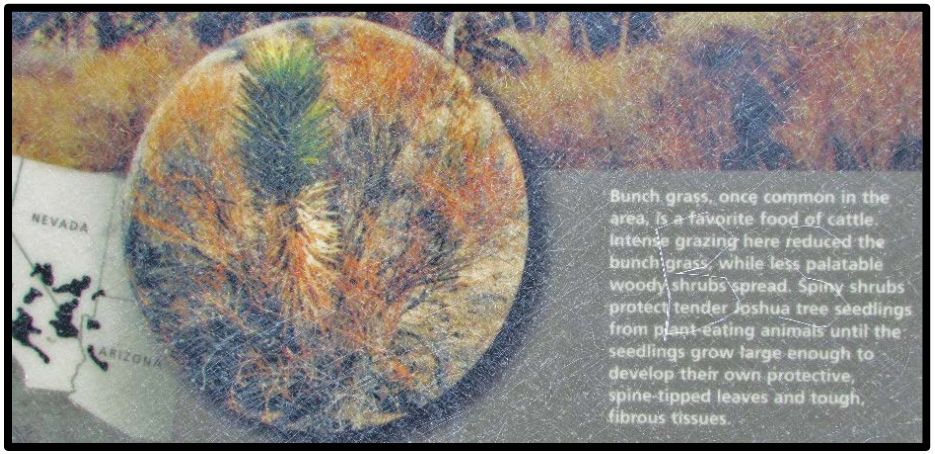
Frequently considered a nuisance, grazing can offer substantial benefits to the Joshua Tree, the desert tortoise, and wildfire protection.

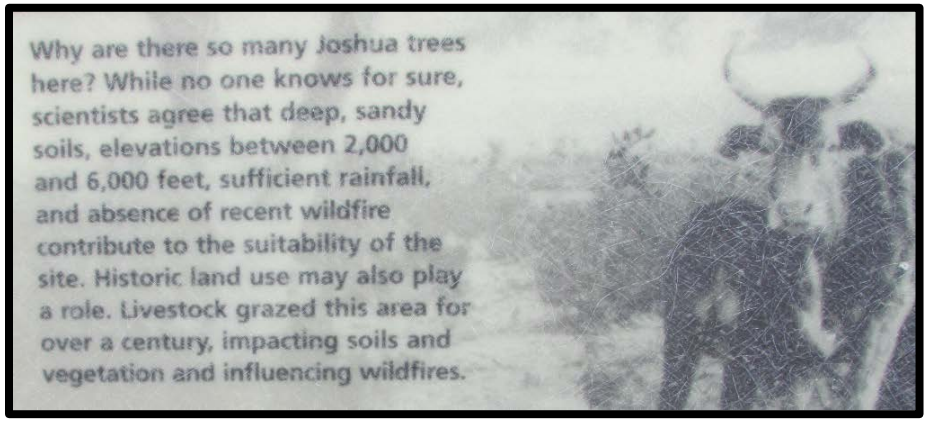
The way different animals chew grasses can make them ideal for an area. UC Berkeley uses goats to protect their lab from wildfires. A forester touted goats as ideal in the Sierra Nevada.

Mule deer, cattle, bighorn sheep, burros, and even rabbits impact the Mojave. Cattlemen typically find mule deer introduced by the CADFG as competitive to their grasses.

Grazing discourages the accumulation of dry underbrush and encourages new green growth. The pasture (p19) survived the Camp Fire while nearby homes burnt to the ground. The link connects to more examples where a fence line stopped a fire.

The NPS posted two graphics on the Teutonia Peak trailhead. These graphics suggest ways grazing may have contributed to form the largest Joshua Tree forest.





46 burros have been shot along I-15; NPS rangers shot 2 in Death Valley. Ironically, these burros could have contributed to the Joshua Tree and environment.


Burro on roadway circa 1977

Grazing

https://www.rightwaytobegreen.com/2019/04/27/__trashed/

Grazing can be beneficial to land by preventing the spread of fires and encouraging new green growth.

In YUJR Central, grazing may have contributed to the ecology of creating the densest Joshua Tree forest in the world. Cattle will eat fire-prone invasive grasses but not spindly nurse plants that can harbor a Joshua Tree seedling.

Mule deer, big horn sheep, and cattle eat invasive grasses. Other candidates include protected wild horses and burros. In the Mojave, the NPS has shot burros, discouraged grazing, and prevented access to big horn sheep guzzlers – resulting in substantial deaths to one herd.