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Emergency Stabilization and Rehabilitation Plan

WILDLIFE ASSESSMENT

OBJECTIVES

1. Identify potential VARs associated with wildlife resources within and immediately downstream from the KNP Complex.
2. Assess the effects of the fire and proposed stabilization actions to state or federallylisted Threatened and Endangered (T&E) species and their habitats.
3. Prescribe emergency stabilization actions, recommendations, and monitoring to benefitstate or federally listed species, if warranted.
4. Initiate and conduct Section 7 Emergency Consultation with the U. S. Fish and WildlifeService (USFWS), as needed.

ISSUES

5. Proposed critical habitat for the federally listed Pacific Fisher (SSN DPS) occurs within the fire perimeter.
6. Habitat for the California spotted owl, a State Species of Special Concern, occurs withinthe fire perimeter.
7. Adverse impacts to black bear habitat and novel food sources resulting from the fire has increased bear/human conflicts within and adjacent to the park.
8. Wildlife monitoring equipment within the fire perimeter was damaged or destroyed bythe fire.
9. The use of lakes and ponds as water sources for fire suppression activities within thepark has increased the risk of aquatic invasive species introduction.

BACKGROUND

The purpose of this Burned Area Emergency Response (BAER) Wildlife Assessment (Assessment) is to identify the post-fire threats to protected wildlife following the KNP Complex Fire within Sequoia and Kings Canyon National Parks (SEKI). Protected wildlife includes federallylisted, proposed, threatened, or endangered wildlife species, or their habitats. Post-fire threats also include proposed emergency stabilization (ES) actions. The Assessment will further identify the need for immediate ES actions that are necessary to prevent further post-fire condition degradation to listed species or their habitats.

The U.S. Fish and Wildlife Service (USFWS) Environmental Conservation Online System (ECOS) - Information for Planning and Consultation (IPaC) website lists a total of nine federally threatened, endangered, or candidate species and one critical habitat wholly or partially within

the fire perimeter or that should be considered in an effects analysis within SEKI. This list is provided pursuant to Section 7 of the Endangered Species Act (ESA) and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action". Table 1 displays the IPaC website list of federally listed or proposed wildlife species thatshould be considered in a SEKI effects analysis.

Table 1. IPaC list of federally listed or proposed wildlife species within the fire perimeter.

Species	Scientific Name	Listing Status	Assessment Evaluation
Pacific fisher (Southern Sierra Nevada DPS)	Pekania pennanti	Endangered	Yes
California Condor	Gymnogyps californianus	Endangered	No
California Red-legged Frog	Rana draytonii	Threatened	No
California Tiger Salamander (Central CA DPS)	Ambystoma californiense	Threatened	No
Mountain Yellow-legged Frog (Northern CA DPS)	Rana muscosa	Endangered	No
Delta Smelt	Hypomesus transpacificus	Threatened	No

Pacific fisher proposed critical habitat occurs within the fire perimeter and was negatively impacted bythe fire. The fire did not burn into habitat for California condor, California red-legged frog, California tiger salamander, mountain yellow-legged frog, and Delta smelt. Therefore, fire impacts to these species will not be evaluated in this Assessment.

SEKI is home to a diversity of wildlife species, including approximately 74 mammals, 212 speciesof birds, 22 reptiles, 12 amphibians, and 11 species of fish. The SEKI Resource Stewardship Strategy (NPS 2017) identified 9 terrestrial wildlife species of conservation concern within the park. Table 2 displays the SEKI wildlife species of conservation concern that have been negatively impacted by the fire and will be evaluated in this assessment.

Table 2. SEKI wildlife species of conservation concern evaluated in this assessment.

Species	Scientific Name	Listing Status
California Spotted Owl	Strix occidentalis occidentalis	Federal: None State: CDFW SSC
		Federal: None

American Black Bear	Ursus americanus	State: None

Pacific fisher (*Pekania pennanti*)

The USFWS listed the Southern Sierra Nevada Distinct Population Segment (SSN DPS) of the Pacific fisher as Endangered under the Endangered Species Act (ESA), effective June 15, 2020(FR 2020). The listing decision described the primary causes of endangerment at the time of

listing as including ”loss and fragmentation of habitat resulting from high-severity wildfire and wildfire suppression (*i.e.,* loss of snags and other large habitat structures on which the species relies), climate change, and tree mortality from drought, disease, and insect infestations.“ (FR 2020).

Adverse wildfire impacts to both habitat and individual Pacific fisher are described in the listing document, as summarized above. Fire is a natural ecological process, and fires within the natural range of variation (Safford et al. 2012; Safford and Stevens 2017) are generally considered beneficial to Pacific fisher habitat, especially over the long-term, because they recruit essential habitat elements (e.g., snags, den cavities), increase abundance of some Pacific fisher prey species, and contribute to habitat resiliency (Spencer et al. 2015). In contrast, large and severe fires, outside the natural range of variation, can remove forest cover and result in the long-termfragmentation of Pacific fisher habitat over large areas.

In addition to altered fire regimes, drought, climate change, and related changes to large tree mortality may also reduce or fragment suitable Pacific fisher habitat. Recent drought in dense forests has led to severe water stress (Asner et al. 2015, Young et al. 2017), which in turn attracts insects (bark beetles) and increases risks from pathogens and air pollution. Since 2012, there has been a dramatic increase in large tree mortality due to bark beetles in low- to mid-elevationconiferous forests of the southern Sierra Nevada. These forests make up much of the Pacific fisher’s critical habitat in the southern portion of its range. There, the western pine beetle, which is considered one of the principal agents of tree mortality in the Sierra Nevada (Fettig 2012), has had a widespread impact on ponderosa and sugar pines (USDA Forest Service 2017b). These elevated tree mortality levels, and the associated habitat change, have been tied to increased stress hormones and decreased survival in resident female Pacific fishers (Kordosky 2018). Actions to protect large trees from beetle attack following environmental stress may be warranted in some areas of Pacific fisher habitat to prevent habitat degradation or loss.

Over much of the Sierra Nevada, the Pacific fisher’s mixed-conifer forest habitat is outside the naturalrange of variation due to historic logging, fire suppression, and climate change (Safford et al.

2012, Mallek et al. 2013, Safford and van de Water 2013). This may elevate the risk of forest loss and fragmentation by large, severe fires and other disturbances (Miller et al. 2009, Churchill et al. 2013) and consequently, at least the temporary loss and fragmentation of Pacific fisher habitat (Scheller et al. 2011, Spencer et al. 2015).

Historically, the yellow pine and mixed-conifer forest types were characterized by higher densities of large trees and lower densities of small trees than today, with about the same overall basal area but fewer trees per acre (Dolanc et al. 2014). Trees 24-36 in dbh, and especially trees >36 in dbh, have declined in abundance, and trees 36 in dbh appear to be indeficit throughout most of the Sierra Nevada (Dolanc et al. 2014).

According to the most current Pacific fisher habitat models (Thompson et al. 2020), SEKI contains 117,315 acres of suitable Pacific fisher habitat, of which 18,075 acres are modeled as potential denning habitat, 59,872 acres of high-quality habitat and 112,953 acres of foraging habitat. SEKIalso contains a significant portion of Core 3 and a small segment of Core 4, as defined by the

Strategy (Spencer et al. 2016). Compared to northerly cores, Core 3 has more mature forest conditions, high average basal area, denser canopies, and more black oaks; however, this bandof habitat is narrow due to the parks' steep elevation gradient (Spencer et al. 2016).

California Spotted Owl (*Strix occidentalis occidentalis*)

California spotted owl (Spotted Owl) is a California Department of Fish and Wildlife (CDFW) Species of Special Concern (SSC). The USFWS was petitioned to list the species in 2015 and released a decision not to list in November 2019. (FR 2019). Despite not listing the species, the USFWS released a draft habitat management plan for both California spotted owl and northernspotted owl. The following is a summary of conservation issues for California spotted owl from Roberts et al. (2019):

> "California spotted owls (*Strix occidentalis occidentalis*), old-forest-dependent species that use large, old trees for nesting, are a species of conservation concern due to a range-wide decline in their populations and the densities of large trees. Because national parks do not have the century-old legacy of commercial, large-scale removal of large trees as on US National Forests and private forests throughout the Sierra Nevada, Sequoia-Kings Canyon and Yosemite National Parks contain vital spotted owl nesting habitat. Further, evidence suggests these national parks may contain critical source spotted owl populations. California spotted owls (*Strix occidentalis occidentalis*) are long-lived with high adult survival and site and pair fidelity but have low reproductive output that varies greatly annually (Seamans and Gutiérrez 2007, Franklin et al. 2004). This species occurs throughout the west side forests of the Sierra Nevada and predominately uses mid-elevation mixed-conifer older forests with a complex heterogeneous structure (Verner et al. 1992a). Their nest and roost stands have high overstory canopy cover and closure (>70%) and contain large trees (> 61 cm diameter atbreast height, dbh) with a multi-layered mid-story canopy composed of trees of varying sizes often numerically dominated by medium-sized trees (30-61cm dbh) (Roberts et al. 2011, Blakesley et al. 2005, Moen and Gutiérrez 1997, Bias and Gutiérrez 1992).
>
> Currently, the most imminent threat to California spotted owl persistence in Yosemite and Sequoia and Kings Canyon National Parks is rapid and extensive habitat loss due to increasing occurrences and probabilities of future megafires and stand-replacing fires (Jones et al. 2017, Stephens et al. 2016). Megafires typically burn forests outside of the natural (i.e., historical) range of variation that characterizes these forests and their resident species adapted to historical conditions. These fires burn at much larger spatialextents (>10,000 ha) and result in high fire severity patch sizes that are significantly larger and more numerous than was historically typical for mixed-conifer forest types in the Sierra Nevada (Stephens et al. 2014). The frequency and severity of megafires and stand-replacing fires have increased due to decades of fire suppression, legacy logging impacts, increased tree densities, and climate change (Miller and Safford 2012, Collins et al. 2011, Miller et al. 2009, Westerling et al. 2006, Fulé et al. 2004). Habitat loss from these megafires is not only spatially extensive, but also these extensive high severity patches that result from megafires tend to have very low conifer regeneration for at

least 11 years after the burn (Welch et al. 2016, Collins and Roller 2013). Fires that burn within the natural range of variation (where stand-replacing patches are generally <1-10ha in size) typically result in high conifer regeneration, especially pines (Safford and Stevens 2017). However, as the frequency and occurrence of large stand-replacing fires and megafires increase, post-fire forest regeneration may not occur, but instead lead to large-scale forest loss. Even with sufficient tree regeneration and recruitment following stand-replacing fire, there is a long time lag (i.e., decades to more than a century) required for forest succession to potentially recreate a spatially complex forest dominated by large trees spotted owls require for nesting and roosting.

In recent years, multiple factors occurred simultaneously that significantly increased tree mortality rates in mixed conifer forests, especially for large diameter pines (USDA US Forest Service unpublished report 2017, Moore et al. 2017). Nearly a century of firesuppression led to forests with excessively high tree densities and biomass that increased individual competition for limited resources such as available soil moisture (Stephens et al. 2015, van Mantgem et al. 2009, van Mantgem and Stephenson 2007). Recently, a prolonged drought in 2012-2016 combined with extended periods of much higher-than-average annual temperatures (and greater climatic water deficit) significantly lowered the amount of moisture available to the trees, especially in high- density stands (Young et al. 2016). Coupled with a widespread and simultaneous outbreak of bark beetles, severely moisture-stressed trees did not have adequate reserves to fight off bark beetles and completely succumbed within a couple of years (Preisler et al. 2017). Due to their greater moisture demand and high frequency of attacks, the largest tree classes (especially pines) suffered the highest mortality rates (Fettig et al. 2019). A state-wide aerial survey conducted annually between 2014-2017 by the US Forest Service estimated approximately 130 million trees have died in the Sierra Nevada with the highest mortality in the southern portion (USDA US Forest Service unpublished report 2017, Moore et al. 2017). Despite having more aggressive prescribed and wildland fire programs, Yosemite and Sequoia-Kings Canyon National Parks were not spared this extensive tree mortality. These aerial surveys of tree mortality estimated a three-year (2015-2017) total area of 121,810 ha (301,000 acres) or 4.7 million dead trees for Yosemite and an area of 149,329 ha (369,000 acres) or 5.8million dead trees for Sequoia-Kings Canyon (Moore et al. 2018).”

While fires within the natural range of variability can be beneficial to spotted owl habitat, megafires driven by extreme droughts and high fuel-loading that result in large patches of highseverity fire have negative impacts on spotted owl occupancy, foraging, and breeding success (Roberts et al. 2019).

American Black Bear (*Ursus americanus*)

American black bears (bears) are recognized as an important component of California's ecosystems and as a valuable resource for the people of California. Bears has been classified asa game mammal in California since 1948. Data indicate that California's bear population has

increased in recent years. Between 25,000 - 30,000 bears are estimated to occupy 52,000square miles in California (CDFW 2021).

Bears commonly consume ants and other insects in summer, but prefer nut crops, especially acorns, and manzanita berries in the fall. Though most of the bears subsist on natural foods, others have learned to forage for human foods. This is most likely to occur in spring if naturalfoods are scarce, or in late summer and fall, especially during drought years when berry and acorn yields are poor.

Human food may become available to bears from several sources: intentional feeding by visitors, improper use of bear-proof garbage cans, inadequate garbage collection schedules, inadequate design of garbage and/or food storage facilities, improper food storage, and food left unattended. Once bears discover human food, they often alter their natural behavior and foraging habits to continue to obtain it. The ensuing conflicts between bears and humans resultin damaged property, personal injuries, and destruction of some bears (NPS 1992).

Wildlife Monitoring Equipment

The SEKI wildlife program was actively conducting fieldwork for several major projects whenthe KNP Complex occurred. SEKI uses remote field cameras and acoustic detectors to determine the presence, distribution, and habitat use of multiple wildlife species.

Aquatic Invasive Species (AIS)

SEKI and incident staff identified the use of lakes and ponds as water sources for fire suppression activities within the parks. The use of water sources with known occurrences of AISmay have increased the risk of AIS introduction within the parks.

RECONNAISSANCE METHODS

For all species of interest, due to the timing, remoteness, and post-fire safety concerns (i.e., hazard trees, trail damage, etc.), BAER wildlife biologists were unable to initiate field surveys forwildlife species or habitat impacts. The BAER Team used remotely sensed imagery to create vegetation fire severity maps (RAVG) and soil burn severity maps (BARC), and these measures of fire effects were overlaid on habitat maps to analyze the possible extent of impacts due to these fires.

BAER watershed and vegetation specialists mapped soil burn severity and vegetation mortalityto determine effects to soil and vegetation resources. To better understand the species and habitat information discussed in this Assessment, it is important to review the KNP Complex BAER Vegetation and Watershed Assessments. These reports contain more detailed descriptions of pre-fire vegetation, post-fire vegetative recovery estimates, and effects to watersheds.

FINDINGS

Pacific fisher

This Assessment focused on two metrics: area of Pacific fisher proposed critical habitat burned under various fire severity classes and the size of patches burned at high severity. We also identified moderate severity burned habitat where targeted chemical treatment could be effective to protect remaining large trees from mountain pine beetle and thereby preserve habitat quality for Pacific fisher.

In total, 27,757 acres of Pacific fisher proposed critical habitat in SEKI is within the fire perimeter (Table 3, Figure 1). This acreage represents 50% of total Pacific fisher proposed critical habitat within SEKI (55,651 acres). Of the area burned, 7,738 acres (28%) burned at high severity and 8,435 acres (30%) burned at moderate severity. A review of the literature indicates that high severity fire areas with loss of greater than 75% canopy cover may be effectively lost as Pacific fisher habitat inthe short- to medium-term (NPS Pacific Fisher Biological Assessment). Additional discussion of fire effects on Pacific fisher critical habitat in the mixed conifer forest appears in the *Vegetation Assessment*.

Table 3. NPS acres of Pacific fisher proposed critical habitat burned by severity class.

Fire Severity (RAVG)	Sum of Acres	Percent
High	7,738	28%
Moderate	8,435	30%
Low	7,319	26%
Unchanged	4,218	15%
Unclassified	47	0.2%
Totals	27,757	100%

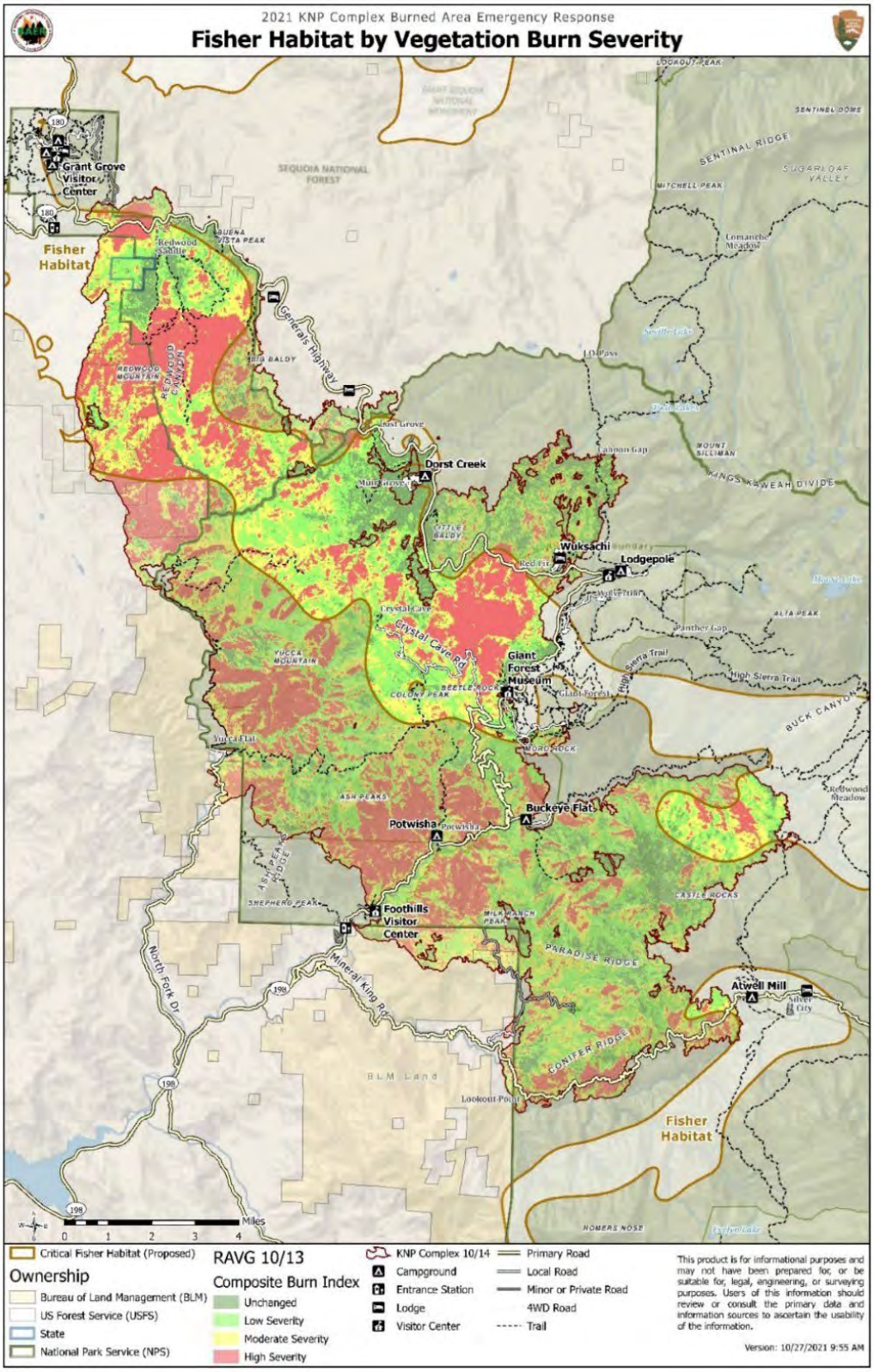
2021 KNP Complex Burned Area Emergency Response
Fisher Habitat by Vegetation Burn Severity
Grant Grove Visitor Center
Fisher Habitat
Dorst Creek
Wuksachi
Lodgepole
Giant Forest Museum
Buckeye Flat
Potwisha
Foothills Visitor Center
Atwell Mill
Fisher Habitat
SEQUOIA NATIONAL FOREST
BLM Land
Miles
Critical Fisher Habitat (Proposed)
Ownership
Bureau of Land Management (BLM)
US Forest Service (USFS)
State
National Park Service (NPS)
RAVG 10/13
Composite Burn Index
Unchanged
Low Severity
Moderate Severity
High Severity
KNP Complex 10/14
Campground
Entrance Station
Lodge
Visitor Center
Primary Road
Local Road
Minor or Private Road
4WD Road
Trail
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Figure 1. Pacific fisher proposed critical habitat within the KNP Complex by burn severity

California Spotted Owl

In total, 61,365 acres of Spotted Owl habitat within SEKI occurs in the fire perimeter (Table 4, Figure 2). This represents 30% of Spotted Owl habitat within SEKI (201,385 acres). Of the area burned, 11,542 acres (19%) burned at high severity and 16,292 acres (27%) burned at moderateseverity. A review of the literature on Spotted Owl response to fire indicates that foraging, nest success, and occupancy can all be reduced in high severity fire areas. The impacts of large patches of high severity fire are loss of large trees for nesting and reduced prey abundance and availability. The impacts to Spotted Owls are like those to Pacific fisher, and the areas and amounts of habitat burned overlap to a large degree.

Table 4. NPS acres of Spotted Owl habitat burned by severity class.

Fire Severity (RAVG)	Sum of Acres	Percent
High	11,542	19%
Moderate	16,292	27%
Low	22,913	37%
Unchanged	10,500	17%
Unclassified	117	0.2%
Totals	61,365	100%

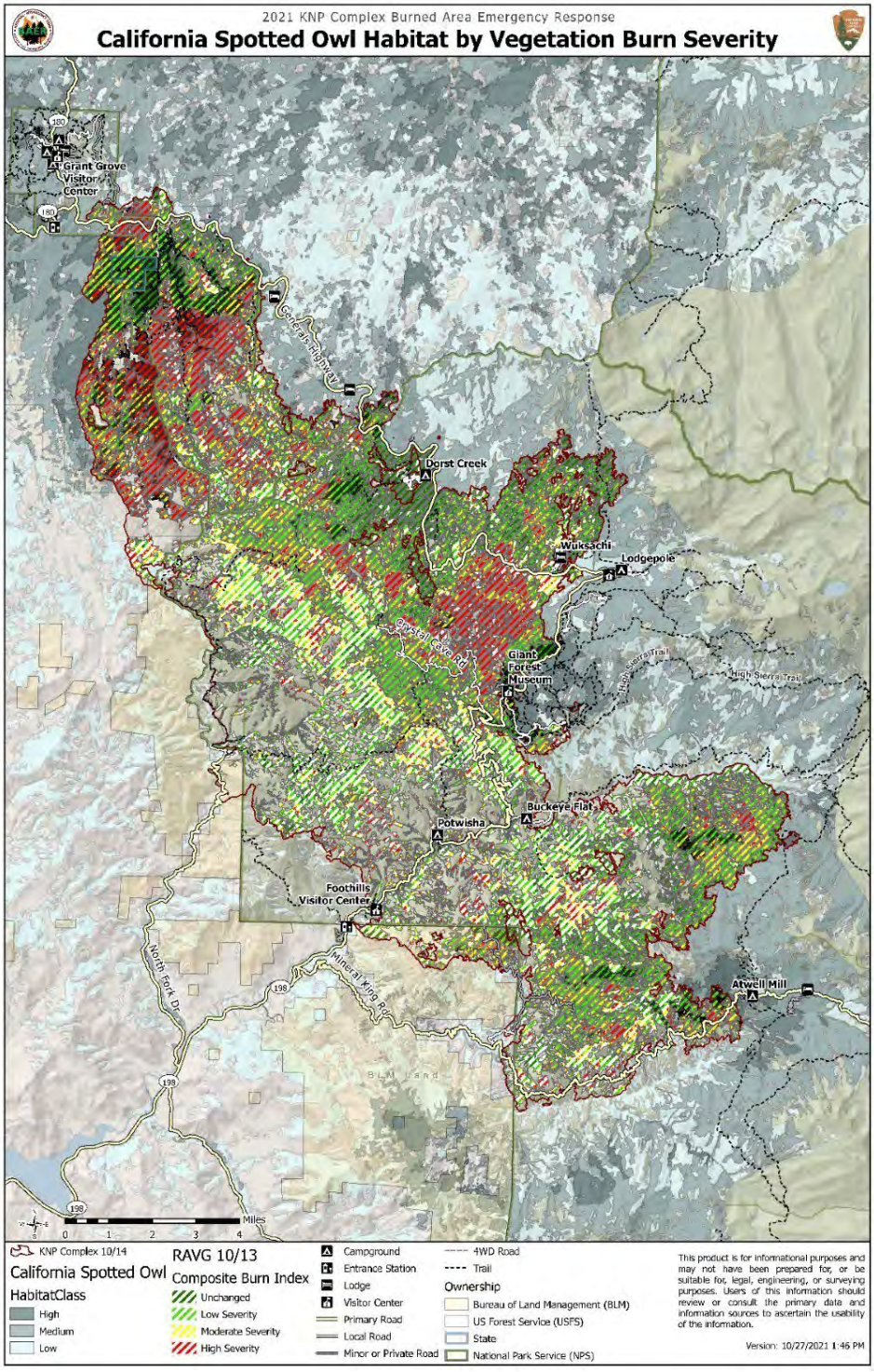

Figure 2. Spotted Owl habitat within the KNP Complex by burn severity

American Black Bear (*Ursus americanus*)

Incident staff documented bears throughout the incident, including a viral video on social media of a bear cub approaching an engine for food. A Wildlife REAF was assigned to bear and food management based out of Hume Lake Camp and successfully hazed at least one bear on the night of October 2nd, 2021. In addition to hazing, REAFs worked with Hume Lake Camp managers and USFS staff on trash management at camp and in surrounding areas. BAER Teammembers observed multiple bear-proof food storage lockers throughout the fire perimeter andall food storage lockers appeared undamaged by the fire.

Wildlife Monitoring Equipment

Twelve trail cameras were deployed within SEKI to monitor wildlife populations prior to theKNP Complex. Of the cameras deployed at the time of the incident, four were deployedwithin the fire perimeter. All camera locations occurred within unburned or lowseverity areas within the fire. The BAER Team was unable to access the camera locations to determine potential fire impacts to the cameras.

Figure 3. Wildlife monitoring equipment within the KNP Complex

Aquatic Invasive Species

The primary protection measures in place for aquatic habitats within the fire perimeter were noretardant zones within 300 ft. of streams, lakes and other water bodies and to prevent the establishment of dip sites in areas of known AIS. However, due to the critical need to protect communities on the north side of the fire and the lack of invasive-free dip sites in that area, a number of dip sites with known or suspected infestations of invasives were used throughout the incident.

The KNP Complex Fire READ Report (2021) evaluated dip site locations and vectors for AIS introduction. One dip site, DP36 (Oriole Lake) was removed from the list of potential dip sites on 9/30/21 because of the presence of invasive fish, including golden shiner. Approved dip siteswith known AIS concerns that were used due to a lack of acceptable alternatives are described in Table 5.

Table 5. Dip site locations and AIS concerns

Dip Site Name	Latitude	Longitude	AIS Concerns
Weaver Dip	36º 42.210’ N	118º 47.900’ W	Non-native Trout, Chytrid
Twin Dip	36º 39.423’ N	118º 42.864’ W	Non-native Trout, Chytrid

Eshom Dip	36º 39.066’ N	118º 56.444’ W	Bullfrogs, Non-native snails, sunfish, Gambusia sp., rumored invasive aquatic plants

RECOMMENDATIONS

Two specifications - both through BAR—are prescribed to address post-fire wildlife issues.

Specifications

BAR 10 – Protection of Trees in Pacific fisher Habitat: Protect fire-weakened old-growth (≥ 36 in. DBH)sugar pine from mountain pine beetle infestation within federally endangered Pacific fisher (Pekania pennanti) proposed critical habitat in the KNP Complex. Protection of old growth pine is essential for maintaining Pacific fisher proposed critical habitat. Local Forest Service entomologists recommend that pheromone (SPLAT VERB) placement is a viable treatment to prevent beetles from causing mortality of fire-weakened trees. At least three years of this effort is needed to treat fire-impacted trees.

BAR 11 – Revegetation of Pacific fisher Critical Habitat: Replant 500 acres of high burn severity mixed conifer in areas of maximum benefit to Pacific fisher. The Recommendations section of the *Vegetation Assessment* has additional information regarding other actions that can be taken torestore Pacific fisher critical habitat in targeted areas.

Non-Specification

SEKI wildlife biologists should initiate emergency Section 7 consultation with USFWS and/or coordinate with other federal emergency consultation efforts for federally listed fish and wildlife species affected by the KNP Complex. This would include finalizing consultation oneffects of the fire, fire suppression activities, emergency stabilization practices, and future rehabilitation practices. Potential ESA Section 7 consultation points-of-contact include:

10. Richard Kuyper, Supervisory Fish and Wildlife Biologist, USFWS Endangered Species Program, Sacramento Fish and Wildlife Office, richard_kuyper@fws.gov.

Determination of Effects of Proposed Emergency Stabilization and Rehabilitation Actions

Based upon the above analysis and discussion, the proposed ES and BAR treatments in this BAER Plan **may affect but are not likely to adversely affect Pacific fisher and Pacific fisher proposed critical habitat.** This determination is based on the likelihood that implementation of some ES and BARmeasures may result in short-term and localized increases in vegetation and soil disturbance, but this is not likely to adversely affect T&E species or adversely modify critical habitat.

Implementation of ES and BAR treatments will have localized beneficial effects to wildlifehabitat over the short-term and long-term.

Pacific fisher

SEKI wildlife biologists should continue Pacific fisher survey efforts occurring prior to the KNP Complex. SEKI should also consider conducting a more-intensive survey effort in high severity fire areas, alongside the less-intensive work that is already funded.

Spotted Owl

SEKI wildlife biologists should consider conducting a post-fire study of potential effects on spotted owl and non-native barred owl. SEKI conducted a similar study in summer 2021 prior to the KNP Complex. Repeating this effort in summer 2022 would provide a powerful and direct comparison of pre-fire measurements with post-fire measurements on this animal group.

Black Bears

SEKI wildlife biologists should document fire effects to the local black bear population and continue bear management efforts to reduce bear/human conflicts. SEKI staff should also assess food storage locker locations within the fire perimeter and replace any damaged by thefire.

Wildlife Monitoring Equipment

SEKI wildlife staff should document the condition of cameras and acoustic monitoring equipment deployed within the fire perimeter and consider replacing any damaged by the fire.

Aquatic Invasive Species

Given the low probability of AIS organisms having been moved between dip sites or from waterdrops, SEKI should continue existing AIS monitoring, with a focus on high priority areas.

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Specifications

Appendix

KNP Complex BAER
Emergency Stabilization &
Rehabilitation Plan

APPENDIX A

Environmental Compliance

BURNED AREA EMERGENCY RESPONSE PLAN

2021 KNP Complex

Sequoia and Kings Canyon National Parks

Environmental Compliance Considerations and Documentation

1. FEDERAL ENVIRONMENTAL COMPLIANCE RESPONSIBILITIES

All projects proposed in the KNP Complex Fire Post-Fire Response Plan, which includes recommendations for Burned Area Emergency Response (BAER) and Burned Area Rehabilitation(BAR) mitigation actions, that are prescribed, funded, or implemented on park lands are subject to compliance with the National Environmental Policy Act (NEPA) in accordance with the guidelines provided by the Council on Environmental Quality (CEQ) Regulations (40 CFR 1500- 1508). This Appendix documents the BAER Team considerations of NEPA compliance requirements for prescribed emergency stabilization, rehabilitation and monitoring actions described in this plan for NPS lands affected by the KNP Complex, Sequoia and Kings Canyon National Parks, California.

This plan identifies specific emergency stabilization, rehabilitation, and monitoring actions and recommendations designed to mitigate damages to resources as a result of the KNP and associated fire suppression activities. The park must complete separate NEPA analysesand compliance for fire response activities not addressed in this plan.

Agency Specific Guidance: This NEPA documentation has been developed in accordance withNational Park Service specific guidelines. Emergency stabilization and rehabilitation actions proposed on National Park Service lands, involving the agencies permitting, funding, or implementation, must comply with regulations set forth in the Department of the Interior Manual Part 516 (DM 12).

2. RELATED PLANS AND CUMULATIVE IMPACT ANALYSIS

Fire and Fuel Management Plan, Sequoia and Kings Canyon National Parks, 2003, with annualamendments: Sequoia and Kings Canyon National Parks completed this updated *Fire and FuelsManagement Plan* to provide long-term direction for achieving park goals related to human safety and ecosystem management. Within that document is direction for utilizing the BAER process as needed for fires within parks, and to utilize the Minimum Requirement Analysis process to review proposed treatments that fall within those areas managed as Wilderness.

Foundation Document, Sequoia and Kings Canyon National Parks, 2016: This document recognizes the role of fire in park ecosystems and supports restoration activities associatedwith fire on the landscape.

Wilderness Stewardship Plan and Final Environmental Impact Statement, Sequoia and Kings Canyon National Parks, **2015**: This plan includes the goal of protecting the natural and cultural resources within wilderness, with “fire regimes” one of the defining characteristics of the

Natural Character of wilderness in the parks. As noted above, a Minimum Requirement Analysisevaluation is required for proposed actions within lands managed as wilderness.

A Climate Smart Resource Stewardship Strategy for Sequoia and Kings Canyon National Parks,2017: The intent of this plan is to provide a long-range strategic planning tool for managing andprotecting natural and cultural resources of the parks, to be informed by current, accurate science. The plan calls for implementing a fire and fuels management plan across the park ecosystems.

Programmatic Categorical Exclusion (CE) for the Survey and Treatment of Non-Native Plants, Sequoia and Kings Canyon National Parks, 2020: This Categorical Exclusion for treating invasiveplants within the two parks is an update to prior Programmatic CE's for invasive plant treatment. The use of herbicides is permitted through this Programmatic CE.

Programmatic Categorical Exclusion (CE) for the Produce and Install Wayside Exhibits, Kiosks,and Park Signs Program, Sequoia and Kings Canyon National Parks, 2015: This CE documents development and installation of replacement kiosks and signs.

Programmatic Categorical Exclusion (CE) for the Survey and Treatment of Non-Native Plants, Sequoia and Kings Canyon National Parks, 2019: This Categorical Exclusion for treating invasiveplants within the two parks is an update to prior Programmatic CEs for invasive plant treatment. The use of herbicides is permitted through this Programmatic CE.

Programmatic Categorical Exclusion (CE) for Tree Hazard Mitigation Program, Sequoia and Kings Canyon National Parks, 2010, 2015: This CE documents assessment and mitigation of tree hazards within the two parks.

Programmatic Categorical Exclusion (CE) for the Roads and Parking Area Management Program, Sequoia and Kings Canyon National Parks 2009, 2015: This CE documents repair andclearing of existing roads and culverts.

Programmatic Categorical Exclusion (CE) for the Trails and Trail Bridge Management Program, Sequoia and Kings Canyon National Parks 2010, 2016. This CE documents repair and clearing of existing trails and trail bridges.

Programmatic Biological Opinion (BO) on Proposed Activities of the National Park Service thatMay Affect the Southern Sierra Nevada Distinct Population Segment of the Fisher (08ESMF00-2020-F-2011-1). This programmatic BO provides a full assessment of parks wide management activities; outlines a process for consultation with the U.S. Fish and Wildlife Service for actions that *may affect* the endangered Southern Sierra Nevada Distinct Population Segment of the fisher (*Pekania pennanti*); and provides a list of conservation measures the parks will implement to preserve fisher.

Cumulative Impact Analysis: The emergency stabilization and rehabilitation treatments for the KNP Complex, as proposed in this plan, do not result in an intensity of impact that would

cumulatively constitute a significant impact on the quality of the environment. The treatmentsare consistent with the NPS management plans and associated environmental compliance documents described above and the categorical exclusions presented below.

No significant direct or indirect unavoidable adverse impacts to the biological or physicalenvironment would result from the implementation of the KNP Complex Post-Fire Response Plan.

Summary of Compliance Documentation Relevant to the KNP Complex Post-Fire ResponsePlan

The following table summarizes the appropriate NEPA pathways for the BAER/BAR treatments proposed for the KNP Complex. Several treatments may require additional compliance analysis and documentation prior to implementation. Such documentation may include but is not limited to Section 106 Consultation under the National Historic Preservation Act, Section 7. Consultation under the Endangered Species Act, or the preparation of a Minimum RequirementAnalysis as noted in the table below.

Sequoia and Kings Canyon National Parks have numerous mitigations for work conducted within its boundaries; these mitigations and "best management practices" will be identified andapplied as appropriate for any individual actions undertaken through the KNP Complex Post-Fire Response Plan.

Sequoia and Kings Canyon National Parks have numerous mitigations for work conducted withinits boundaries; these mitigations and "best management practices" will be identified and applied as appropriate for any individual actions undertaken through the KNP Complex Post-Fire Response Plan.

3. DOI EXCEPTIONS TO CATEGORICAL EXCLUSIONS

Council on Environmental Quality Regulations at 40 CFR 1508.4 require agencies to consider whether fairly routine actions involve extraordinary circumstances that, per NEPA, trigger an agency to prepare additional assessment and consideration. If it is determined that any of the exceptions listed in the table below apply to a proposed action, that action may not be categorically excluded, and an EA or an EIS must be prepared. The list below is a Department ofthe Interior list that applies to all DOI agencies (516 DM 2, Appendix 2); agencies often have additional items on their own list of Departmental exceptions, appendix 2). All treatments that are proposed as a Categorical Exclusion for Sequoia-Kings Canyon National Parks have been compared against the list of Extraordinary Circumstances listed below and were found not to trigger any exceptions.

Treatment or Action	NEPA documentation (EIS, EA, or Cat Ex)
ES-1: Hazard Tree Assessment & Mitigation	NEPA compliance is consistent with DO-12, 1.3 C, EmergencyAction; 3.3. E.3.; and the SEKI Programmatic Tree Hazard Mitigation Program 2010, 2015.
ES-2: BAER Crew and Storm Patrol	**Staffing:** NEPA compliance for is consistent with DO-12, 3.2A. **Road and culvert clearing:** NEPA compliance is consistent with DO-12, 3.3 C.9.; and with the SEKI Programmatic Roadsand Parking Area Management Program 2009, 2015.
ES-3: Milk Ranch Communications Site	NEPA compliance is consistent with DO-12, CE: 3.3 C.8.*
ES-4: Road Damage Repair	NEPA compliance is consistent with DO-12, 3.3 C.9.; actions may also be consistent with the SEKI Programmatic Roads and Parking Area Management Program 2009, 2015 pending evaluation of scope.
ES-5: Increased Ranger Patrol	NEPA compliance is consistent with DO-12, 3.2 A.[δ]
ES-6: Signage and Gates	**Signs:** NEPA compliance is consistent with DO-12, CE 3.3 C.5.;actions may also be consistent with the SEKI Programmatic Produce and Install Wayside Exhibits, Kiosks, and Park Signs Program, 2015 pending evaluation of scope.* **Gates:** NEPA compliance is consistent with DO-12, CE 3.3 C.9.
ES-7: Post-fire Communications	NEPA compliance is consistent with DO-12, 3.2 I.[δ]
ES-8: Post-fire GIS Support	NEPA compliance is consistent with DO-12, 3.2 A.[δ]
ES-9: Cultural Protection and Stabilization	**Staffing:** NEPA compliance is consistent with DO-12, 3.2 A.[δ] **Stabilization:** NEPA compliance is consistent with DO-12, 3.3G.1.
ES-10: Cultural Resource Assessments	NEPA compliance is consistent with DO-12, 3.2 Y.; and 3.2 R.[δ]

ES-11: Museum Collection Assessment	NEPA compliance is consistent with DO-12, 3.2 Y.[δ]
ES-12: NHPA Compliance and Consultation	NEPA compliance is consistent with DO-12, 3.2 A.; and 3.2 Y.[δ]
ES-13 Invasive Plant Management	DO-12, 3.3 E.2.; and with the SEKI Programmatic for the Invasive/Non-Native Plant Management Program, 2010,2019.*
ES-14 Halstead Meadow Protection	NEPA compliance is consistent with DO-12, 3.3 G.1.
ES-15 Implementation Leader	NEPA compliance is consistent with DO-12, 3.2 A.[δ]
ES - 16 BAER Plan Preparation	NEPA compliance is consistent with DO-12, 3.2 R.[δ]

BAR-1 Shooting Range Building Replacement	NEPA compliance is consistent with DO-12, 3.3 C.8.
BAR-2 Wuksachi Bridge Repair	NEPA compliance is consistent with DO-12, 3.3 C.3.; actions may also be consistent with the SEKI Programmatic Trails andTrail Bridge Management Program, 2010, 2016 pending evaluation of scope.
BAR-3 Trails Stabilization and Hazard Mitigation	NEPA compliance is consistent with DO-12, 3.3 C.3.; actions may also be consistent with the SEKI Programmatic Trails andTrail Bridge Management Program, 2010, 2016 pending evaluation of scope.*
BAR-4 Out-year Trails Maintenance	NEPA compliance is consistent with DO-12, 3.3 C.3.; actions may also be consistent with the SEKI Programmatic Trails andTrail Bridge Management Program 2010, 2016 pending evaluation of scope.*
BAR-5 Invasive Plant Management	NEPA compliance is consistent with DO 12, 3.3 E.2.; and withthe SEKI Programmatic Invasive/Non-Native Plant Management Program, 2010.*
BAR-6 Replace Conservation Plantings	NEPA compliance is consistent with DO-12, 3.2 X.[δ]*

BAR-7 Safety Zone Revegetation	NEPA compliance is consistent with DO-12, 3.2 X.δ*
BAR-8 Replace Rare Buckwheat	NEPA compliance is consistent with DO-12, 3.2 X.δ*
BAR-9 Revegetation of Selected Sequoia Groves	NEPA compliance is consistent with DO-12, 3.3 G.1 pending evaluation of scope.*
BAR-10 Protection of Trees in Fisher Habitat	NEPA compliance is consistent with DO-12, 3.3 E.3.*
BAR-11 Revegetation of Fisher Critical Habitat	NEPA compliance is consistent with DO-12, G.1 pending evaluation of scope.*
BAR-12 Replace Hydrologic/Scientific Equipment	NEPA compliance is consistent with DO-12 3.3 C.8.*
BAR-13 BAER Crew and Storm Patrol	**Staffing:** NEPA compliance is consistent with DO-12, 3.2 A.δ **Road and culvert clearing:** NEPA compliance is consistent with DO-12, 3.3 C.9.; and with the SEKI Programmatic Roads and Parking Area Management Program 2009, 2015.
BAR-14 Increased Ranger Patrol	NEPA compliance is consistent with DO-12, 3.2 A.δ

δ Categorical Exclusions for which No Documentation is required.

* Minimum Requirement Analysis may be required for proposed actions in wilderness.

Yes	No	Extraordinary Circumstance. Would this action…
	X	2.1 Have significant impacts on public health or safety?
	X	2.2 Have significant impacts on such natural resources and unique geographic characteristics as historic or cultural resources; park, recreation or refuge lands; wilderness areas; wild or scenic rivers; national natural landmarks; sole or principal drinking water aquifers; prime farmlands; wetlands (Executive Order 11990); floodplains (Executive Order 11988); national monuments; migratory birds; and other ecologically significant or critical areas?
	X	2.3 Have highly controversial environmental effects or involve unresolved conflicts concerning alternative uses of available resources [NEPA Section 102(2)(E)]?
	X	2.4 Have highly uncertain and potentially significant environmental effects or involve unique or unknown environmental risks?
	X	2.5 Establish a precedent for future action or represent a decision in principle about future actions with potentially significant environmental effects?
	X	2.6 Have a direct relationship to other actions with individually insignificant but cumulatively significant environmental effects?
	X	2.7 Have significant impacts on properties listed, or eligible for listing, on the National Register of Historic Places as determined by either the bureau or office?
	X	2.8 Have significant impacts on species listed, or proposed to be listed, on theList of Endangered or Threatened Species, or have significant impacts on designated Critical Habitat for these species?
	X	2.9 Violate a Federal law, or a State, local, or tribal law or requirement imposed for the protection of the environment?
	X	2.10 Have a disproportionately high and adverse effect on low income or minority populations (Executive Order 12898)?
	X	2.11 Limit access to and ceremonial use of Indian sacred sites on Federal lands byIndian religious practitioners or significantly adversely affect the physical integrity of such sacred sites (Executive Order 13007)?
	X	Contribute to the introduction, continued existence, or spread of noxious weeds ornon-native invasive species known to occur in the area or actions that may promotethe introduction, growth, or expansion of the range of such species (Federal Noxious Weed Control Act and Executive Order 13112)?

D.CONSULTATIONS

National Park Service

1. Elizabeth Boerke, Chief of Environmental Planning and Compliance, Sequoia and KingsCanyon National Parks
2. Juanita Bonnifield, Branch Chief of Cultural Resources, Sequoia and Kings CanyonNational Parks

All BAER and BAR treatments will be presented to the Sequoia and Kings Canyon NP complianceteam for discussion of the recommended compliance requirements described above prior to initiation of any of the actions.

US Fish and Wildlife Service, National Historic Preservation Act, and tribal consultations:

3. Juanita Bonnifield, Branch Chief of Cultural Resources, submitted the parks' Declaration of Emergency Action for the KNP to the California SHPO on Sept. 13, 2021. Consultationwith SHPO is ongoing.

4. Jane Allen, the parks' Tribal Liaison, notified the tribes of the KNP on September 12,2021. Consultation is ongoing.

5. Danny Boiano, Branch Chief of Physical and Wildlife Sciences, initiated contact with the U.S. Fish and Wildlife Service on September 14, 2021, to provide information on theKNP. Consultation is ongoing.

CONCLUSION

I have reviewed the treatments in the KNP Complex Post-Fire Response Plan in accordancewith the criteria above. Those actions which require additional environmental review will be analyzed and appropriate compliance completed before they can be implemented; those actions with approved existing compliance would not involve any significant environmental effect and are approved for initiation. Applicable park-identified mitigations will be applied toindividual actions undertaken as part of this Plan. Sequoia and Kings Canyon National Parks staff will review the proposed projects identified in the KNP Complex Post-Fire Response Plan and coordinate to ensure compliance with the National Historic Preservation Act, Endangered Species Act, Wilderness Act, Clean Water Act and other Federal, State and local environment review requirements.

Prepared by: Jack Oelfke, KNP Complex BAER Team Leader, and Theresa Fiorino, SEKIEnvironmental Protection Specialist, Nov. 3, 2021

Approved: _____

Superintendent, Sequoia & Kings Canyon National Parks Date

APPENDIX B

BAER Restoration Recommendations

NP BAER TEAM RECOMMENDATIONS FOR LONG-TERM ECOLOGICAL RESTORATION

Prepared by Greg Eckert, Restoration Ecologist

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INTRODUCTION

By early November 2021, the KNP Complex burned over 88,000 acres affecting substantial acreages within key Sequoia National Park ecosystems. Post-fire assessments for fire and fire operations-related damages to resources are conducted under Department of Interior DirectorsManual 620 Part 3 (DOI 2006) for Burned Area Emergency Response (BAER). BAER support to parks is focused on emergency stabilization to protect life and property, with additional supportto facilitate recovery of resources and park operations. It is not intended to provide for full restoration, and the funding period is often too short for managers to sufficiently evaluate "natural" regeneration of vegetation or the stability of slopes before park managers can realistically apply on-the-ground treatments. BAER guidance §5.3.2 Transition to Resource Management Activities addresses this:

Occasionally, emergency stabilization treatments/activities initiates a management action that is significantly longer than the emergency funding limitations (e.g., structural emergency stabilization treatments, biotic community stabilization, non-native invasive species control, appropriate livestockand animal management, etc.) The BAER Plan/Report should identify the types of programs and steps that are needed to tie BAER to long term management programs and their goals. The Plan/Report may also identify other potential program areas able to accommodate these added long-term management commitments and actions beyond the emergency funding limits. Unless long-term activities are fully integrated into the other program areas, the ultimate success of the activity and the benefits to the resource may be jeopardized. (Department of Interior 2006).

Following this guidance, The BAER Team recommends the park commit to long-term restoration of KNP Complex burned areas. We see two benefits of this. First, continued fueltreatments and invasive species management in unburned areas will protect BAER-funded investments. Second, BAER-supported work can catalyze a climate-smart, comprehensive ecosystem restoration portfolio for the park.

CLIMATE-SMART RESTORATION

Managers must acknowledge that post-fire landscapes, particularly moderate and high severity burn areas, may not recover according to historical successional patterns (North *et.al.,* 2019). Uncharacteristic fire severity, biological invasions, drought, and landscape fragmentation affectsoils, seed availability, dispersal and germination niche in the burned areas. Factors such as directional changes in temperature and drought, both of which co-occurred with the KNP Complex, can create feedback loops increasing the probability of permanent "type conversion" to novel vegetation composition and structure (Coop, et al 2020). Given the potentially large scale of this conversion, these changes are unacceptable to park goals for visitor experience, park biodiversity, and regional ecological services.

NPS managers have traditionally worked within the concept of "stationarity." This reflects natural resource conditions under a stable climate where there are understood and predictableboundaries for natural resource processes and conditions (e.g., annual stream flows, 10-year floods, historical range of variation for fire regimes, and plant community succession).

However, managers are now moving into an era of continuous change and uncharacteristicallyextreme natural events such as wildfires and severe storms. Under a new management paradigm, managers will need to be more creative in creating "bet hedging" strategies by re- evaluating source ranges for revegetation materials, combining plantings with fire and

mechanical treatments to create greater landscape heterogeneity, and accept gradual re- assembly of biological communities and food webs. The intention to shift NPS management in this direction was initiated in NPS Policy Memorandum 12-02 (NPS 2012). Highly disturbed areas such as the KNP Complex burned area provide opportunities to test climate-related adaptation strategies. The focus of such longer-term climate smart restoration is to prevent abrupt large-scale changes and provide for maintenance of ecosystem services to the greatest extent possible incorporating the Resist-Adapt-Direct framework (Schuurmann, *et.al*., 2020). This framework has been evolving over the past decade (Aplet and Cole, 2010) and, as a simplesummary, states that managers have three options to consider in a climate-oriented decision environment. Resisting climate change pits management action and resources (a species, a vegetation type, etc.) against overwhelming impacts of climate change. Decisions to adapt to climate change mean that managers must still address non-climate issues. These may be complicated as species-by-species declines or increases can challenge the traditional understanding of system boundaries which have driven management practices in the past.

Decisions to direct change will be challenging to the NPS institutional culture and place the novel climate reality of picking resource winners and losers more directly in manager's hands.But this may be necessary when options to avoid aggressive action may lead to significant declines in park diversity and ecosystem services.

Other frameworks reflect the philosophy of RAD but are put in the context of the KNP post-fire scenario. A conceptual framework recently introduced by the US Forest Service provides a structure for evaluating fire effects from the KNP Complex and suggests responses within the context of shifting climate conditions (Meyer, et. al., 2021). That is, fire effects must be evaluated against desired conditions to direct resource managers towards appropriate and realistic restoration targets (Figure 1). While the concept of "natural range of variation" (NRV) identified in Meyer, *et.al.* (2021) is less appropriate given widespread climate change impacts, ametric-driven approach to "acceptable" range of variation (ARV) for ecological integrity (EI) (Unnasch, *et. al.,* 2018) better aligns with the shifting National Park Service paradigm of managing ecological systems for long term change (Schuurmann, in prep). In these discussions, the range of terms such as NRV, ARV, EI are understood as the baseline of resource condition by which managers can understand and plan for the degree and rate of change in ecological systems.

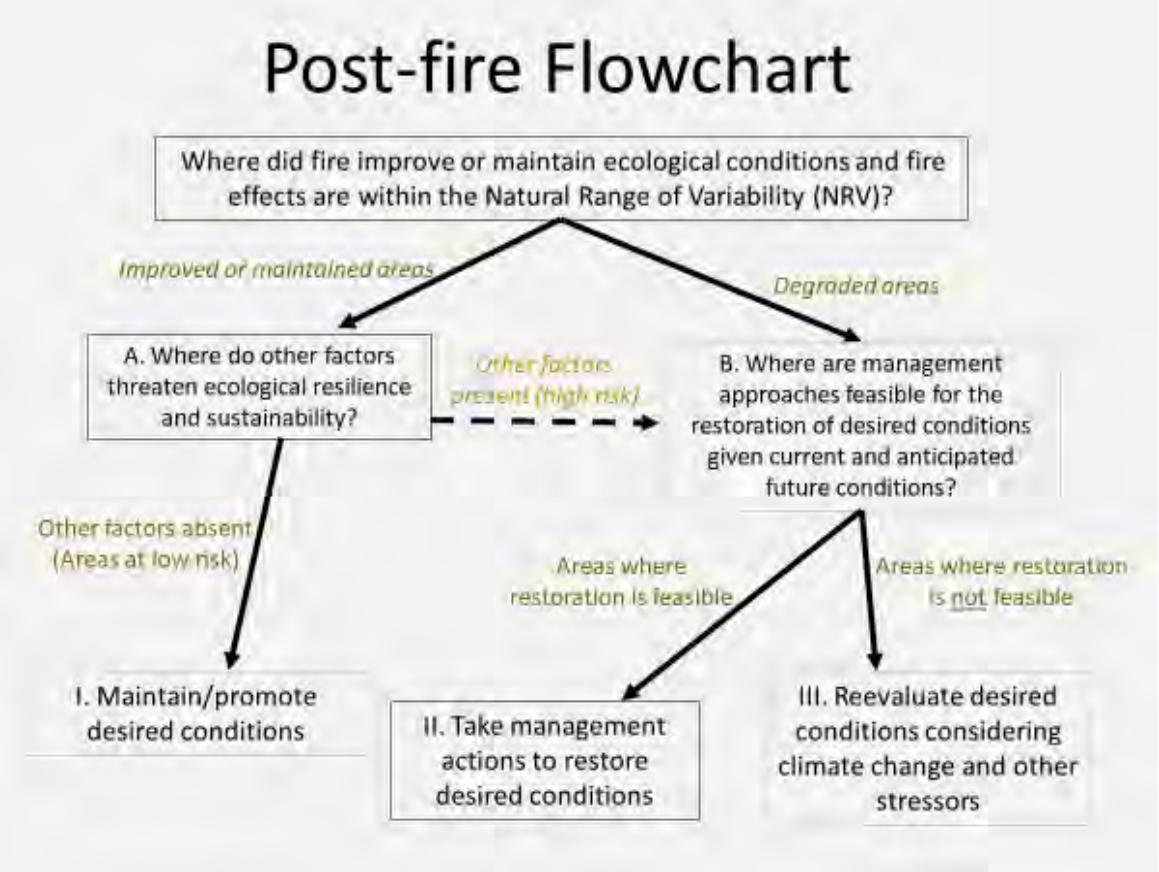

Figure 1. *The postfire flowchart is based on three questions (A, B, and C) for the identification of management responses or "restoration opportunities" (1, 2, and 3) that support overarching restoration goals (e.g., promote or maintain native vegetation cover) in different portions of thepostfire landscape.*

Ecological restoration is not limited to static pictures of the past. Accordingly, the Society for Ecological Restoration acknowledges the potential for irreversible impacts to sites and ecosystems (Gann, et. al., 2019) (Figure 2). The BAER Team recommends that the Park considera wide range of reference models, conditions and sites in developing restoration design at multiple scales of biodiversity in the park, including species habitat, forest stand, and southern Sierra Nevada Mountain landscape.

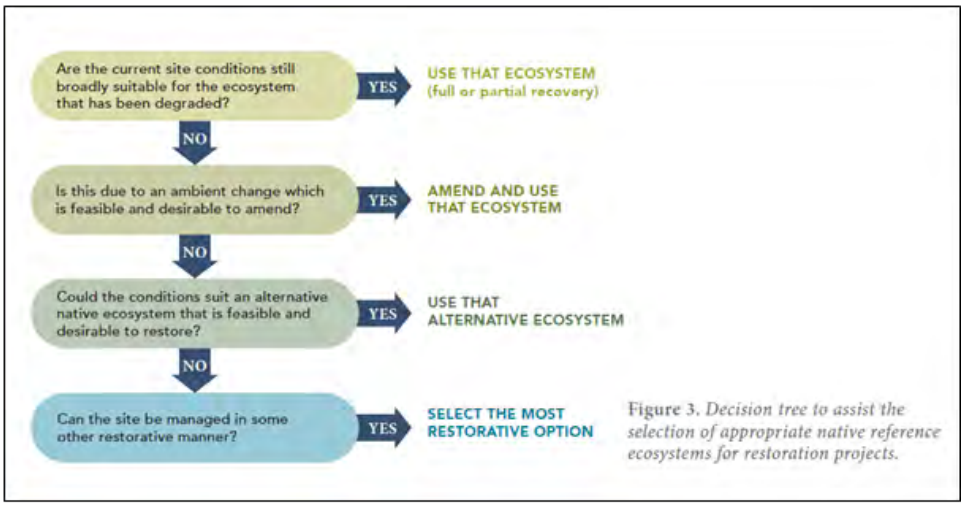

Figure 2 *Decision tree to assist the selection of appropriate native reference ecosystems forrestoration projects (Gann, et.al., 2019)*

Under climate change scenarios, climate adaptation strategies such as those identified in Millar,*et.al.,* 2007 fit the range of approaches to conservation that managers can evaluate. These include:

1. Increasing redundancy and buffers 2. Expanding genetic diversity guidelines 3. Managing for asynchrony and use establishment phase to reset succession	1. Facilitating species range shifts 2. Planting neo-native forests 3. Experimenting with refugia

RESOURCES

Strategic planning and science must be translated to on-the-ground actions. The Baer Team recommends that the Park work with the NPS Biological Resources Division and other supportprograms and partners to build a toolbox including, but not limited to, items identified below:

<u>Build on BAER-funded work</u>

4. Early detection and rapid response to invasive plant establishment
5. Vegetation management to minimize the potential for "re-burns" of vulnerable sites
6. Slope protection / Protection of downslope assets
7. Supplemental seeding or planting of areas where soil bank or adjacent site input isinsufficient

<u>Knowledge Development and Planning</u>

8. Fuel model development for standing dead in burned areas
9. Species envelope and other climate impact models on species distribution

10. Prioritization workshops with regional and climate experts

11. Research agenda development and coordination
12. Post-fire restoration model development and project tracking
13. Planning and compliance support
14. Templates for CESU/USGS research agreements
15. Native plant propagation, increase, storage, and establishment
16. Frameworks for seed networks and commercial grower contracts
17. Invasive plant treatment technologies

Build Conservation Infrastructure

18. Conservation collections for species of concern
19. Restoration species seed collection, increase and storage
20. Greenhouse and nursery infrastructure and staffing
21. Skilled and unskilled staff position descriptions and hiring packages
22. Planting and monitoring equipment

CLOSING

As shown by its long-term association with place-based and other science, and success with land treatments through the Resilient Landscapes Program, Sequoia National Park has demonstrated itself as a leader in NPS science-informed management. A comprehensive, long- term restoration commitment is ambitious. However, it is important to affirm this need when identifying ongoing funding and management needs. Restoration of lands impacted by the KNPComplex at SEKI provides an excellent opportunity to test the strategies, technologies, and models presented here.

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APPENDIX C

Fire Progression Report

KNP Complex Burn Progression Narrative, September-October 2021

Tony Caprio (SEKI Fire Ecologist), 11/1/2021

This burn progression narrative is based on corrected progression maps (provided by Kevin Morris) that are primarily derived from IR mapping flights made of the fire. There are days missing from this record when flights didn't occur and gaps toward the end of the record whenthere was little fire activity. Additionally, the progression date recorded in the data is the date the mapping of the fire took place, not the date the areas burned. Since most flights were at night and mapping done the following morning, mapped dates are typically one day after an area burned (but could be longer). For example, the big run the fire made in Redwood Canyon occurred on October 4th but the progression map has a date of October 5th, the day the area was mapped.

The KNP Complex started during a late evening thunderstorm on September 9, 2021 and were discovered on 9/10/21. The significant lightning event associated with the

storm resulted in three fires in Sequoia National Park. The Cabin Fire (36° 40.254, -118° 48.330),located near Dorst Creek, north of Dorst Campground and the Generals Highway in mixed conifer forest, was contained at 1.25 acres on September 11, 2021. The Colony Fire (36° 34.014,

-118° 48.690) was located near Colony Peak, west of the old Colony Mill Road and south of the

Crystal Cave Road. It was initially estimated at 4 acres burning in mixed conifer with a heavy component of drought killed trees. The Paradise Fire (36° 30.432, -118° 46.050) was located south of Buckeye Campground and west of Paradise Creek and was initially estimated at 0.25acres in rugged and inaccessible terrain in foothill chaparral.

By September 11 the Colony and Paradise Fires had burned 112 ac. By the 12th this was 1,066 ac and, on the 13th, total acreage was 6,918 ac with the bulk of this being the Paradise Fire, which had made runs to the southeast and southwest on to Paradise Ridge, and to the north where it crossed the Middle Fork Kaweah River and Generals Highway late in the day. The southwestern run burned and destroyed the Milk Ranch repeater site, but the fire lookout survived. On 9/15 the Colony Fire crossed the Crystal Cave Road and the Paradise Fire was backing south off Paradise Ridge into the Oriole Lake drainage. Both fires continued to expand outward until they joined on September 17 in the central portion of the Marble Fork. On September 17th the northern portion of the fire made a major run out of the Marble Fork intothe Halstead Creek area and west to Crystal Cave. Suwanee Grove burned during this run (see Suwanee section for details). This high severity run burned most of the lower Marble Fork drainage and crossed the Generals Highway just west of Red Fir and Wuksachi and burned intohigher elevation red fir forests. Additional acreage burned on the 18th, but growth northward petered out in the higher elevation red fir forest. By the 18th total area burned was 21,771

ac. On the 17th and 18th the fire also burned into Giant Forest (see Giant Forest section) but previous burn treatments significantly moderated fire effects and fire spread into the grove. The fire was now actively burning to the south in the Oriole Lake drainage, to the east into the Middle Fork, to the west down the Middle Fork, and west into the Yucca Creek drainage. Over the next 10 days the fire burned most of the Oriole Lake drainage, out-flanking control lines andcrossing Conifer Ridge into the East Fork (There are no old dozer line on Conifer

Ridge. Lines were put in for the 200 ac 1955 Conifer Fire in the center of Atwell Grove, prior to the area being added to the parks). Three sequoia groves, Oriole Lake, New Oriole Lake, and Squirrel Creek burned in this area (see sequoia section for details). Several dozer lines were put in on park lands in this drainage with the parks' permission, including one to the southwest toward New Oriole Grove. In the Middle Fork the fire continued burning eastward at a slow pace and stayed south of the river over this period. The fire also flanked westward down the Middle Fork toward Ash Mountain. Control line south of Milk Ranch that ran down Paradise Ridge to the Middle Fork near the SCE powerhouse and north from Ash Mountain to Fry's Point checked the fire in this direction by September 25th. On the west and northwest flank of the firegrowth was slow until the last week in September when the fire began to move through the 2008 Hidden Fire burn scar and west down the Yucca Creek drainage, on to Yucca Peak, and into the Burnt Point Creek drainage. Fire lines on the North Fork of the Kaweah River held the growth of the fire in the North Fork in the Burnt Point Creek area. The old Hidden Springs Road, last used in the 1970s (Ed Nelson personal communication) and now in wilderness, was reopened as a dozer line out to Burnt Point with the parks' permission. Plans to continue

to reopen the road up to Hidden Springs on Pine Ridge to tie in with the north boundary line from the 2008 Hidden Fire failed when the fire burned over Pine Ridge to the north, with only ashort section of this road accessed. Lower portions of the Colony Mill Rd. were also opened by dozers with a goal of providing access to the fire in the middle reaches of the Yucca Creek drainage. There was little activity in the northern and northeastern perimeter of the fire.

At this point in late September and early October the fire was burning into the East Fork, continuing to burn up into the Middle Fork, burning lower elevations in the Yucca creek drainage, and northward into the upper reaches of the North Fork, north of Pine Ridge. In the East Fork the fire burned down to the river west of Lookout Point, resulting in the re-evacuationof parts of Three Rivers and Ash Mountain after residents had just returned. Further east in the East Fork the fire burned into the Atwell Grove and into the portion of the East Fork grove on the north side of the river. The last major activity of the fire occurred in mid-October near Atwell when the fire burned east of Atwell Creek below the Atwell Campground. In the upper Middle Fork, the fire burned into the Castle Creek Grove (see sequoia grove section) and continued to flank east further up the canyon. There were concerns at this point on whether the fire would cross the Middle Fork and burn into the Redwood Meadow Grove or northwardtoward Bearpaw. However, the fire never crossed the river, staying to the south. To the west in lower Yucca Creek the fire backed to control lines or burnouts were made off control lines, while in the Ash Peaks area the fire stalled at high elevation in chaparral vegetation. In the upper North Fork the fire backed down the north slope of Pine Ridge into Pine Ridge, Skagway and Muir Groves (see grove section) and on September 30 crossed the North Fork to the south of Redwood Mountain Ridge into lower Pierce Creek. The fire made a major push into up into Pierce Creek on October 1 and crossed the lower portion of Redwood Mountain Ridge into Redwood Canyon.

The last major fire activity took place in early October in the Redwood Mountain area. Blacklining operations were begun along Generals Highway on 10/1 with crews working from the Little Baldy Saddle area north around the Dorst Campground to the Lost Grove over several days. To the north blacklining was begun on Big Baldy Ridge, then along Generals Highway to the north, past Quail Flat to the junction of Redwood Mountain Ridge and the highway. Firing continued south along the east flank of Redwood Mountain Ridge. The Arrowhead UAS was used for recon and aerial ignition in the latter operation to access areas where fire crews could not safely go. On Oct. 2nd and 3rd the fire backed into the lower Redwood Canyon and made run east up toward Big Baldy. On October 4th, extreme fire activity, which appears to have begun onthe west side of Redwood Ridge near Pierce Meadow in the evening of the 3rd, burned at high severity across the central portion of Redwood Canyon, combined with another run that appears to have originated north of the Big Springs Grove, and crashed into the Big Baldy Ridge where blacklining had occurred. Fire effects in this section of the canyon were severe and impacted the lower portion of Redwood Mountain Grove (see sequoia section). While this run continued north through the grove effects were moderated by previous prescribed

burns (Upper Redwood Rx 2006, Hart Rx 2009, Redwood Mountain Rx 2011, Whitaker Rx 2012,and Goliath Rx 2016) and the blacklining operation that had backed down into the canyon.

Witnesses to this run were impressed by how rapidly this run subsided when it reached these treated areas. Later in the day on the fourth the fire burned to the west side of Redwood Mountain Ridge (between Redwood Saddle and Generals Highway) and made a significant but smaller run uphill from the Whitakers Forest area, across Generals Highway, and onto GSNM lands near Bacon Meadow, east of Park Ridge. The fire continued to burn area on the west sideof Redwood Mountain Ridge, filling in the 2012 Rx treatment area and burning into the

upper Eshom Creek area through October 9th. To the east on October 4th, the fire made arun north out of the upper North Fork burning north across the park

boundary but remaining south of Generals Highway and northeast along the park USFS boundary into the Stoney Creek area where it crossed to the east side of Generals Highway. Inthe Giant Forest area the fire flanked slowly east toward Moro Rock and then

backed rapidly down the east side of Generals Highway to the Hospital Rock area.

Giant Sequoia Groves – Burn Narrative details

A total of 16 groves had some portion of the grove burned by the KNP Complex. In some grovesthis was the whole grove and, in some cases, just a small portion. Groves were located on

NPS (SEKI), USFS (GSNM), and UC Berkeley (Whitaker Forest) lands. Additionally, there were five groves where some kind of fire suppression activity or pre-fire prep work around giant sequoia trees took place. The latter groves included Case Mountain (BLM's only sequoia grove),

Big Stump (NPS and USFS), Grant Grove (NPS), Bearskin (USFS), and Redwood Meadow(NPS). Plans for the aerial application of fire-retardant GEL were developed

for six groves, Suwanee, Muir, Castle Creek, Redwood Mountain, Big Stump, and RedwoodMeadow, but were only implemented in a portion of Muir Grove.

Oriole Lake – 9/16 to 9/26 – Fire flanked and backed into the grove from the northwest off ofParadise Ridge burning into the lower portions of the grove first and slowly moving into high areas, further east up Squirrel Creek, over the next 10 days.

Suwanee – 9/17 – All of Suwanee burned during an extreme head fire run north up the Marble Fork drainage that burned about 6,500 ac. The bulk of the grove burned with high or moderate severity with a couple of small low severity patches.

Giant Forest – 9/17 to Oct. 18 – The main portion of the KNP Fire burned into the western areas of Giant Forest during the run on 9/17, primarily burning into lower Deer Creek. On the 18th the fire pushed further east into the grove burning across Generals Highway and the Crescent Meadow Road on the west side of the grove and into Sherman Creek area on the northwest side of the grove with one spot fire located about 130 meters northwest of the Sherman Tree on the east side of Generals Highway. On neither the 17th or 18th did the fire expand to any degree within the recently completed (2019) Rx unit west of Generals Highway. Fire continued to expand along this flank into the grove on 9/19. Burnout operationwere implemented by Arrowhead and Alpine Hotshots, and the Whiskeytown module on 9/19 on the west and southwest flanks of the fire to prevent further spread of high

severity fire into Giant Forest. On 9/21 burnout operation implemented in upper Sherman Creek and down around Pinewood. On 9/22 burnout operations were carried out in the SunsetRock area. Fire continued to flank east around the south side of the grove toward Moro

Rock (where a historic restroom burned on October 3rd) with burnout operations continuingahead of the fire within the grove and south of the Crescent Meadow Road and High Sierra Trail into late October as a precaution

in case the fire downslope of Giant Forest made an uphill run. Drought mortality made containing these burnouts difficult. No impacts to trees of

special interest have been reported for Giant Forest other than the charring of the bases of twoof the Four Guardsmen.

Squirrel Creek – 9/18 – Fire backed into these few trees along Squirrel Creek near the OrioleLake Road crossing.

Douglass – 9/22 to 9/23 – This very small grove on the north side of Paradise Ridge in theParadise Creek drainage appeared to have burned with a head fire.

Redwood Creek – 9/23 to 10/2 – Fire approached and backed into the grove from across Conifer Ridge until 10/1 when it ran to the east out of Redwood Creek drainage up towardAtwell Grove. Portions of the grove below Mineral King Road did not burn.

New Oriole Lake – 9/24 to 9/25 – Most of the grove burned on 9/24 after the fire made a push out of the Oriole Lake area, east of where fire suppression activities were occurring. The grove burned under an inversion.

Skagway – 9/24 to 9/29– backing fire off Pine Ridge. Grove map does not show the groveextending up to the top of Pine Ridge but ground observation (Tyler Schmitt personal communication) and photos from helicopter recon indicate this is the case.

Muir – 9/25 to 10/5 (east flank) – A firing operation was carried out on 9/25 over the upper ridgetop with the fire then backing off the ridge to east, west and north. Significant portions ofthe grove burned on 9/25, 9/30 (lower west area), 10/1 (west center and north area). Areas burned on 9/30 and 10/1 appeared to have been burned by a fire burning upslope from the lower canyon (possibly out of Pine Ridge Grove). A plan for aerial application of fire-

retardant GEL was prepared for this grove that focused on application to sequoia trees alongthe lower and upper border of the grove, depending on how fire spread into the area, to potentially reduce severity of a fire burning upslope into the grove. It was reported that GEL was applied to the grove but it's not certain where it was applied and how much was applied.

Pine Ridge – 9/26 to 9/30 – Appeared to have been largely burned by backing

fire coming off Pine Ridge. Fire severity was predominantly low with some moderate.

Castle Creek – 9/26 to 10/2 – The fire approached the grove from the west flanking into thegrove over several days from 9/26 to 9/29. On 9/30 the fire made a strong push to the

east below the grove and then upslope into the lower portions of the grove, burning lower elevation pockets of trees. On 10/1 this push continued with the fire burning upslope throughthe grove to the south and east. It was reported that the sun got on this grove resulting in

a head fire while burning upslope. A column of unknown size was reported. This grovepreviously burned in a backing fire during the 1996 Castle Fire.

Atwell – 9/30 to 10/18 – The fire first flanked into the grove from the west on 9/30 and followed on 10/1 by a major run into the west side of the grove from the Redwood Creek area. Fire continued to flank through the grove to the east and crossed Mineral King Road to the south. One 10/5 the fire made a significant uphill run from south of the road up into the center of the grove resulting in some high severity effects. Much of the area that burned in this part of the grove was second growth forest that had been logged (and had summer cabins) prior to thearea being purchased and incorporated into the parks in 19?? (date ?). The fire continued to flank east through the grove, although spread was minimal into higher elevations by this date. The fire made on last push upslope below the Atwell Campground on about 10/18 along the west boundary of the 2016 Deadwood Rx. Condition of the four trees of special interest in the grove is unknown.

Big Springs – 10/2 to 10/3 -- The three-small pockets of trees that make up this grove burnedon 10/2 and 10/3.

Redwood Mountain – 10/4 to 10/9 -- The initial burning in this grove was blacklining operationsthat were initiated at night along Generals Highway on 10/1 (southwest side of highway in area of Kings Canyon Overlook). These operations continued 10/2 with crews working southeast and northwest along the highway from the previous area burned. By the morning of 10/3 the area

from Big Baldy Trailhead to Redwood Canyon Overlook had been completed. On the evening of10/3 operations continued south along the Big Baldy Trail and west from the overlook to Redwood Ridge. During all three nights the Arrowhead UAS was used for recon and to conduct interior firing by dropping ball to increase blackline depth. On the morning of 10/4 they were firing out on the east flank of Redwood Ridge south of Redwood Saddle. Late in the evening of 10/3 fire that was burning to the west of Redwood Mountain in the Peirce Meadow

area appears to have begun a run up the west side of Redwood Mountain Ridge (based on distant IR drone images and burn scar patterns). On the morning of 10/4 this fire was running across the ridge into the main Redwood Canyon and appears to have merged with another run that came up-canyon from the area that was burning just north of the Big Springs Grove. These runs merged and burned the southern end of Redwood Mountain Ridge and lower portions of the grove in Redwood Canyon at high severity and ran to the east just to the south of the East Fork of Redwood Creek onto the Big Baldy Ridge. The fire also ran to the north through the Redwood Canyon until reaching the blackline burn but the severity was moderated by previous Rx burns (2009 Hart Rx, 2011 Redwood Rx, 2012 Whitaker Rx, and 2016 Goliath Rx). Area burned on 10/4 was 11,678 ac. The Redwood Saddle Cabin and Barton's Cabin Log burned on this day (condition of the Tunnel Log, Roosevelt and Hart Trees are unknown). Much of the 2012 Rx did not immediate burn but the fire flanked west from the Redwood Saddle and burned into the Whitaker Forest area and late in the day made another run north across the Generals Highway and into GSNM lands near Bacon Meadow, east of Park Ridge and northwestof Quail Flat. The fire then continued to back to the west into the Eshom area on USFS lands, burning nearly all the remaining portion of the grove.

Lost – 10/4 to 10/5 – Backing fire was put into grove on 10/4 and was immediately followed bya head fire run just to the northwest of the grove missed the grove.

East Fork – 10/8 & 10/9, and 10/18 – Only a small section of the East Fork Grove on the northside of the East Fork burned over three days (prior to the recent remapping of sequoia grove boundaries sequoia trees on the south side of the East Fork were considered within the East Fork Grove and trees on the north side of the river as in the Atwell Grove).

APPENDIX D

Maps

APPENDIX – MAPS

1. Fire Location
2. Fire Progression
3. Fire History
4. Soil Burn Severity
5. Rapid Assessment of Vegetation Condition after Wildfire (RAVG)
6. Sequoia Groves Burn Severity
7. Debris Flow Estimate Combined Hazard 15 min 20 mm/hr. (Roads)
8. Debris Flow Estimate Combined Hazard 15 min 32 mm/hr. (Roads)

9. Debris Flow Estimate Probability 15min 20 mm/hr. (Roads)
10. Debris Flow Estimate Probability 15min 32 mm/hr. (Roads)
11. Debris Flow Estimate Probability 15min 20mm/hr. (Trails)
12. Water Erosion Predictions (Sequoia Groves)
13. Watershed Modeling 10 Year 6 Hour Percent Change in Peak Flow
14. Watershed Modeling 10 Year 6 Hour Changes in Sediment
15. Hazard Tree Assessment and Mitigation (ES-1)
16. Boundary Fencing and Signage Treatments (ES-2)
17. Storm Patrol Treatments (ES-2)
18. Minor Facilities Treatments (ES-2, ES-3, BAR-1, BAR-2)
19. Generals Highway Road Damage Observations (ES-4)
20. Signage and Gates (ES-6)

2021 KNP Complex Burned Area Emergency Response

Fire Location

Panther Gap

ALTA PEAK

YUCCA MOUNTAIN

Giant Forest

BEETLE ROCK

COLONY PEAK

Giant Forest

Giant Forest Museum

YuccaFlat

MORO ROCK

Redwood Meadow

ASH PEAKS

Buckeye Flat

Potwisha

Potwisha

Foothills

Visitor Center

SHEPHERD PEAK

Ash Mountain Headquarters

MILK RANCH PEAK

CASTLE ROCKS

North Fork

BLM Land

Lookout Point

Oriole Lake

Atwell Grove

Atwell Mill

Silver City

198

198

198

290

KNP Complex, 88,307 acres burned total, 78,675 NPS acres within perimeter

Campground
Entrance Station
Lodge
Visitor Center
Primary Road
Local Road

Minor or Private Road
4WD Road

Trail Class
Class 5: Fully Developed
Class 4: Highly Developed
Class 3: Developed

Class 2: Moderately Developed
Class 1: Minimally Developed

Sequoia Groves
KNP Complex Perimeter 10/14
NPS Boundary

Miles
0 1 2 3 4

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KINGS CANYON NP
MANZANAR NHS
SEQUOIA NP

Cherry Gap
Evans
Deer Meadow
Abbott
Kennedy
Burton
Landslide
Little Boulder
Boulder Creek
Grant Grove
General Grant
Crystal Springs
Bearskin
Tenmile Grove
Fresno
Tulare
Azalea
Sunset
Sequoia Creek
Big Stump
Kings Entrance
GG Entr
Kiosk B
Redwood Mountain
Ranger Lake
Big Springs
Lost
Dorst Creek
Muir
Pine Ridge
Skagway
Lodgepole
Lodgepole
Pear Lake
Suwanee
Giant Forest
Giant Forest
Bearpaw
Granite Creek
Redwood Meadow
Redwood Meadow Grove
Little Redwood Meadow
Buckeye Flat
Potwisha
Castle Creek
Foothills
Entrance
Douglass
Squirrel Creek
Oriole Lake
Redwood Creek
Atwell
Atwell Mill
New Oriole Lake
East Fork
Mineral King
Cold Springs
Case Mountain
Horse Creek
Cahoon
Eden Creek

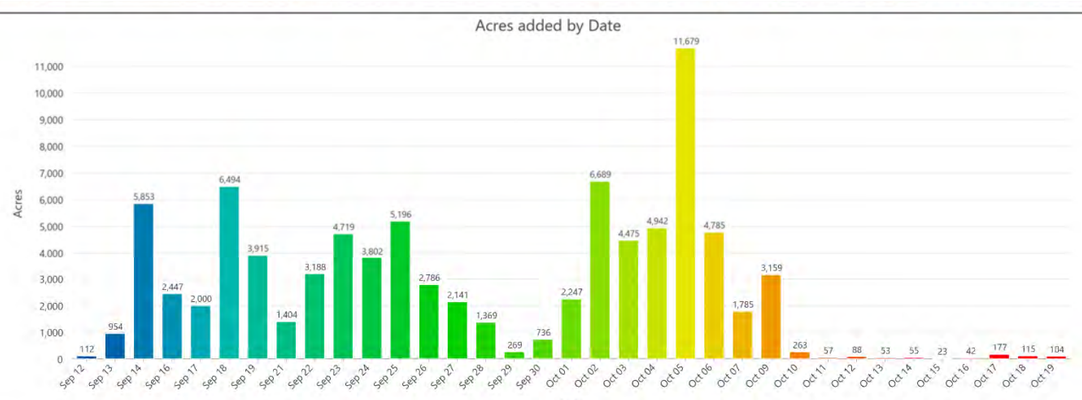
PROGRESSION

KNP COMPLEX
CA-KNP-000122
10/19/2021

88,287 acres at 10/18/2021 2100

1:40,000 - CIIMT 2 - 10/19/2021 1830
Acres from IR and GIS
North American 1983 Datum. LatLong Grid

- Campground
- Entrance Station
- Ranger Station
- Visitor Center
- Sequoia Groves
- SEKI Boundary
- CountyBoundary



Miles
0 1 2
0 1 2
Kilometers

N

PROGRESSION

2021 KNP Complex Burned Area Emergency Response

Fire History, 1990 to Present

2019rX

1.

1.

Suwanee Grove

2002 rX

1991 rX

2020 rX

ALTA PEAK

Cr

Suwanee

2001 rX

2005 rX

1.

ysta

2021 KNP Complex

R

l Cave

YUCCA MOUNTAIN

1.

202 rX

1.

Giant

2003 rX

Rd

2015 rX

1996 rX

1992

Forest

Hi gh S e i rra Trail

COLONY PEAK

BEETLE ROCK

Grove

2001 rX

1999 rX

2004 rX

COLONY PEAK

Shade 1/4

1994 rX

Yucca Mt

Giant Forest Museum

2014 rX

2003

1990 rX

1.

1997rX

1.

1.

1998 rX

2011rX

1.

2007 rX

1.

2010 rX

Yucca Mtn

1.

MORO ROCK

1997

1.

1.

Redwood Meadow

ASH PEAKS

1.

Castle Wf

Buckeye Flat

1995

Gro ve

1.

1996

Castle Rk

Castle Co

wa y

Potwisha

1995 rX

Castle Creek Grove

1996

PE AK S

2018 rX

2019 rX

WEDGE

A H S R

era ls H igh

Ge n

Kaweah

Ash Mountain Headquarters

SHEPHERD PEAK

1996

1.

1.

CASTLE ROCKS

1.

MILK RANCH PEAK

2.

1.

Paradise 2

Foothills Visitor Center

2003

2003

P A RAD ISE

2017

North Fork Dr

M e i n

Ori ole Lake

D G E

2005 rX

2000 rX

1.

1995 rX

GO

Mineral 1

Gro ve

Atwell Mill

Highbridge West

198

r al Ki

Redwood

2003 rX

ng Rd

Atwell

Creek Grove

Atwood

Grove

2016 rX

2006 rX

2005 rX

1.

1.

1999 rX

East Fork

1991

Highbridge

1994 rX

1997 rX

East

1.

1999

1999 rX

Davenport

G rove

Mosquito Rx

2008 rX

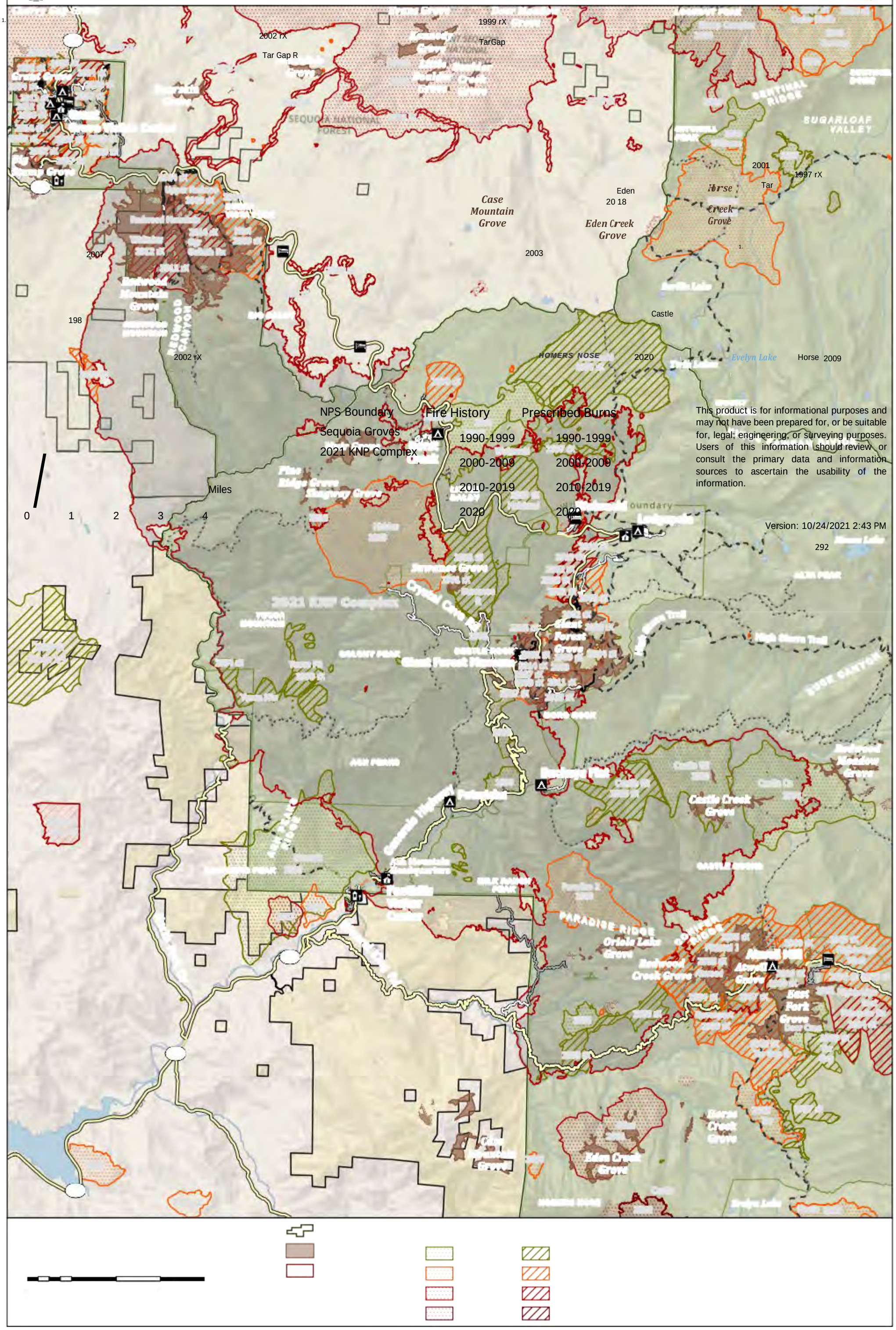
Deer Cree

2014 rX

1998

BLM Land

1999 rX


1999 rX
2002 rX
TarGap
Tar Gap R
SEQUOIA NATIONAL FOREST
BUCKHORN RIDGE
SUGARLOAF VALLEY
2001
1997 rX
Tar
Horse Creek Grove
Eden
20 18
Case Mountain Grove
Eden Creek Grove
2003
2007
198
REDWOOD CANYON
2002 rX
HOMERS NOSE
2020
Evelyn Lake
Horse
2009
Castle
NPS Boundary
Sequoia Groves
2021 KNP Complex
Fire History
1990-1999
2000-2009
2010-2019
2020
Prescribed Burns
1990-1999
2000-2009
2010-2019
2020
Miles
0
1
2
3
4
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292
PARADISE RIDGE
Oriole Lake Grove
Redwood Creek Grove
Castle Creek Grove
Bear Creek Grove
Horse Creek Grove
West Fork Grove

2021 KNP Complex Burned Area Emergency Response

Soil Burn Severity

Cherry Gap Grove

Evans Grove

Deer Meadow Grove

LOOKOUT PEAK

Kennedy Grove

180

Little Boulder

Boulder Creek

SENTINEL DOME

Landslide Grove

General Grant

NALRI DG

Grant Grove

Bearskin Grove

Grove

Grove

E

Grant Grove Visitor Center

SUGARLOAF VALLEY

SENT

Big Stump Grove

MITCHELL PEAK

180

BUENA VISTA PEAK

Redwood Mountain Grove

REDWOOD MOUNTAIN

BIG BALDY

Seville Lake

Twin Lakes

Dorst Creek

SILLIMAN

Muir Grove

WEAHDIVIDE

Pine Ridge Grove

Skagway Grove

LITTLE BALDY

Wuksachi

Lodgepole

Moose Lake

Sequoia

Grove

YUCCA

Crystal

ALTA PEAK

Ca ve

Giant

Gia nt For est

MOUNTAI N

Forest Grove

Rd

Museum

Trail

High Sierra Trail

BEETLE ROCK

COLONY PEAK

MORO ROCK

ASH PEAKS

Redwood Meadow

Buckeye Flat

Grove

Potwisha

Castle Creek Grove

CASTLE ROCKS

Foothills

Visitor

SHEPHERD PEAK

Center

Ash Mountain Headquarter

MILK RANCH PEAK

North Fork Dr

Creek

BLM Land

Oriole Lake Grove

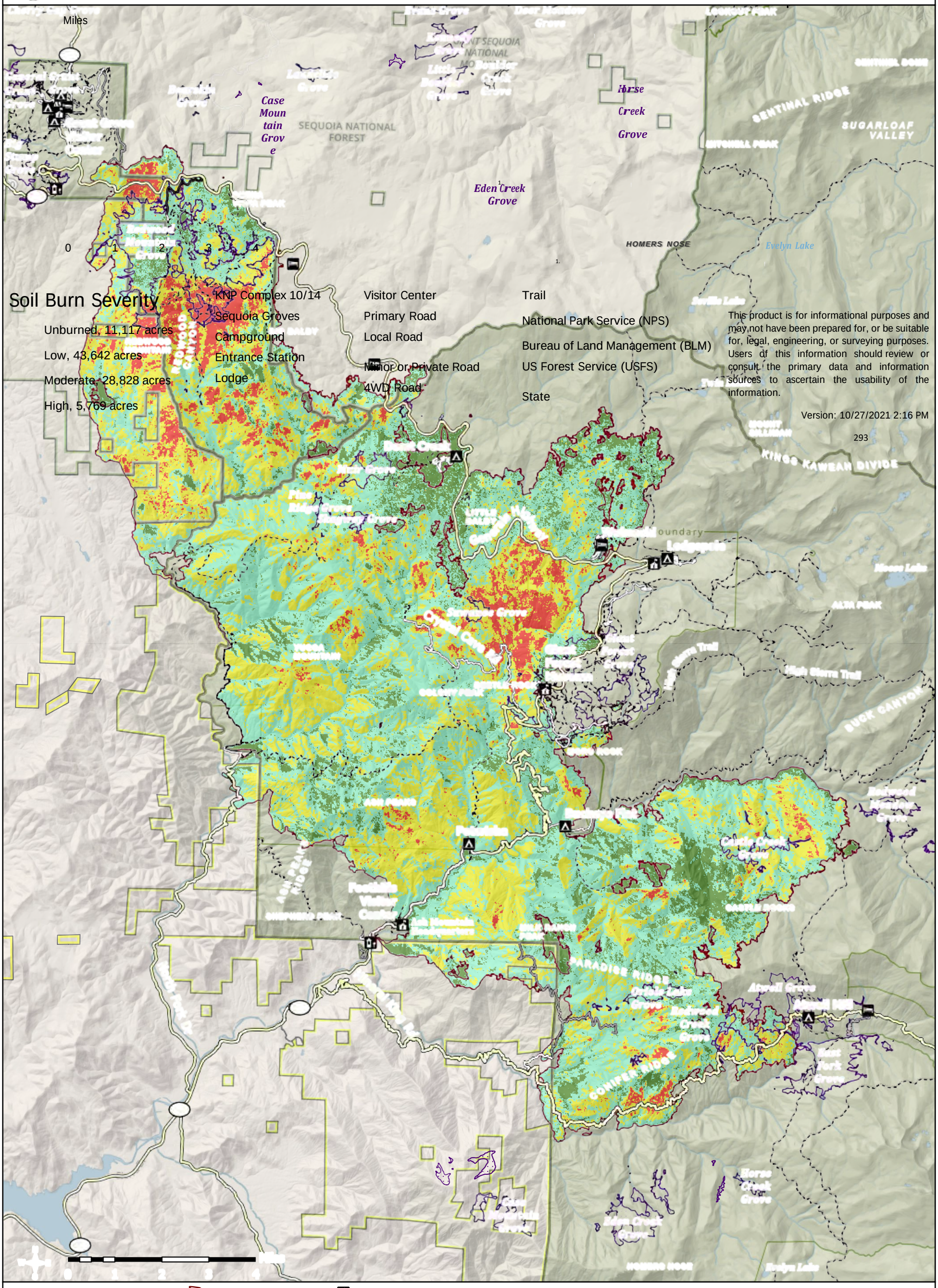
Atwell Grove

Atwell Mill

Redwood Grove

East Fork Grove

198


Miles
0 1 2 3 4
Case Mountain Grove
SEQUOIA NATIONAL FOREST
Horse Creek Grove
Eden Creek Grove
SENTINAL RIDGE
SUGARLOAF VALLEY
HOMERS NOSE
Evelyn Lake
KINGS KAWEAH DIVIDE
ALTA PEAK
BUCK CANYON
Soil Burn Severity
Unburned, 11,117 acres
Low, 43,642 acres
Moderate, 28,828 acres
High, 5,769 acres
KNP Complex 10/14
Sequoia Groves
Campground
Entrance Station
Lodge
Visitor Center
Primary Road
Local Road
Minor or Private Road
4WD Road
Trail
National Park Service (NPS)
Bureau of Land Management (BLM)
US Forest Service (USFS)
State
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293

2021 KNP Complex Burned Area Emergency Response

Rapid Assessment of Vegetation Condition after Wildfire (RAVG)

Cherry Gap Grove

Evans Grove

Deer Meadow Grove

LOOKOUT PEAK

Kennedy Grove

180

Little Boulder

Boulder Creek

SENTINEL DOME

Landslide Grove

General Grant

NALRIDG

Grant Grove

Bearskin Grove

Grove

Grove

E

Grant Grove Visitor Center

SUGARLOAF VALLEY

SENT

Big Stump Grove

MITCHELL PEAK

180

BUENA VISTA PEAK

Redwood Mountain Grove

REDWOOD MOUNTAIN

BIG BALDY

Seville Lake

Twin Lakes

Dorst Creek

SILLIMAN

Muir Grove

WEAHDIVIDE

Pine Ridge Grove

Skagway Grove

LITTLE BALDY

Wuksachi

Lodgepole

Moose Lake

Crystal

YUCCA

Sequoia Grove

ALTA PEAK

Ca ve

Giant

Gia nt For est

MOUNTAI N

Forest Grove

Rd

Museum

Trail

High Sierra Trail

BEETLE ROCK

COLONY PEAK

MORO ROCK

ASH PEAKS

Redwood Meadow

Buckeye Flat

Grove

Potwisha

Castle Creek Grove

CASTLE ROCKS

Foothills

Visitor

SHEPHERD PEAK

Center

Ash Mountain Headquarter

MILK RANCH PEAK

North Fork Dr

Creek

BLM Land

Oriole Lake Grove

Atwell Grove

Atwell Mill

Redwood Grove

East Fork Grove

198

Miles

0 1 2 3 4

RAVG 10/13

Composite Burn Index

Unchanged, 13,045 acres

Low Severity, 28,197 acres

Moderate Severity, 23,448 acres

High Severity, 24,535 acres

Unclassified Severity, 139 acres

KNP Complex 10/14

Sequoia Groves

Campground

Entrance Station

Lodge

Visitor Center

Primary Road

Local Road

Minor or Private Road

4WD Road

Trail

National Park Service (NPS)

Bureau of Land Management (BLM)

US Forest Service (USFS)

State

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Version: 10/27/2021 2:24 PM

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1. Debris Flow Estimate Combined Hazard 15 min 32 mm/hr Maps (Roads)

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2. Debris Flow Estimate Probability 15min 20 mm/hr Maps (Roads)

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11. Debris Flow Estimate Probability 15min 20mm/hr Maps (Trails)

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Watershed Modeling 10 Year 6 Hour Percent Change in Peak Flow

198

198

198

East Fork Kaweah River

Horse Creek

Miles

0 1 2 3 4

KNP Complex 10/14

10yr 6hr Modeled Stream Response

Percent Change in Peak Flows

No Data

0% - 50%

51% - 300%

310% - 600%

610% - 800%

Large

Primary Road

Local Road

Minor or Private Road

4WD Road

National Park Service (NPS)

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Version: 10/31/2021 6:41 PM

Watershed Modeling 10 Year 6 Hour Changes in Sediment

180

eG nerals Hi ghway

Creek

Sugarloaf

KINGSCANYONNATIONAL PARK

ort Creek

Marble F rk Kaweah River

N

ort h Fork Ka eah River

Yucca Creek

Crystal Cave Rd

High Sier a Trail

High Sierra Trail

Middle Fork Kaweah River

SEQUOIA NATIONAL PARK

Kaweah River

North Fork Dr

198

g Rd

weah River

Mineral Kin

East Fork Ka

Horse Cr e ek

198

Miles

0 1 2 3 4

KNP Complex 10/14

10y 6hr Modeled Stream Response

Percent Change in Sediment Delivery

No Data

0% - 50%

51% - 300%

310% - 600%

610% - 900%

Large

10yr 6hr Modeled Drainage Response

Percent Change in Sediment Delivery

No Data

0% - 100%

110% - 300%

310% - 600%

610% - 900%

Large

AGWA Modeled Watersheds

Primary Road

Local Road

Minor or Private Road

4WD Road

Trail

National Park Service (NPS)

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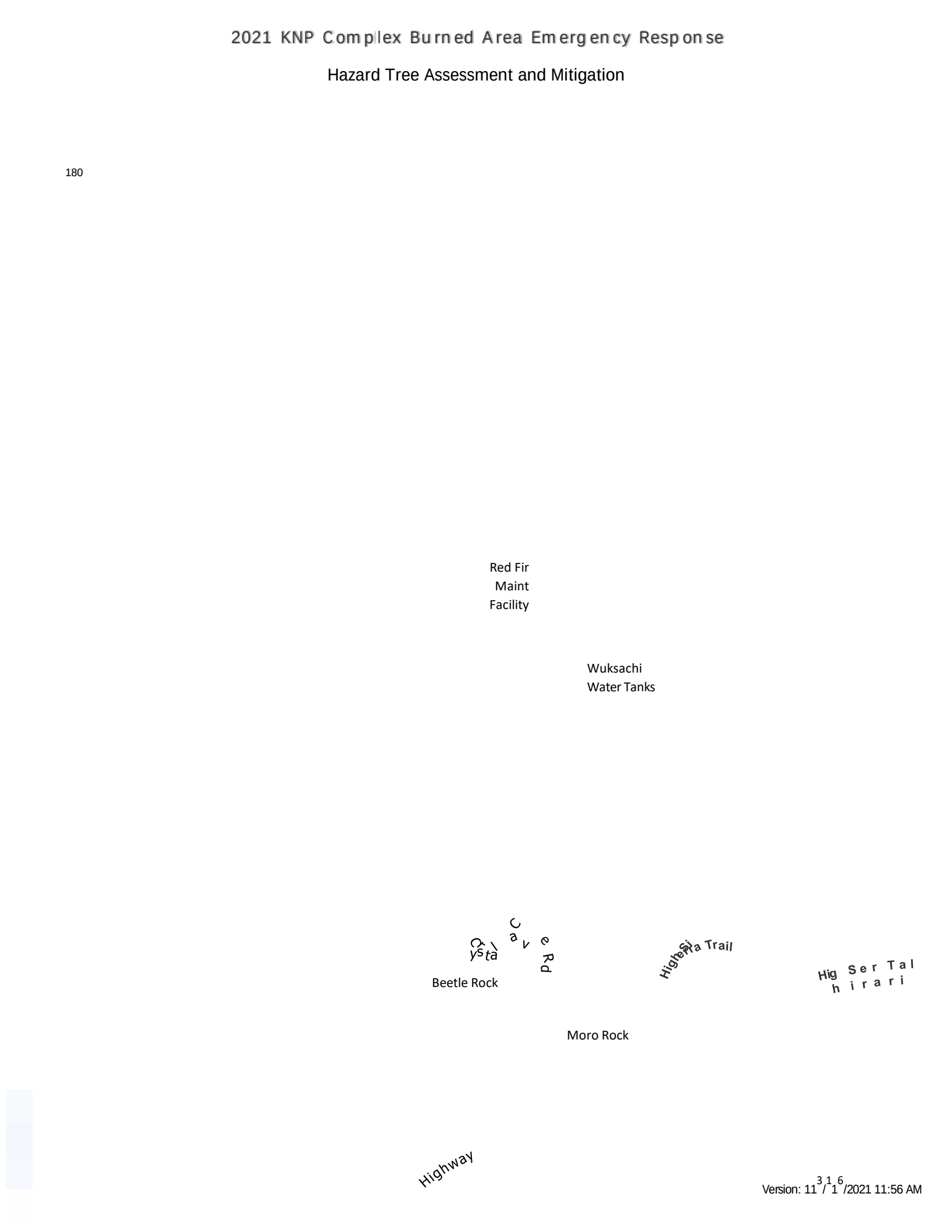
Version: 10/31/2021 6:56 PM

Hazard Tree Assessment and Mitigation



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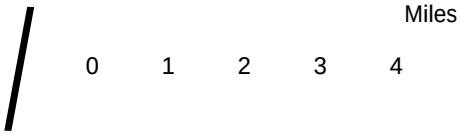

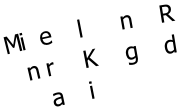

Hazard Trees Marked for Mitigation

Hazard Trees Mitigated

Hazard Tree Mitigation Pending (Includes High Vegetation Burn Intensity Areas)

Specific Locations Assessed (Road Turnouts Not Labeled)

KNP Complex 10/14

Primary Road

Local Road

Minor or Private Road

4WD Road

Trail

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Boundary Fencing and Signage Treatments

Grant Grove Visitor Center

Boundary Signage

180

Boundary Signage

Whitaker's Forest

Whitaker's Forest Fencing

Boundary Signage

Boundary Signage

Boundary Signage

Dorst Creek

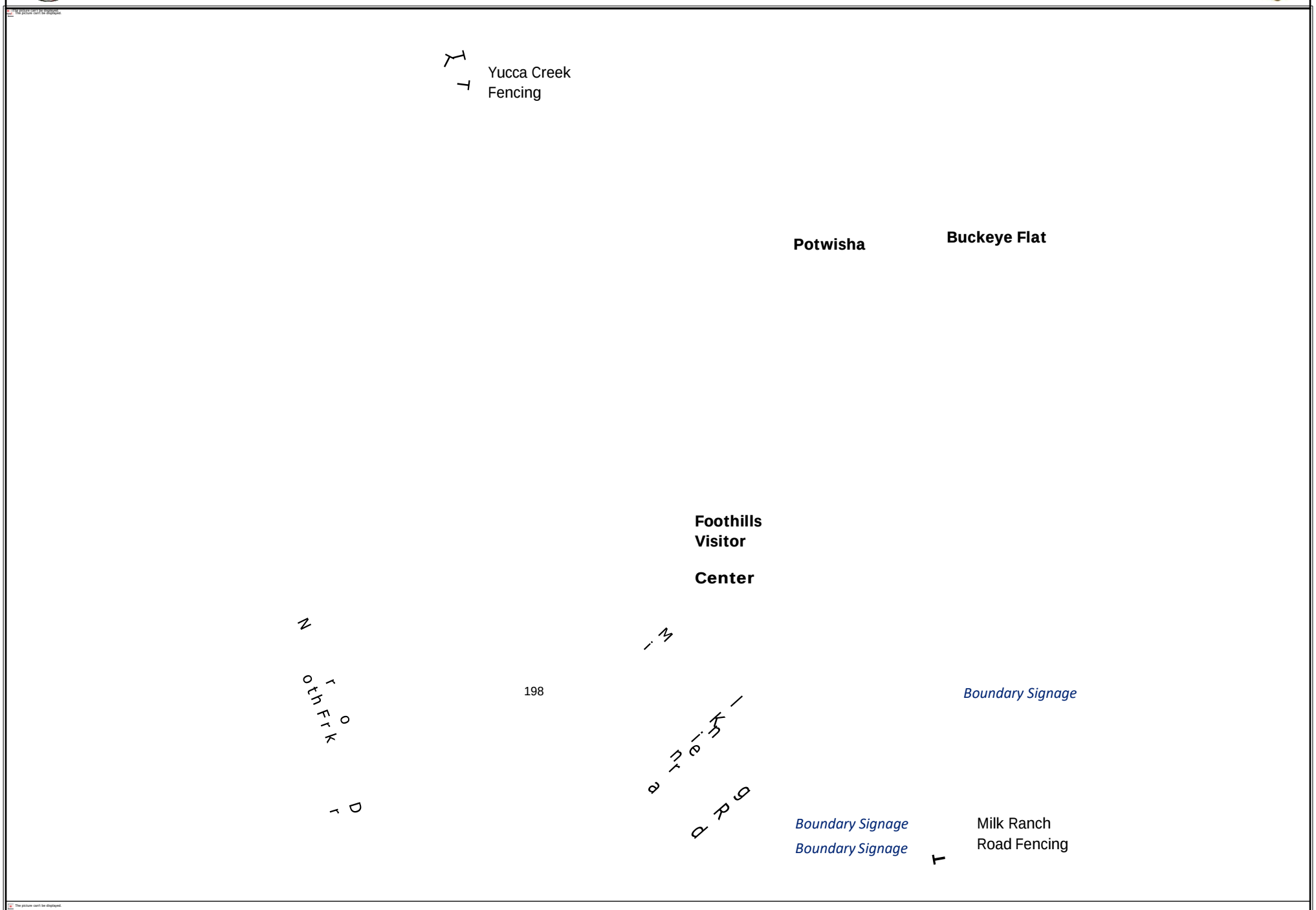
Boundary Signage

Wuksachi

Lodgepole

Giant Forest Museum

Boundary Signage



Boundary Signage

T T Fencing

KNP Complex 10/14

Campground

Entrance Station

Lodge

Visitor Center

Primary Road

Local Road

Minor or Private Road

4WD Road

Trail

National Park Service (NPS)

Bureau of Land Management (BLM)

US Forest Service (USFS)

State

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2021 KNP Complex Burned Area Emergency Response

Storm Patrol Treatments

Dorst Creek

1.

Silliman Lake

Silliman Meadow

Muir Grove Muir Grove

Cahoon Meadow

KAWEAH DIVIDE

Halstead Meadow

Generals Highway

LITTLE BALDY

KINGS

BALD

Wuksachi

Lodgepole

Hidden Spring

Red Fir

Pear Lake

Moose Lake

Heather Lake

Wolverton

Crystal Cave

ALTA PEAK

General Sherman Tree

Panther Gap

Alta Meadow

YUCCA MOUNTAIN

SUNSET ROCK

Pinewood

COLONY PEAK

Giant Forest Museum

Giant Forest

High Sierra Trail

BEETLE ROCK

Yucca Flat

MORO ROCK

Giant Forest

Little Bearpaw Meadow

ASH PEAKS

ASHPE RIDGE

Redwood Meadow

Buckeye Flat

Potwisha

Castle Creek Grove

Shepherd Saddle

TUNNEL ROCK

Little Sand Meadow

SHEPHERD PEAK

CASTLE ROCKS

Ash Mountain Headqu arters

Foothills

Visitor Center

MI LK RANCH PEAK

PARADISE PEAK

PARADISER IDGE

Atwell Grove

Atwell Mill

PINE TOP MOUNTAIN

Oriole Lake

Silver City

Faculty Flat

Cold Springs

East Fork Grove

North Fork Dr

BLM Land

Lookout Point

Tar Gap

Horse Creek Grove

HENGST PEAK

Case Mountain Grove

Eden Creek Grove

HOMERS NOSE

CAHOON ROCK

198

Generals Highway (37.5 Miles)
Crystal Cave Rd (6.6 Miles)
Mineral King Rd (9.2 Miles)
Oriole Lake Rd (2.3 Miles)
Milk Ranch Rd (1.7 Miles)

Culverts (Incomplete inventory) (310)

Sequoia Groves

NPS Boundary

Soil Burn Severity

High
Moderate
Low
Unburned

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Miles

0 1 2 3 4

318

N
W E
S