



## Public Scoping Information on Proposal to Re-establish Tree Seedlings in Severely Burned Giant Sequoia Groves and Adjacent Fisher Habitat Corridor

The National Park Service (NPS) is seeking public feedback on a proposal to replant giant sequoia (*Sequoiadendron giganteum*) and other mixed conifer seedlings in up to six giant sequoia groves, and in a mixed conifer habitat corridor for the endangered Southern Sierra Nevada distinct population segment of fisher (*Pekania pennanti*), severely impacted by recent wildfires. Although other groves and mixed conifer forests in Sequoia and Kings Canyon National Parks were affected to some extent by recent wildfire, these seven areas burned at such high and unprecedented severity and suffered such extensive sequoia and mixed conifer mortality that these forests are unlikely to recover—and will instead remain vulnerable to fire-initiated long-term conversion from forest to shrub dominated communities—without intervention. Forest conversion, at least for giant sequoia, would likely equate to a functional loss of this species from these areas severely burned in recent wildfire.

The NPS is planning to prepare an Environmental Assessment (EA), in accordance with the National Environmental Policy Act, and complete additional analyses and consultations to ensure agency decision-making conforms with all federal resource protection laws.

### Purpose and Need for Action

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In order to prevent an unacceptable loss of sequoias, a fundamental resource for which these parks were established, and restore proposed critical habitat for an endangered species, the purpose of the proposed action is to promote post-fire recovery of giant sequoia groves and proposed fisher critical habitat impacted by high severity fire in areas where these forests are unlikely to recover without intervention.

The NPS is considering action at this time to direct the trajectory of severely burned areas toward forest recovery—as would have occurred naturally had unnaturally high fuel loading (a result of over 100 years of active fire suppression, exacerbated by more recent effects of climate change induced drought) not led to severe fire effects across large, contiguous acres of sequoia groves and other mixed conifer forests during recent wildfires.

Giant sequoia (sequoia) is a fundamental resource for which Sequoia and Kings Canyon National Parks were established and a primary attribute of the wilderness character of both the Sequoia and Kings Canyon Wilderness and the John Krebs Wilderness, where actions are being considered. In 2020 and 2021, the Castle and KNP Complex (KNP) Fires together burned 27 sequoia groves within the parks and associated wildernesses, six of which included contiguous areas of high severity fire effects where mortality of monarch sequoias occurred at a scope and scale unprecedented in sequoia groves prior to 2020 (Stephenson and Brigham 2020).

Post fire assessments of some of these areas by NPS and partner agencies show low seedling regeneration and high sequoia mortality leading to a lack of adequate seed source within these contiguous high severity patches. For example, in the first-year post-fire, the NPS found an average of 33 seedlings per acre (83/hectare) within portions of Upper Dillonwood Grove that experienced high severity effects from the Castle Fire in 2020. In comparison, the NPS typically measures densities that average close to 36,000 seedlings/acre (88,700/hectare) in post-fire plots within the same time frame (T. Caprio, personal communication, December 2022). This combination of factors (insufficient natural seedling densities and lack of living sequoias), combined with previous studies that demonstrate a high mortality rate of post-fire germinated sequoia seedlings, indicate that these areas are highly vulnerable conversion from forest to fire-initiated shrub dominated communities in the long-term (T. Caprio, personal communication, December 2022).

The NPS is also considering action at this time to maintain proposed critical habitat connectivity for the Southern Sierra Nevada distinct population segment of fisher—a federally endangered forest-dependent species increasingly threatened by wildfire-driven habitat loss. During the KNP and Castle fires, tens of thousands of acres of fisher habitat within the parks burned at high severity. Within the KNP complex footprint specifically, previously suitable fisher habitat is now comprised of a mosaic of high severity burn, mixed- to low-severity burn, and predominantly green forest. While mixed-to low severity burn areas and remaining green forest appear to retain value in supporting fishers in the near future, the high severity areas may create barriers to fisher movement within the KNP footprint and between larger patches of green forest on either side. Exploratory connectivity modeling (Meyer et al. 2022) and post fire assessments determined that the loss of habitat connectivity between remaining green forest is especially high within one 485-acre proposed critical habitat corridor in Fisher Core Habitat Area 3, south of Redwood Mountain Grove. This area burned at high severity during the KNP Complex Fire and, like the sequoia groves discussed above, is highly vulnerable to fire-initiated conversion from forest to shrub dominated communities in the long-term (Meyer et al, 2022). Restoration of tree cover in this habitat corridor would speed up the time frame in which some level of connectivity would be recovered which is important to allow for dispersal of young animals, safe travel between foraging patches, and genetic connectivity in otherwise disjointed forest habitat for this endangered species.

## Proposed Action

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The NPS is proposing to replant giant sequoia and other mixed conifer seedlings in up to six giant sequoia groves in Sequoia and Kings Canyon National Parks: Homers Nose, Board Camp, Dillonwood, Suwanee, Redwood Mountain, and New Oriole Lake where these forests are otherwise unlikely to naturally recover following the impacts of high severity fire. The NPS is also proposing to plant pine seedlings in the mixed conifer forest immediately south of the Redwood Mountain Grove where seed sources were also lost and where natural pine regeneration is lower than what is necessary to re-establish this important fisher habitat corridor.

Considering the purpose and need for action outlined above, the goal of this proposed action is to have sequoia and mixed conifer seedlings at sufficient densities in these areas to mimic natural regeneration of these species post wildfire and thereby direct the trajectory of these forests toward recovery. Based on evaluation of site-specific climate, use of other recommendations from published literature, and general technical reports from the United States Forest Service (USFS), the NPS is proposing to plant 200 to 600 seedlings per acre in areas where intervention is determined to be necessary following the assessments and decision tree outlined below (see also additional details in the associated FAQs).

### **Pre-Planting Site Assessments and Decision Tree**

Based on post-fire assessments completed to date, the NPS has preliminarily determined that intervention may be necessary on up to roughly 1,200 acres of formerly forested areas across Homers Nose, Board Camp, Dillonwood, Suwanee, Redwood Mountain, and New Oriole Lake Groves and one 485-acre proposed critical habitat corridor in Fisher Core Habitat Area 3, south of Redwood Mountain Grove. However, additional site-specific analyses have been and would continue to be completed and the results applied through a decision-making framework (see decision tree on page 4) to determine if planting is both necessary and warranted in each proposed location and if so, to refine planting locations and inform the development of site-specific planting plans that would align the final scope of action with the specific needs of each proposed planting location.

By implementing this decision-making framework, the NPS would consider action only in areas where data show insufficient natural regeneration for sequoia mixed conifer forest to successfully re-establish without supplemental planting and where analyses indicate the site can support forest cover in the future. In other words, action would not occur in areas that show regeneration is sufficient to support forest recovery or where analyses indicate the site may not support forest cover in the future.

This decision tree would incorporate: (1) analysis of remote sensing data to identify areas of concern based on post-fire conditions (complete) (2) current conditions as measured in the field (completed for two groves, initiated but not yet complete for two groves, and not yet initiated for two groves), (3) comparison of measured natural seedling densities to thresholds of natural seedling levels required to reestablish monarch sequoias within the groves (based on previous datasets) or other conifers in the fisher habitat corridor (based on the Post-fire Spatial Conifer Regeneration Prediction Tool (POSCRPT)) and (4) climate change vulnerability given site conditions such as elevation and slope. These components are described further below.

### **Preliminary Site Identification**

The development of the decision tree began with an assessment of fire effects on forested habitats immediately post KNP and Castle Fires using the RAVG four category CBI product. This remote sensing tool rapidly identified areas where sequoia and mixed conifer mortality was so high and so widespread that successful tree cover reestablishment was unlikely. The NPS used maps derived from these data to identify the seven proposed re-planting areas considered for action at this time.

### **Ongoing Regeneration Assessments**

Once these areas were identified, field crews from NPS and partner agencies (USGS and USFS) began implementing a rigorous sampling protocol to assess natural seedling density and tree mortality in target areas. These evaluations include field data which documents survival of reproductive trees, natural regeneration, and the potential for this measured reproduction to be sufficient to reestablish monarch sequoias or mixed conifer forests (in the case of fisher habitat) at densities similar to pre-fire conditions. As of February 2023, field assessments have been completed for two of the six groves (Board Camp and Redwood Mountain), as well as the fisher corridor immediately to the south of Redwood Mountain Grove, and surveys have been initiated but not yet completed for two more groves (Dillonwood and Suwanee). The NPS anticipates completion of the Dillonwood and Suwanee surveys in early summer 2023 and intends to initiate and complete surveys in the final two groves (New Oriole Lake and Homers Nose) in early summer 2023. In areas where these sites assessments have been completed—Board Camp Grove, Redwood Mountain Grove, and the 485-acre proposed critical habitat corridor in Fisher Core Habitat Area 3, south of Redwood Mountain Grove—survey data, as applied through the decision tree, indicate action is necessary to avoid loss of portions of these sequoia groves and mixed conifer forests.

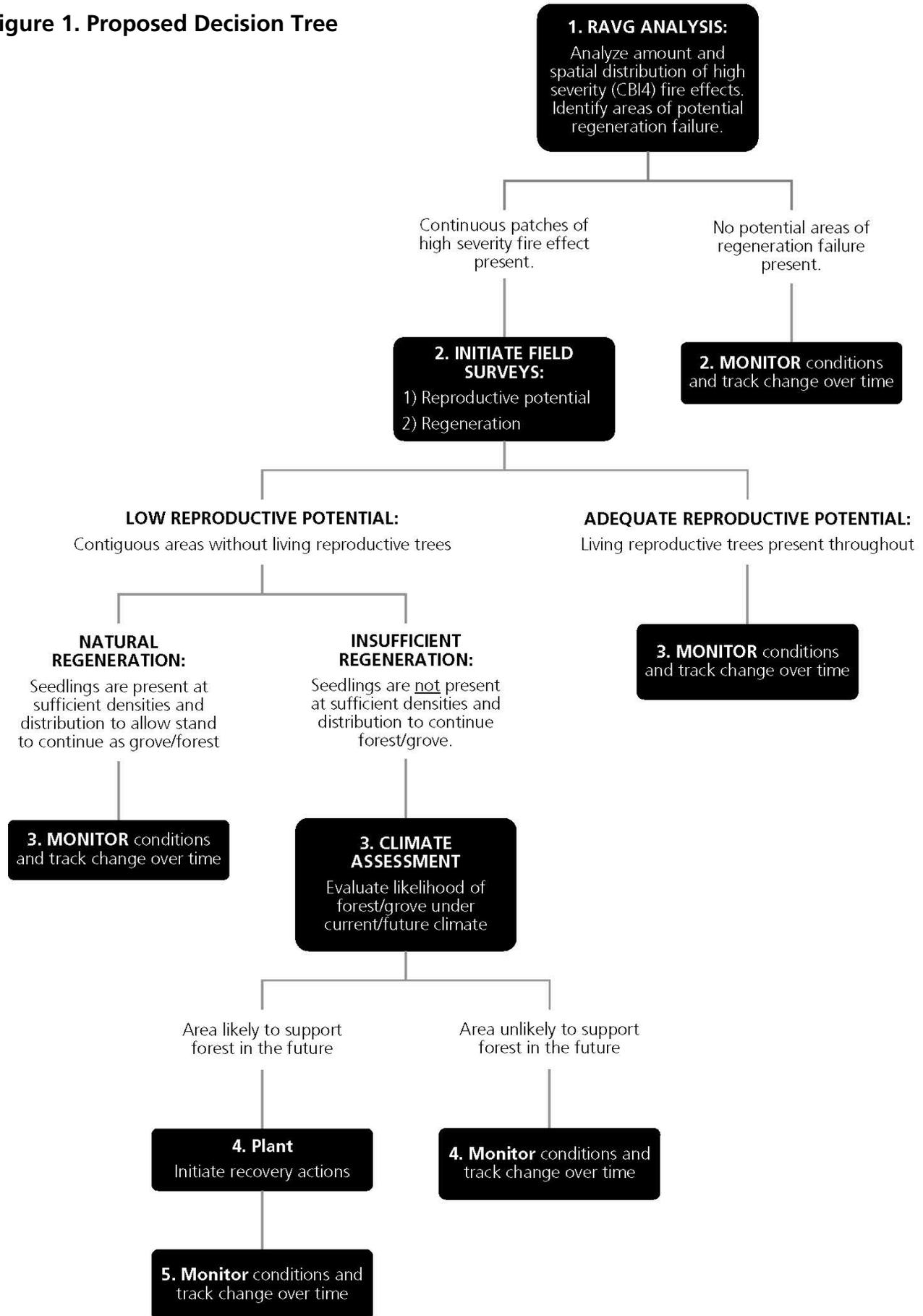
### **Climate Assessment**

To consider current and future effects of climate change on project need and success, an interagency team also completed an analysis evaluating the climate of the proposed locations and the likelihood that these sites can support forest cover in the future (Meyer et al. 2022). As of February 2023, this analysis has been completed for all of the proposed planting areas and found that all of the areas have a high likelihood of continuing to support forest under future climate conditions, although tree densities in some sites may be lower than they were pre-fire due to lower water availability in the future (Meyer et al. 2022). For these locations, site specific planting plans (discussed below) would incorporate this information and consider planning for lower planting densities.

### **Site Planting Plans**

For each grove or for the fisher habitat corridor where the decision tree indicates that action is necessary and warranted, the NPS would develop a site-specific planting plan, including an analysis of the minimum requirement, that considers site conditions in determining the best way to achieve the purpose and need for action within that grove or the habitat corridor. With a goal of 200-600 seedlings per acre (discussed above), these planting plans would lay out a planting map that considers environmental variables critical to seedling survival, species composition, and site-specific forest structure, such as slope percentage, slope aspect, elevation, microtopography and soils to best mimic natural distribution of seedlings after fire (North et al. 2019, Marsh et al. 2022).

**Figure 1. Proposed Decision Tree**



## Implementation

### Seed Collection and Treatment

In accordance with resource protection laws, the NPS reviewed, analyzed, and initiated a project to collect cones from Board Camp and Redwood Mountain Groves in September of 2022. Some of the collected seed was preserved in a seedbank to preserve sequoia genetic diversity and for research—as called for in the park’s Resource Stewardship Strategy. The NPS additionally germinated a portion of the collected seed to allow the option of planting seedlings within the necessary timeframe should the NPS ultimately decide to act on this replanting proposal. Should the NPS decide to take no action on this replanting proposal, seedlings that have been germinated would be transferred to partner organizations or agencies for their use.

Under the proposed action, seed collection would continue—as described below—on a timeline that would allow seedlings to achieve necessary planting size within planting timeframes.

- All pinecone collection would occur within California Tree Seed Zone 534 (Buck et al. 1970).
- Sequoia seed would be collected from a number of source groves, which may include a percentage of seed from natural sequoia groves that are outside the local seed zone.
- Species collected for this project would be the dominant tree species in the giant sequoia forest alliance, ponderosa pine-incense cedar forest alliance, and white fir sugar pine forest alliance vegetation communities (Haultain et al. 2020). Within those vegetation communities, target species for collection and propagation would include giant sequoia (*Sequoiadendron gigantea*), sugar pine (*Pinus lambertiana*), Jeffrey pine (*P. jefferii*), and ponderosa pine (*P. ponderosa*). California black oak (*Quercus kelloggii*) is a resprouting species and therefore, would only be replanted if there is inadequate natural resprouting. (Preliminary field conditions show adequate CA black oak sprouting and no need for planting.) Fir (*Abies concolor*, *Abies magnifica*) and incense cedar (*Calocedrus decurrens*) would not be targeted for collection because they have a wide distribution and range and they are showing adequate post-fire regeneration in these groves (Andrew Bishop, pers. Comm.).
- To ensure that seed collection would have no measurable impact on the seed availability in the source groves, the NPS would collect a conservative quantity of cones following established guidelines for seed collection developed by the BLM’s “Seeds of Success” Program, as well as the Center for Plant Conservation. For example, in Board Camp Grove, where the NPS estimates that only around 40 living sequoias remain in the grove, the cone collection effort in 2022 equaled roughly 1.5% of the total cone crop potentially available in the grove that year.
- Cones would be collected by tree climbers in late summer or early fall with oversight from NPS ecologists and would be supplemented by ground collections to increase genetic diversity.
- All cones would be labelled to track source and to ensure chain of custody from collection, through propagation, and planting, if approved.

Following collection, the NPS would promptly transport seed to cleaning facilities where cones would be dried to prevent molding; then seed would be placed into cold storage. Prior to germinating the seeds to grow seedlings, growers would put them in cool moist stratification for 60-90 days in sterilized peat to overcome dormancy.

Seedlings would then be grown at multiple nurseries to reduce risk of unforeseen circumstances that could result in complete loss of seedlings. Those facilities include but are not limited to the Sequoia National Park Native Plant Nursery at Ash Mountain, Hoopa Tribal Nursery on the Hoopa Reservation in Northern California, and the USFS Nursery at Placerville, CA. All nurseries would sow seed in January-March in sterilized soilless media following best management practices for nursery sanitation to prevent introduction of pathogens or non-native species. The

seedlings would be grown in 3.5-7.25-ounce (108-215 milliliters) containers (styro 6 and 15) for one year to achieve a target seedling size of 0.1 inches (2.2mm) in diameter and 3 inches (8cm) high.

## **Seedling Planting**

### *Schedule*

Once site assessments are completed and site planting plans developed, the NPS would move forward with planting seedlings as soon as possible—in the following fall or spring season—to establish seedlings prior to regrowth of dense, tall, uniform shrub cover in order to mimic as closely as possible natural post fire conditions under which sequoia and mixed conifer seedlings thrive. For this reason, the NPS would consider planting in Board Camp Grove, Redwood Mountain Grove, and the fisher corridor immediately to the south of Redwood Mountain Grove (where analyses indicate action is both necessary and warranted) as early as fall 2023. The NPS would generally plant either in late October, just before the season’s first snow, or in early spring, as sites become accessible and when soil moisture is highest, to improve chances of planting success.

Given the above, the NPS anticipates that most initial planting in these potential seven areas would occur over the next two years, fall 2023-fall 2025, but additional supplemental plantings could occur per area through fall 2028 if survivorship of seedlings is such that seedling density targets are not achieved following the initial plantings. Although the NPS anticipates high survivorship of seedlings based on similar planting efforts elsewhere, planting over this longer time period would improve probability of planting events aligning with years of above-average precipitation; a critical component of seedling success in the southern Sierra Nevada (Shive et al. 2022; York et al. 2009).

### *Planting Methods*

As would be outlined in site-specific planting plans, seedlings would be planted following the Individuals, Clumps, and Openings methods outlined in North et al (2019) across the diversity of topography and microsites (ridges, flats, depressions, along drainages, etc.) to mimic natural distribution of seedlings after fire. Following this pattern, some individual trees would be widely spaced, and others would be clustered together in small clumps.

To plant seedlings, the NPS would use hand tools to create divots a maximum of 8” in diameter and 14” in depth. The soil around each seedling’s roots would be loosened gently before it would be planted into the divot, and the divot would be backfilled by gently compressing soil back in place around the root base. The NPS would hand-build 2-3” wells with a rim of native soil on downslope sides of each seedling to capture incidental moisture.

## **Transport and Staging**

The six sequoia groves and one mixed conifer forest considered for planting under this proposed action are distributed across both parks with varying degrees of access, and most are within wilderness. While crews are expected to be able to travel to all locations by foot, it may be necessary to rely on pack stock and/or helicopter to transport seedlings and associated materials or tools, depending on the final planting plans and access to each location. For this reason, the NPS will consider and evaluate the various transportation methods that could be considered for each area through the EA, but a site-specific minimum requirement analysis (MRA) would be completed as a component of individual planting plan development and approval to determine the minimum requirement necessary to transport these materials.

Staging and spike camps would occur in non-wilderness areas where possible (e.g., Dillonwood, Redwood Mountain) and within wilderness when determined necessary (again, as determined by a site-specific MRA).

## **Monitoring**

In areas where planting is determined to be necessary and a planting plan is developed, the NPS would establish benchmarks and thresholds prior to planting and assess baseline site conditions to determine whether planting goals are being met. The NPS would also develop a monitoring plan to track seedling survival and growth.

## Resource Issues Being Considered

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The NPS has preliminarily identified the following resource issues that may be fully considered within the EA:

### **Sequoia Grove Recovery and Resilience**

As outlined above, giant sequoia is an iconic species symbolizing the NPS and a fundamental resource for which these parks were established and which the NPS is legally obligated to protect. Sequoia groves suffered extensive losses to high severity fire during the KNP and Castle fires and some severely burned areas are unlikely to recover on their own. Planting sequoia and other mixed conifers would beneficially affect sequoias by directing the trajectory of these areas toward forest recovery—as they would have done naturally had unnaturally high fuel loading due to active fire suppression not led to severe fire effects in these six groves. Although beneficial impacts are anticipated for this iconic species, the proposed alternatives may vary in their impacts to genetic composition of individual sequoia groves and future climate change resiliency. Finally, in planting a high density of seedlings in areas that recently burned at high severity, the NPS would modify the fuels within these groves which may influence future fire behavior in the area. The NPS is proposing to therefore analyze these considerations within the EA.

### **Fisher and Fisher Habitat**

The Southern Sierra Nevada distinct population segment of fisher is federally listed as endangered, and the species is increasingly threatened by wildfire-driven habitat loss. Like sequoia, fishers suffered extensive habitat loss during the Castle and KNP fires; including extensive loss of large diameter trees and canopy cover in the critical habitat corridor proposed for replanting. Re-establishing pine seedlings in this area would be beneficial for fisher by promoting post-fire recovery of tree cover in this critical habitat linkage. Restoration of this area would help speed up the return of tree cover and suitability for fisher movement, thus facilitating dispersal and associated gene flow vital to the species conservation. Given these potential impacts and the nexus of this issue to the purpose for taking action, the NPS is proposing to analyze impacts to fisher within the EA.

### **Wilderness**

840,000 acres of Sequoia and Kings Canyon National Parks are designated or managed as wilderness; this proposed action, if approved, would occur across up to roughly 1,130 acres of these wildernesses. For any proposed action within wilderness, the NPS must consider and analyze the proposal through the lens of wilderness preservation. This includes an understanding of purposes for which these wildernesses were designated, the legal mandate to preserve both the untrammeled and natural qualities of wilderness, the importance of both un-manipulated and naturally functioning ecosystems, and the unique role that wilderness contributes to visitor experiences and societal ideals. As well the NPS must ensure that both the proposed action and the tools used to achieve the action are the minimum required to manage the area as wilderness. Replanting these areas would have both short-term impacts and long-term benefits to several qualities of wilderness character which will be carefully considered in the decision-making process and will therefore be analyzed in the EA as well.

## Join Us

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Interested parties can participate in a one-hour virtual webinar on Monday, February 27 at 4:00 p.m. (PST). For additional information on the webinar, visit the PEPC project website, listed at the bottom of this page. Materials from the webinar, along with link to a recording of the webinar, will be posted to the project website following the event.

## How to Comment

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Public feedback on the proposed action will be accepted via the PEPC project website between February 17 and March 18, 2023. Comments may also be submitted by mail to:

Superintendent  
Sequoia and Kings Canyon National Parks  
Attn: Re-Establish Giant Sequoia  
47050 Generals Highway  
Three Rivers, CA 93271

Comments that provide insights about the project purpose and the park's current proposal are particularly helpful, and new ideas and proposals are welcome.

Please note that the NPS initiated public scoping on one component of the proposed action in Spring 2022 and received just over 2,800 comments. The NPS incorporated feedback it received into the planning process and developed a project FAQ to respond to public questions frequently raised during the previous scoping process. The FAQ document is available in the project file list in PEPC.

## Next Steps

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Following the public comment period, the NPS will analyze and consider all feedback and begin preparation of the EA. The NPS will not select an alternative for implementation until after the analysis of the alternatives and their potential impacts has been completed within the EA. The NPS anticipates the EA will be available to the public in Summer 2023.

## Project Website

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<https://parkplanning.nps.gov/ReEstablishGiantSequoiaPostFire2021>

## References

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