

Over the past five years, more than 200,000 acres of conifer forest have burned in large (>100 acre) high severity patches, of which 88% is unlikely to regenerate naturally.

Conifer stands that burned at low to moderate severity, may still require treatment due to high fuel loads and high densities of live and dead trees.

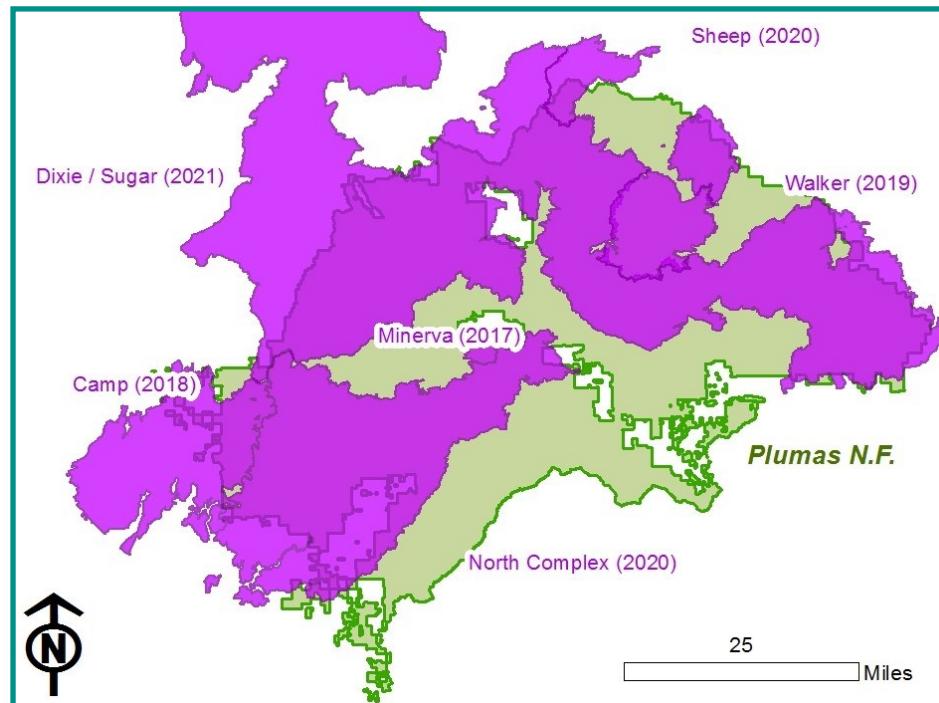
Fig. 1. The analysis area and the seven focal fires. Together, these seven fires burned 890,859 acres (64%) of the PNF.

Identifying restoration opportunities in recently burned and unburned conifer forest across the Plumas National Forest

We conducted post-fire landscape assessments following the process outlined in [GTR-270](#) for seven large fires that occurred on the Plumas National Forest (PNF) between 2017-2021. Taken together, these seven fires (Minerva, Camp, Walker, Sheep, North Complex, Dixie, and Sugar) burned 64% of the PNF. We identified restoration opportunities for mixed conifer forests both within and outside of these fire perimeters, for all lands managed by the PNF. To do this, we compared current conditions with those that would have occurred under a pre-settlement fire regime characterized by frequent, low-severity fire.

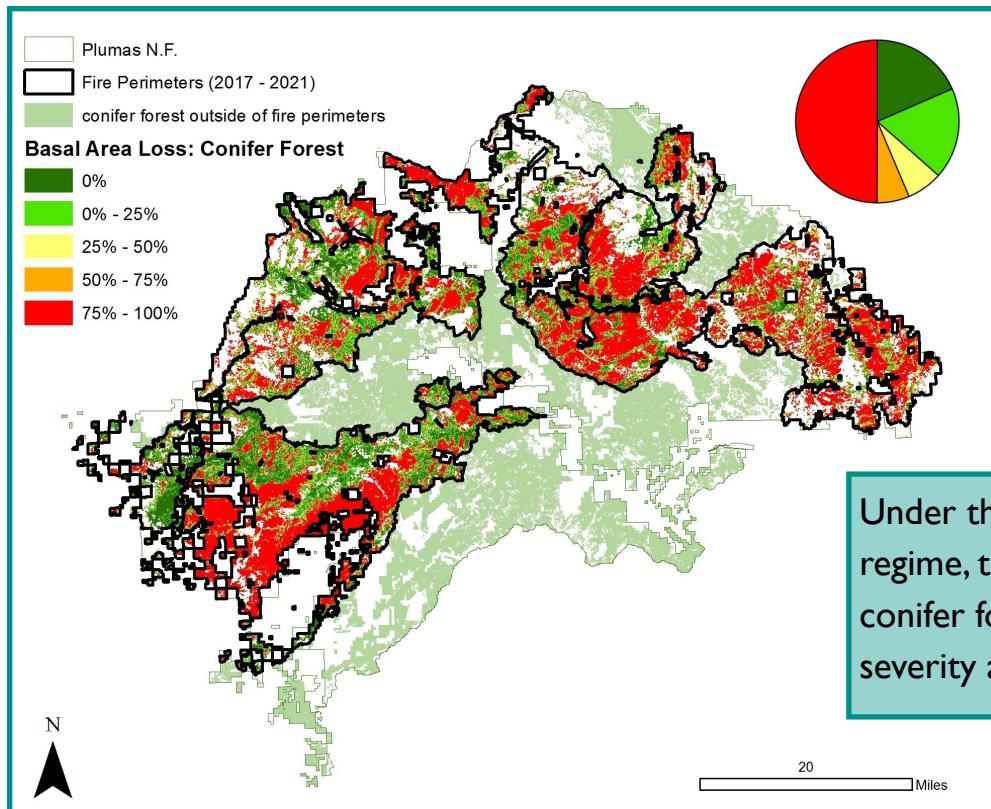
Key Findings

- Half of the conifer forest within the seven focal fires burned at high severity, with >75% basal area loss.
- A total of 203,336 acres of conifer forest on the PNF burned in large (>100 acre) high severity patches, of which 88% are predicted not to recover through natural regeneration.
- High densities of live and/or dead trees currently characterize much of the PNF, with 554,445 acres identified as requiring restoration action.



What proportion of conifer forest has burned at high severity?

Since 2017 approximately 62% of the mixed conifer forest on the PNF has burned in a large wildfire. Across the entire PNF, 31% of conifer forest has been impacted by high severity fire with more than 75% basal area loss.



Historically, small patches of high severity fire were relatively common in mixed conifer forests, playing an important role in regeneration and creating spatial heterogeneity. However, higher proportions of the landscape have burned with high severity fire effects in recent fires. Within the seven focal fires on the PNF, 50% of the conifer forest within the fire perimeters experienced more than 75% basal area loss. While 36% of conifer forest within the fire perimeters burned at low severity or remained unburned, just 13% experienced moderate basal area losses between 25% - 75%.

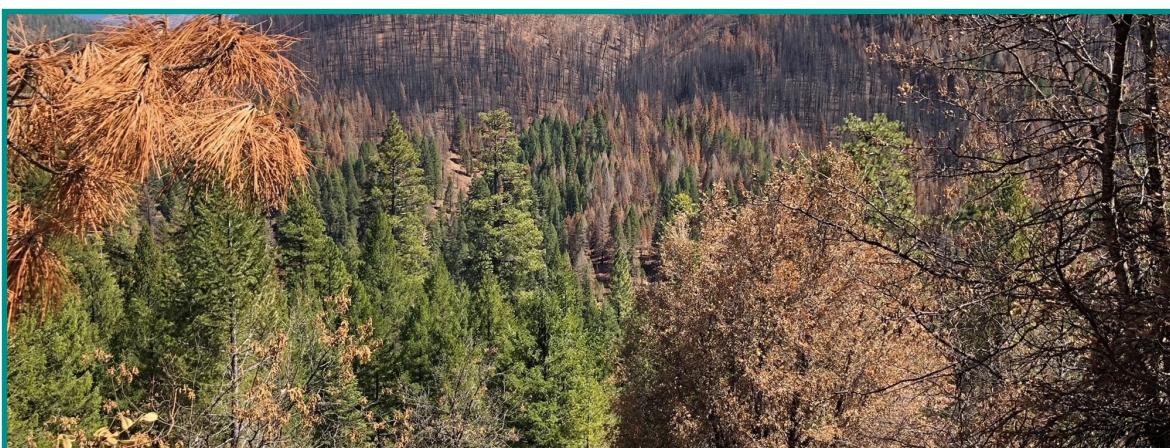


Fig. 3. This photo from the North Complex shows a mosaic of burn severities.

How many acres are within large patches of high severity fire?

Under the pre-settlement fire regime, high severity patches rarely exceeded 100 acres in size. The seven focal fires however, contained 235 high severity patches greater than 100 acres in size, totaling 187,236 acres on the PNF.

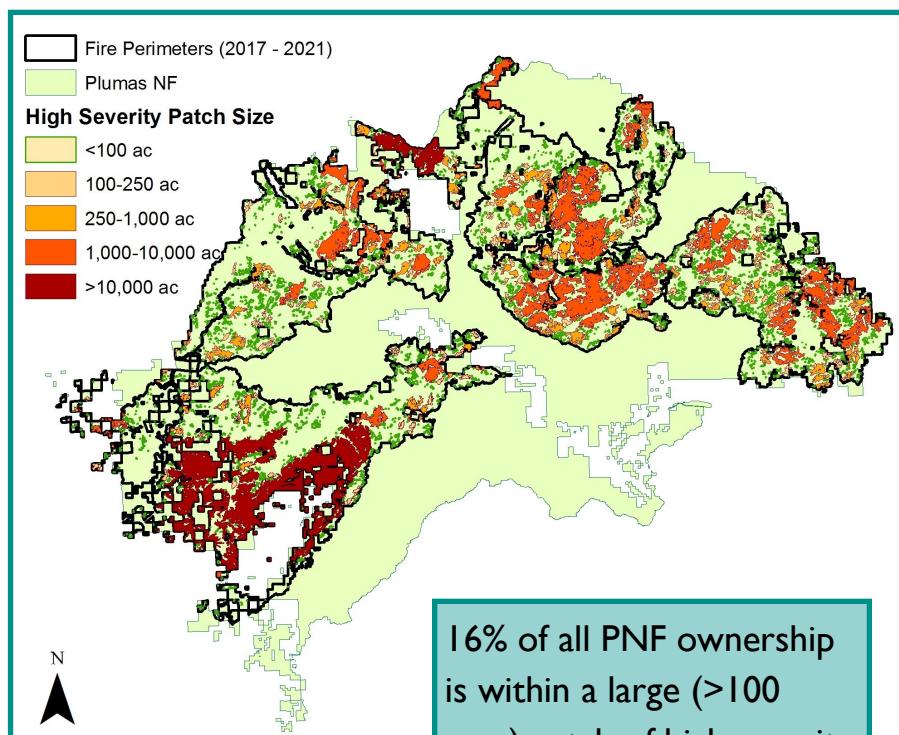


Fig. 4. High severity patches (>75% basal area loss) symbolized by size class.

16% of all PNF ownership is within a large (>100 acre) patch of high severity fire in conifer forest.

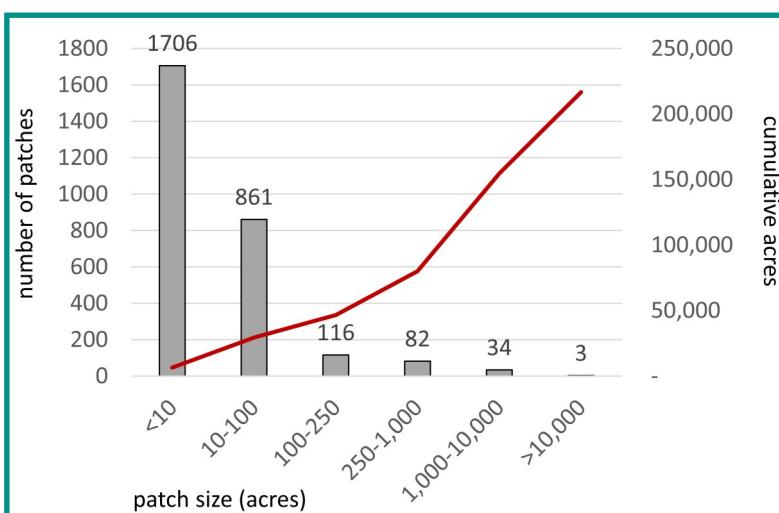


Fig. 5 (left). High severity patches binned by size in acres (x axis), with number of patches shown on left y-axis, and cumulative acres shown on right y-axis (above). Bars depict the number of patches by size class; the red line shows cumulative acres within high severity patches.

Small patches (<100 acres) accounted for more than 92% of the total number of high severity patches, but represented only a small proportion (34%) of the total area burned at high severity. Patches greater than 100 acres comprise 86% of the PNF acreage that burned at high severity. These large contiguous areas are often characterized by high post-fire fuel loading, as well as potential lack of natural regeneration.

Fig. 6. (right) Severely burned patches with high densities of dead trees cover a large portion of the burned landscape.



How much of the burned landscape is predicted to regenerate naturally?

We applied the Postfire Conifer Reforestation Planning Tool ([PostCRPT](#)) to identify areas within the seven focal fires that were unlikely to naturally regenerate in the near-term without active intervention. The model produces a predictive map with five probability classes that relate to the probability of observing at least one regenerating conifer five years after fire at the 60-m² (field plot) scale. Predictions were made based on mean seed production and mean precipitation scenarios.

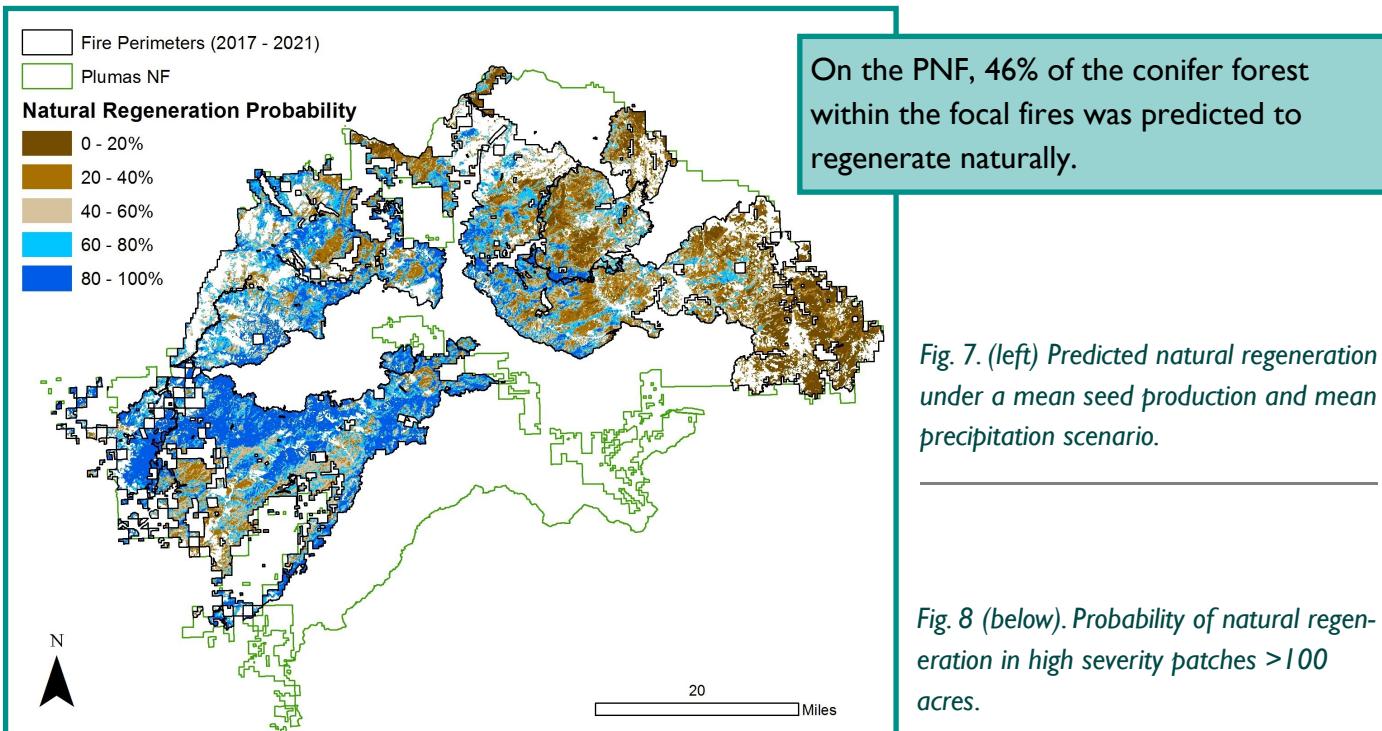
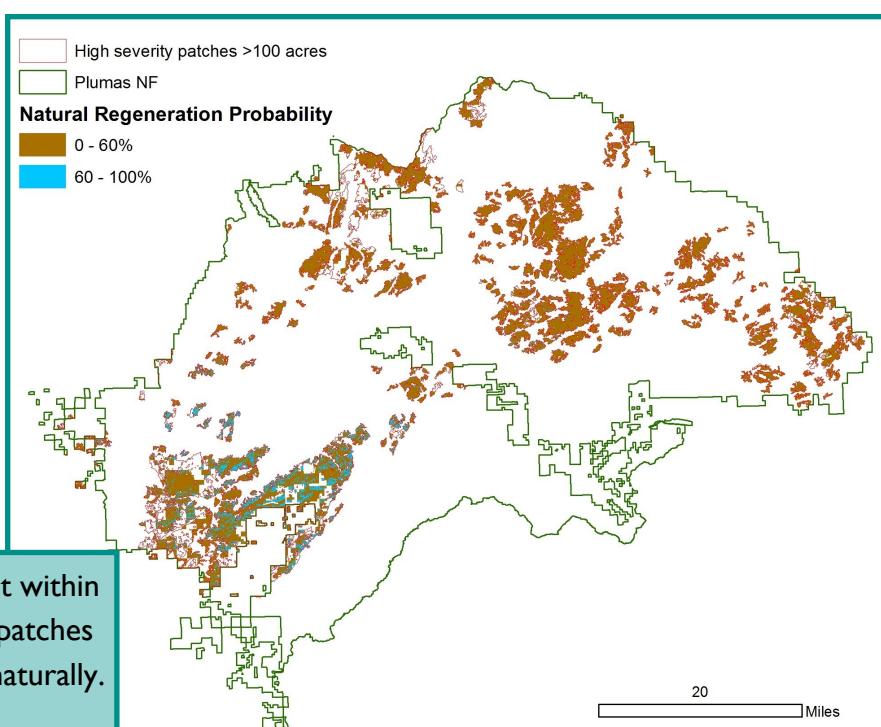


Fig. 7. (left) Predicted natural regeneration under a mean seed production and mean precipitation scenario.

Fig. 8 (below). Probability of natural regeneration in high severity patches >100 acres.

Conifer species on the PNF lack adaptations (e.g., resprouting, long-distance seed dispersal) to quickly regenerate after severe disturbance. This can reduce post-fire regeneration, particularly in large high severity patches that are beyond the range of conifer seed dispersal. On the PNF, only 12% of the area within large high severity patches was predicted to have >60% probability of natural regeneration. The remaining 179,008 acres are unlikely to naturally regenerate in the near-term.

Only 12% of the conifer forest within large (100 acre) high severity patches was predicted to regenerate naturally.



How do we evaluate departure from the Natural Range of Variation (NRV)?

We assessed departure from the Natural Range of Variation (NRV) using four primary indicators: high severity patch size, relative stand density (rSDI) prior to the focal fire, fire history, and vegetation/ fuels treatments implemented within the past 20 years. The details of this analysis varied somewhat between Dixie/Sugar and the other five focal fires, but generally relied on pre-fire rSDI as the primary indicator of departure. Outside of the seven focal fire perimeters, rSDI was the only indicator used to characterize departure. Stands that burned in large (> 100 acre) high severity patches were considered highly departed from NRV regardless of pre-fire conditions.

What is the Natural Range of Variation (NRV)?

NRV refers to the range of conditions that would have occurred in these conifer forests under the natural fire regime. NRV can be described for numerous metrics, including metrics that inform this analysis (fire regime, relative stand density, high severity patch size).

patch size

relative stand density

fire history

treatment history

High severity patch sizes greater than 100 acres are outside of NRV.

Under a frequent fire regime of mostly low-moderate severity fire, stands were usually characterized by $rSDI < 35\%$.

Areas that have burned several times at low to moderate severity over the past 20 years are less likely to be departed from NRV.

A recent history of thinning or fuel treatments can be an indicator of stand conditions that are closer to NRV.

Fig. 9 (right). This stand was unburned, but is characterized by an rSDI (106%) that is well outside of NRV, decreasing its resilience to future disturbance.



Where are conifer stands currently departed from NRV?

Stand densities were high across the PNF prior to the seven focal fires. As a result, even stands that burned at low to moderate severity may still be departed from NRV due to high levels of live and/or fire-generated fuels.

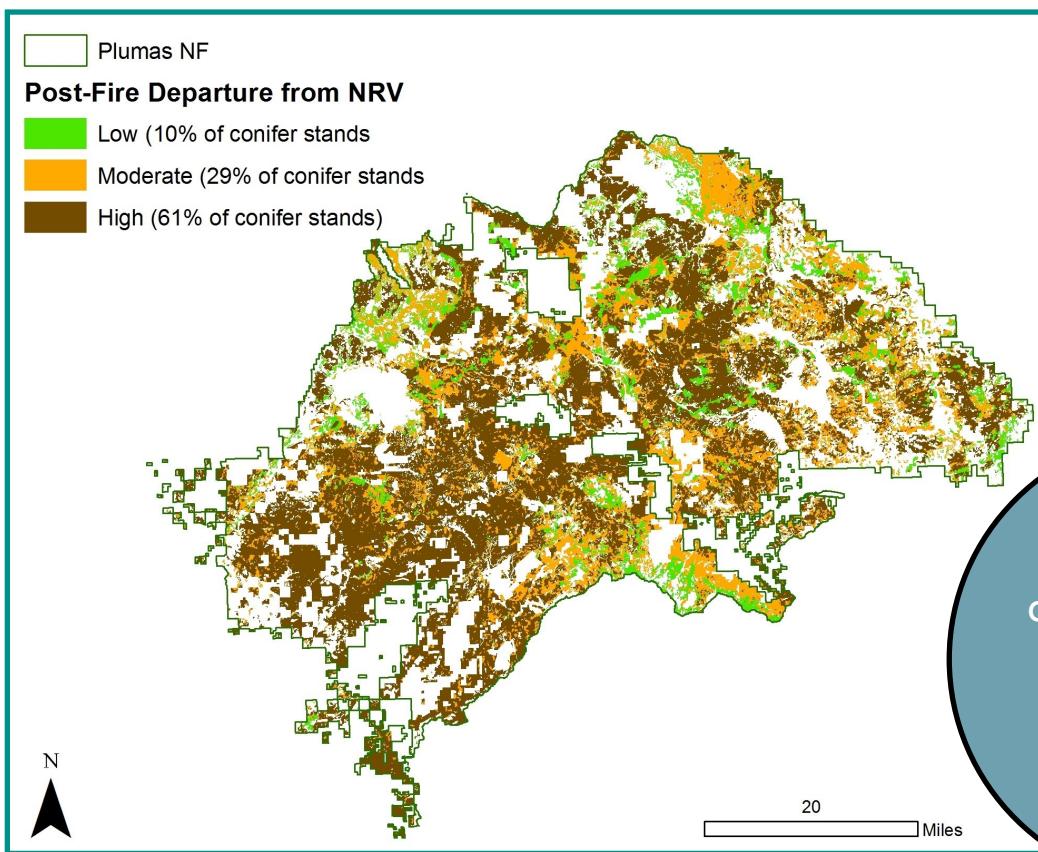


Fig. 10. Post-fire departure from NRV on PNF ownership outside of large high severity patches and outside of wilderness.

61% of PNF conifer stands are highly departed from NRV after the fires.



Fig. 11. This stand burned at low to moderate severity, however both live fuels and standing dead fuels remain post-fire and the stand is considered moderately departed from NRV.



Fig. 12. This low density (40% rSDI) stand with prior treatment history experienced low severity fire effects in the Walker Fire, and is considered to have low departure from NRV.

Where are restoration opportunities on the Plumas NF?

We identified restoration opportunities on 915,779 acres of the PNF. These opportunities range from fuel reduction and reforestation in large, high severity patches (232,384 acres), to maintaining or restoring desired stand densities or fuel loads in areas where the focal fires had beneficial effects, (95,356 acres). Between these two extremes, there are opportunities to address a range of conditions, including unburned stands that continue to support high tree densities and burned stands that are characterized by high snag densities and increased risk of severe reburn.

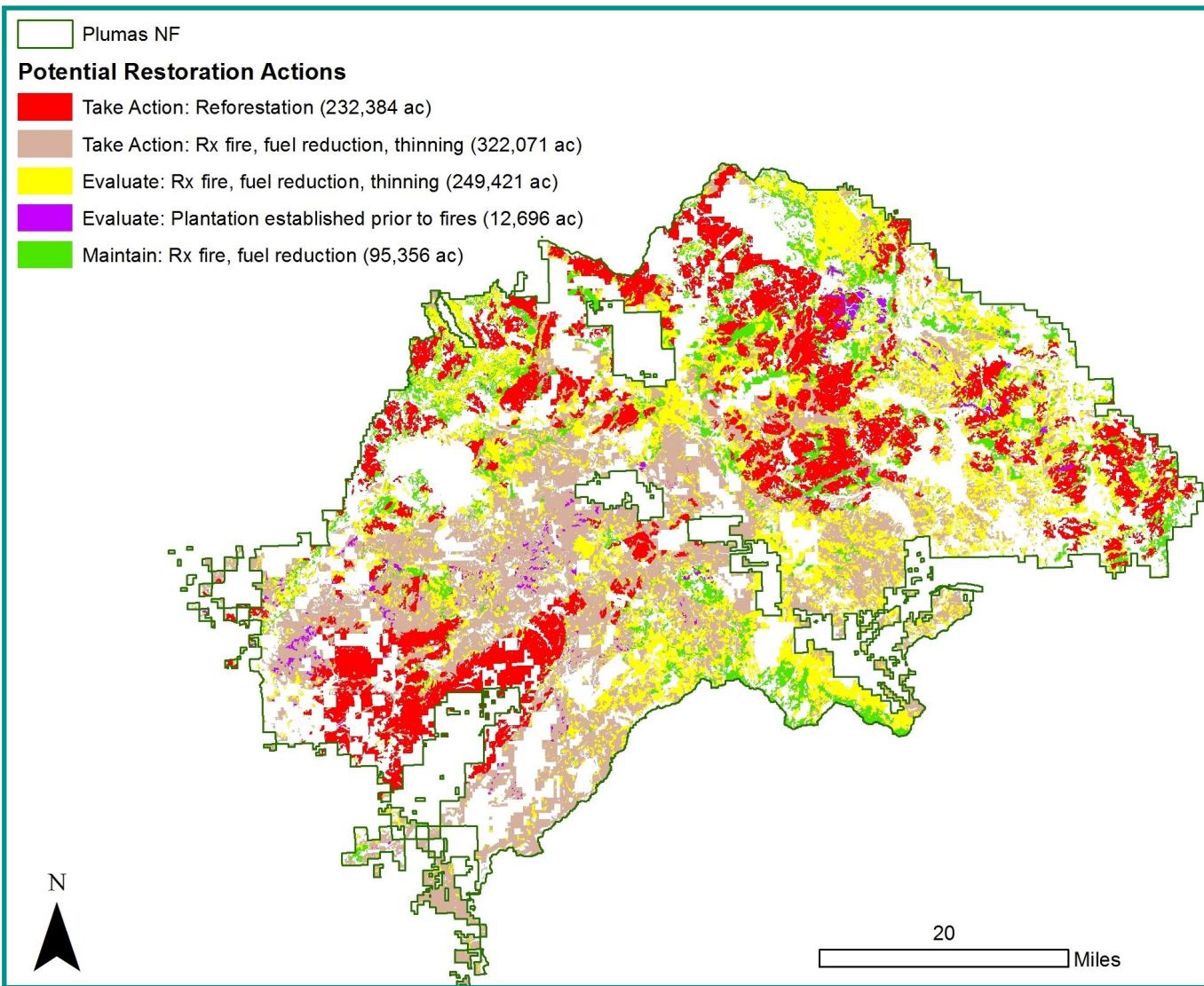


Fig. 13. Post-fire restoration opportunities on NFS lands on the Plumas National Forest.

Where have previous vegetation treatments occurred?

To assist with planning and prioritization, we queried the FACTs (Forest Activity Tracking System) database to identify areas that received one or more treatment prior to the focal fires, as well as areas that have been treated after these recent fires.

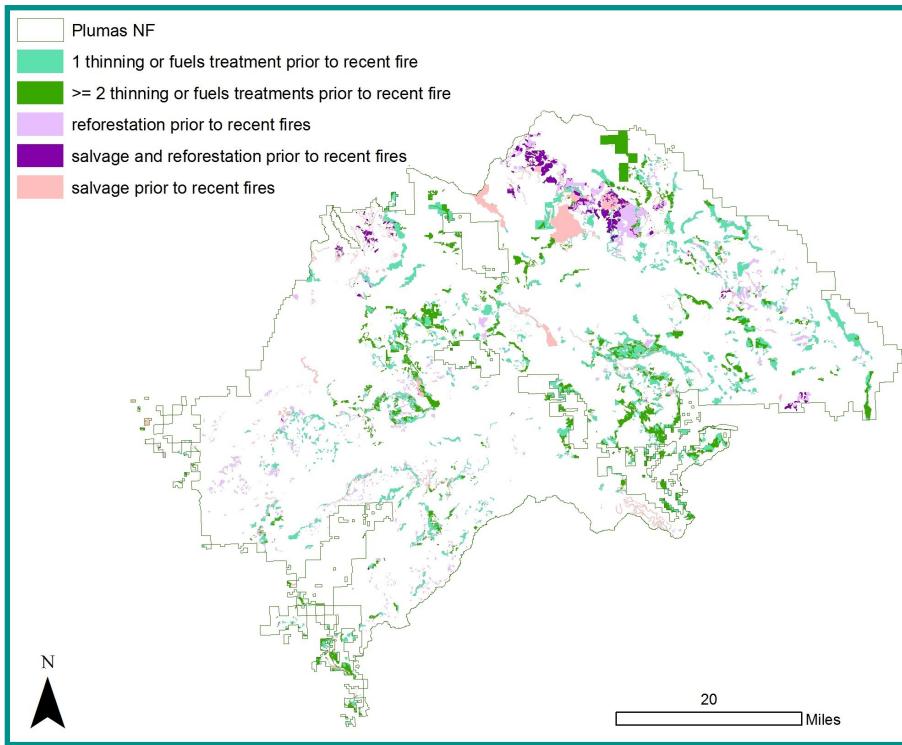
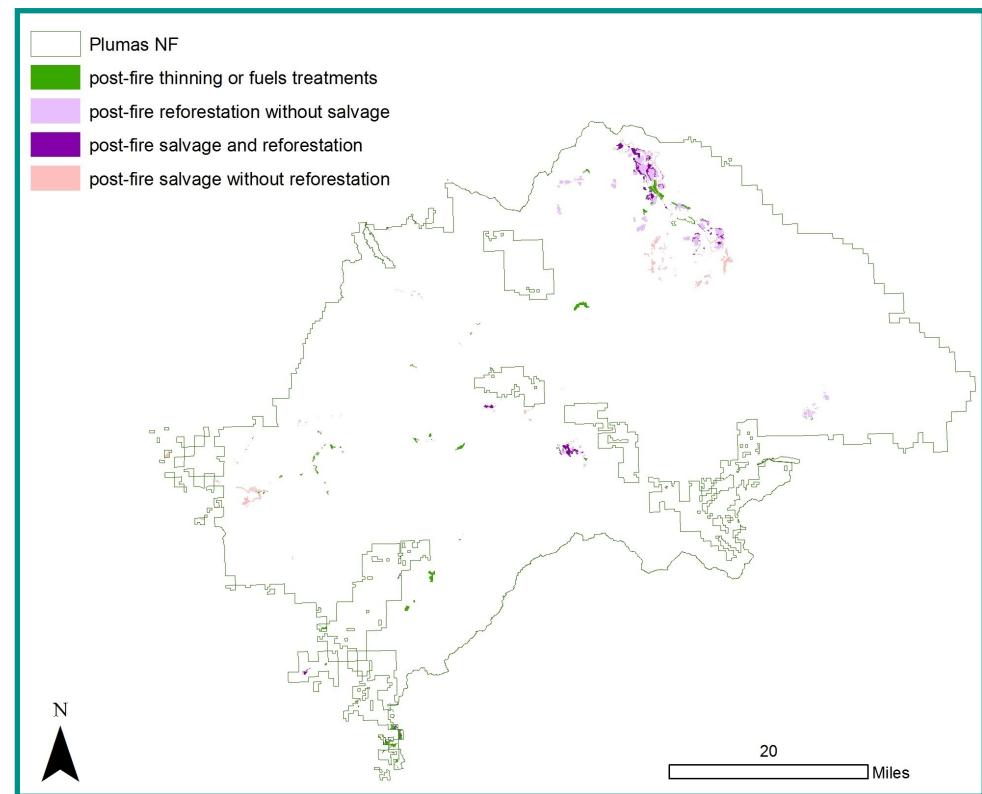


Fig. 14. Treatments that occurred on the Plumas NF between 1997 and the seven focal fires.



Where do restoration opportunities occur in spotted owl PACs and HRCAs?

We highlighted restoration opportunities within the 252 PACs (81,665) and 180,710 acres of HRCA (Home Range Core Area), prioritizing opportunities based upon departure from NRV, as well as the probability of post-fire occupancy.

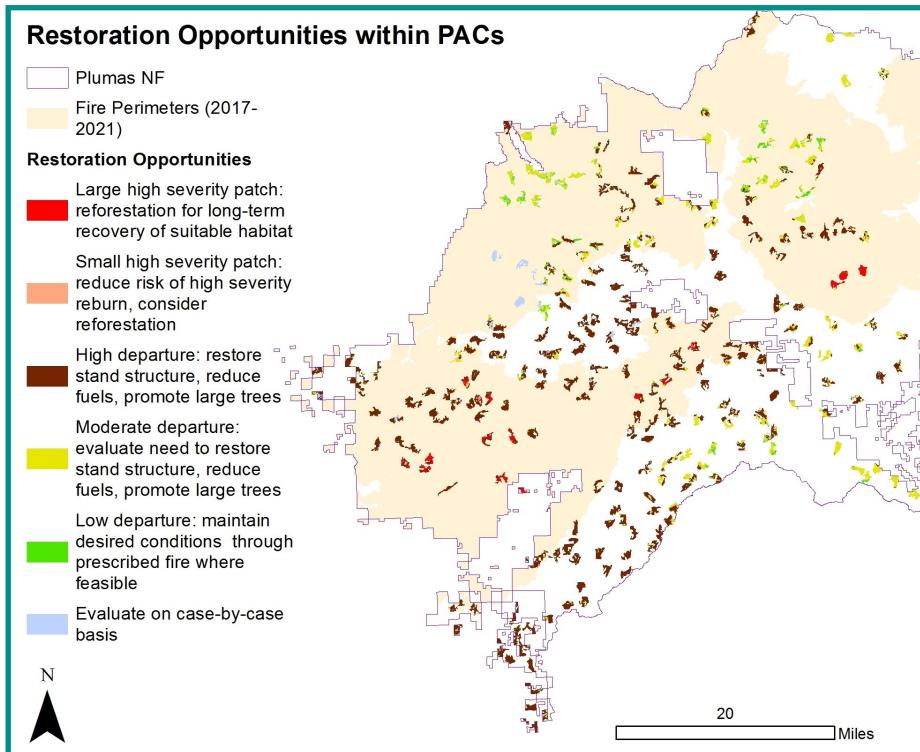


Fig. 16. (left) Opportunities within all PACs on the PNF. Data at the HRCA scale is not shown, but is available as well.

Condition	Acres	Opportunity
Large (>100 ac) high severity patch	3,321	Reforestation for long-term recovery of suitable habitat.
Small high severity patch (10-100 ac)	306	Evaluate for reforestation, reduce fuels to reduce risk of high severity reburn
High stand departure from NRV	51,087	Highest priority to improve resilience to future risk of high severity fire with fuels treatments, consider thinning treatments that promote health, vigor and recruitment of large trees.
Moderate stand departure from NRV	18,195	Moderate priority to improve resilience to future risk of high severity fire with fuels treatments, consider thinning treatments that promote health, vigor and recruitment of large trees.
Low stand departure from NRV	3,572	Maintain with prescribed fire applied at intervals as would have occurred under NRV.
Outside of analysis parameters	4,463	Evaluate on case-by-case basis
Total Acres	81,665	

Table 1 (above). Restoration opportunities within PACs on the PNF.

PAC Treatment Prioritization

Plumas NF
Fire Perimeters (2017-2021)

Priority
Highest (Dark Red)
High (Orange)
Moderate (Yellow)
Low (Green)
Not Evaluated (Grey)

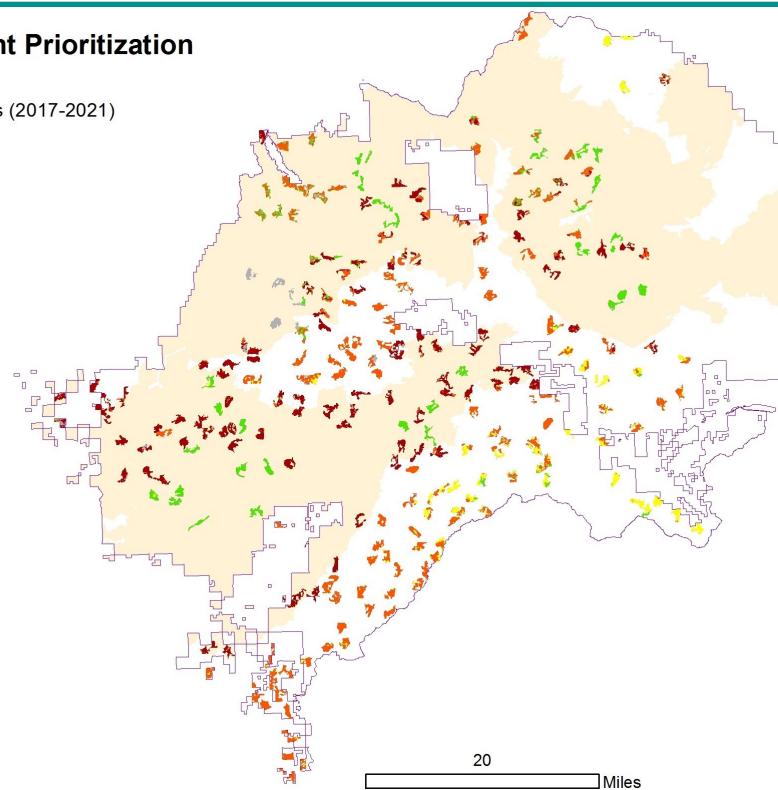


Fig. 17.(left). Prioritization of restoration opportunities that prioritizes PACs that have a high probability of occupancy, as well as PACs that are highly departed from NRV.

We additionally identified patches of remaining suitable spotted owl habitat across the Plumas NF. These are areas with conifer forest in larger size classes (CWHR size class 4 or 5), and higher densities (CWHR density class M or D) in patches at least 300 acres in size that were either unburned by fire over the past five years, or that burned at low to moderate severities.

43% of suitable habitat on the PNF was either fragmented by or lost to high severity fire.

Remaining CSO Habitat

Plumas NF
CWHR Size Class
Post-fire Size Class 4 Conifers (Green)
Post-fire Size Class 5 Conifers (Dark Green)
Size Class 4 and 5 that burned at high severity or are no longer in 300 ac patches (Grey)

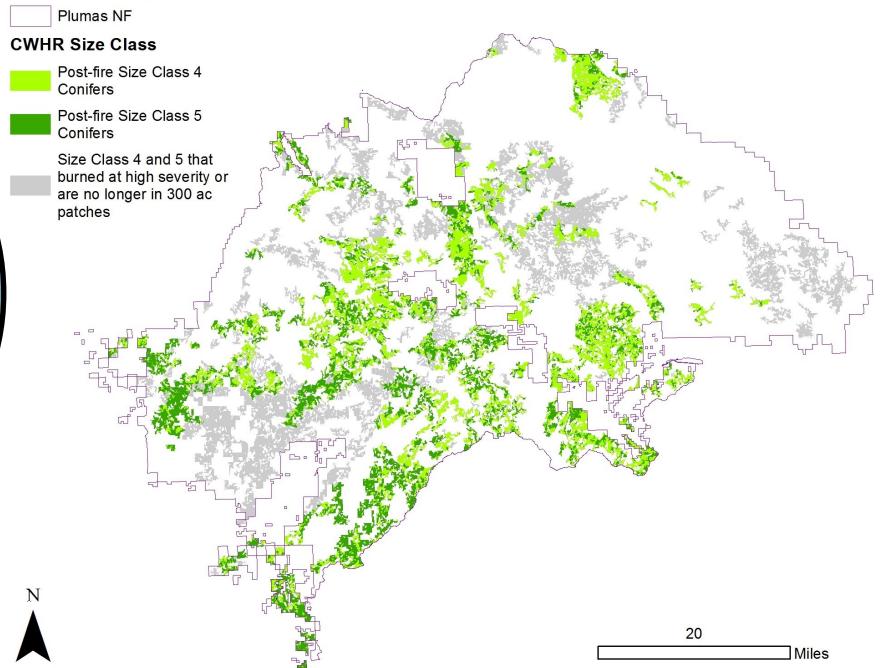


Fig. 18. (right). Spotted owl habitat pre and post fire.



Where can I access PNF restoration opportunity data?

Source Reports

Dixie and Sugar Fires: [Post-fire Restoration Opportunities for Conifer Forest in the 2021 Dixie and Sugar Fires](#)

Minerva, Camp, Walker, Sheep and North Fires: [Post-fire Restoration Opportunities for Conifer Forest, Plumas NF Fires 2017-2020](#)

PNF Geospatial Data

All of the spatial data associated with the PNF assessment are in a geodatabase (**GTR270_PNF_AllLands.gdb**), which can be found in the following location:

[T:\FS\NFS\Plumas\Project\SO\PNF_AllLands_LandscapeAssessment\GIS\MasterData](#)

Guide to PNF Geodatabase

A description of the spatial data associated with this assessment can be found in the [PNF_AllLands_SpatialDataGuide_20221214](#).

CSO Analysis

The analysis of California Spotted Owl opportunities is found in

[Restoration Opportunities for California Spotted Owl on the Plumas National Forest](#).