USDA
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Monitoring Report for the Inyo National Forest Plan
2022 – 2023

Photograph of Mono Lake on the Inyo National Forest during the winter of 2022-2023.

Forest Service

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About Our Plan Monitoring Program

Purpose

The purpose of this biennial monitoring evaluation report is to describe the evaluation of information gathered through the Inyo National Forest plan monitoring program during 2022 and 2023.

This report is not a decision document. Rather, this report has been developed in compliance with the National Forest Management Act policy 36 CFR § 219.12. This report is a vehicle for disseminating to the public timely, accurate monitoring information as well as recommended changes and adaptive management responses.

How Our Plan Monitoring Program Works

Forest plans are required to have plan monitoring programs that inform the management of resources in the plan area by testing relevant assumptions, tracking relevant changes, and measuring management effectiveness and progress towards achieving plan components like desired conditions and objectives (36 CFR § 219.12). The monitoring results help the responsible official determine whether a change is needed in forest plan direction, such as plan components or other plan content that guide management of resources in the plan area, management activities, the monitoring program, or whether a new assessment is warranted.

The Inyo National Forest plan monitoring program includes 23 questions that relate to specific plan desired conditions and one goal. Collectively, the monitoring questions cover the eight required topics, as well as social, economic, and cultural sustainability (see box below). Some questions cover more than one topic. Our monitoring results were grouped into seven themes including:

(1) watershed condition;

(2) status of select ecological conditions;

(3) ecological conditions for at-risk-species;

(4) visitor use, satisfaction, and progress toward meeting recreation objectives;

(5) climate change and other stressors;

(6) fire conditions; and

(7) social and economic sustainability.

The monitoring questions, indicators, and results you'll read about in this report address these themes.

Results Summary

This report describes the results of monitoring activities in fiscal years 2022 and 2023 for the Inyo National Forest. The Forest collected data to answer 16 monitoring questions in the plan monitoring program. Some questions were not answered because data were not refreshed or

their monitoring interval is longer than every two years.

Monitoring results indicate that the big monsoon summers and record-breaking precipitation during the 2022-2023 winter had impacts to Forest resources (Table 1). We experienced an increase in the proportion of road and motorized trail miles with high levels of erosion, higher mean stream flows, and fewer volunteers due to the shortened recreation season. The Forest has been working towards corrective actions due to the damage from the 2022/2023 winter.

The high precipitation levels had some beneficial effects. For example, we experienced fewer wildfires. Wildfires that occurred in 2023 were managed largely for objectives other than full suppression, having ecological benefits. Additionally, species like sagebrush showed a positive response to the additional precipitation.

Partnerships are incredibly valuable to our Forest. We recommend continuing to build valuable partnerships to work towards a common goal of repairing roads and trails, restoring degraded meadows, and maintaining intact systems.

The trend in pinyon-juniper woodlands observed during this monitoring period highlights the need for partnerships to preserve, restore, and facilitate adaptation in such a special ecosystem. The estimated number of dead pinyon pine trees increased from fewer than ~2,000 trees in 2021 (and fewer than 5,000 dead trees annually since 2017) to over 70,000 dead trees in 2022. Most mortality was localized in highly visible locations that are important for recreation and cultural purposes. We recommend working with tribes, partners, other federal agencies, and researchers to monitor and develop restoration and climate adaptation strategies.

We do not see the need for changes to the land management plan, or for a new assessment. We propose to change some of the indicators and data sources in our plan monitoring program which is part of our land management plan. These changes are minor and would improve the clarity of the questions and take advantage of the best available scientific information and data sources (see Table 1).

Photographs of the massive amount of snow on the Inyo National Forest during the 2022-2023 winter.

Table 1. Monitoring results consistency with the Inyo National Forest land management plan (2019) and recommendations for action, adaptive management, or change. Monitoring results cover fiscal years (FY) 2022 and 2023.

Monitoring Questions	Results consistent with plan direction?	Recommended action, adaptive management, or change
Theme 1: Watershed Conditions		
WS01. To what extent are watersheds in proper functioning condition being maintained, and watersheds in altered or impaired condition being improved?	N/A. We have not completed a watershed condition assessment since 2019.	N/A
AE03. What is the status of water quality in national forest waterbodies?	N/A. No new data available.	Replace indicators and data sources with macroinvertebrate and forthcoming water chemistry indicators from the Region 5 Broader-Scale Monitoring Strategy.
WS02. To what extent has erosion from temporary and permanent roads and trails affected water quality and soil sustainability in the national forest?	No. More erosion is occurring on roads and motorized trails over the past monitoring period. These impacts are likely due to the unusually big monsoon seasons during the summer of 2022 and 2023 and record high precipitation levels during the winter of 2022/2023.	Continue to develop local partnerships with various Off Highway Vehicle groups and users to maintain and repair routes and educate users.
PR01. How does soil disturbance differ from pre- and post-activity for timber management?	Yes. Pre- and post-disturbance monitoring showed no evidence of detrimental soil disturbance that would require mitigation action.	Broaden sample size to include additional pre- and post-fuels reduction units, as practical, and include additional types of timber activities, to provide a diversity of disturbance types and soil settings.
Theme 2: Status of Select Ecological Conditions		
TE01. What is the status and trend of large trees and old forests in the Sierra Nevada montane forest?	N/A. This question is answered every third monitoring cycle and will be reported again for the 2026/2027 period.	N/A

Monitoring Questions	Results consistent with plan direction?	Recommended action, adaptive management, or change
TE02. What is the status of pinyon-juniper woodlands?	No. Evaluating data through 2022, pinyon-juniper woodlands, particularly in the White and Inyo Mountains, have experienced a recent pattern of canopy cover loss and tree mortality. The estimated number of dead pinyon pine trees increased from fewer than ~2,000 in 2021 to over 70,000 in 2022.	Develop a separate monitoring plan for pinyon pine in collaboration with local tribes, other federal agencies, researchers, and other partners. Use monitoring results to develop potential restoration and climate adaptation actions. Adjust plan monitoring indicators to also be evaluated at the spatial scale of these affected areas.
TE03. What is the condition of sagebrush communities?	Yes. The forest is meeting the desired conditions for sagebrush except in areas that are burned by wildfires that are larger than just a few acres. In these areas, the fire effectively removes the seed source, prolonging sagebrush re-establishment to >50 years.	Carry out small, strategically placed prescribed burn units (and/or mechanical fuel reductions) in sagebrush to reduce the likelihood of large wildfires that could exclude sagebrush for >50 years. Revise "acres of sagebrush regeneration" indicator to "sagebrush seedling density" to match indicator measured in sampling plots.
FS01. How is the abundance of cheatgrass and red brome (nonnative Bromus spp.) changing?	Uncertain. In a sample of 324 ecology plots across the forest, mean non-native, invasive grass cover increased from 2.8 +/- 0.5% in 2020 to 3.2 +/- 0.5% in 2023. The very small increase could be in part attributed to the historic precipitation event of the winter of 2022-2023. Despite these moderate numbers, cheatgrass density is high (>30% cover) in some disturbed areas, particularly on some south-facing slopes in Long Valley, Mono Basin, and the Owens Valley.	Continue improvements to the model that focus on developing methods to be robust through a range of climate conditions.
AE01. What is the vegetative condition of selected grazed and ungrazed meadows?	No. Forest monitoring identified a downgraded condition in four of the ten livestock grazed meadows; three are in a degraded state. One	Take corrective action in Davis Creek, Trail Canyon, and Mulkey allotments in meadows receiving a

Monitoring Questions	Results consistent with plan direction?	Recommended action, adaptive management, or change
	meadow improved from degraded to functional at risk. Regional range monitoring found two of six meadows downgraded from excellent to good condition.	functional - at risk or degraded rating. Work with grazing permittees and District Rangers to evaluate ways to improve meadow condition scores. Prioritize utilization monitoring in the Casa Vieja meadow.
AE02. To what extent are riparian areas functioning properly across different management areas and levels of disturbance?	Uncertain. Data collected for different packstock meadows in each year so lack a trend for specific meadows over time. For livestock meadows, two of meadows received a downgrade from proper functioning condition to functional -at risk and one meadow (Diaz) was rated as not functional. More data on the same meadows over time are needed.	Take corrective actions (same meadows as in AE01).
Theme 3: Status of Ecological Conditions for At-Risk-Species		
AR01. To what extent is the integrity of special habitats for at-risk plants and animals being maintained or improved?	Uncertain. Trends in special habitat are difficult to discern at this early stage in monitoring and with limited surveys. We added a new special habitat unit, volcanic-warm soil (7.62 acres), and removed black oak and seeps because they are covered by other plan components. Tree mortality and defoliation affected special habitats, particularly those with whitebark pine. Off-highway vehicle use continues to disturb special habitats. Some actions have been taken to addresses identified disturbances. The bat special habitat at Gar Watt mine is currently disturbed by recreational use and action is being taken to secure the mine to protect the bats and ensure human health	Prioritize monitoring in dry forb habitat impacted by off highway vehicles and whitebark pine mortality across all special habitat units.

Monitoring Questions	Results consistent with plan direction?	Recommended action, adaptive management, or change
	and safety.	
AR02. What is the quality of bighorn sheep winter range?	Uncertain. The data for wildfires indicate little change in the fire return interval.	None
AR03. How is the condition of seasonal sage-grouse habitats and connectivity changing?	Uncertain. Sagebrush habitat trended well over the last monitoring period but additional data are needed.	
Theme 4: Visitor Use, Satisfaction, ROS Progress		
VU01. What are the trends in visitor use and satisfaction?	Uncertain. National Forest visitation was down in 2021 compared to 2016. State travel deterrents and Forest Service closures likely limited travel. No in-person interviews were conducted in 2021.	None
VU02. To what extent are trails providing access to the activities as intended?	Yes. We repaired more roads and trails in 2022 and 2023 than in 2021.	None
VU03. How effective have Forest communications with the public been in considering diverse backgrounds?	Yes. We continued quarterly forums with tribal governments, conducted field trips to visit project areas, and worked on agreements to modernize the cultural displays at the Mono Basin Visitor Center and to help monitor water quality for Wild and Scenic Rivers. The Forest continued the annual partnership with the Eastern Sierra Interpretive Association and Eastside Sports to host the Eastern Sierra Youth Outdoor Program. Forest participates in tribally-led Earth Day events annually.	Continue to improve annual tracking of public outreach communications.
VU04. To what extent is designated wilderness being managed to preserve wilderness character?	NA. Data are not ready yet.	NA

Monitoring Questions	Results consistent with plan direction?	Recommended action, adaptive management, or change
PC03. To what degree is the national forest using partnerships to provide additional capacity for visitor services?	Yes. There were fewer volunteer agreements and value of contributed time in 2022 than in 2021 but still more than in 2019 and 2020. In 2023, there was a steep decline in number of volunteers, volunteer hours, and the value of contributed time likely due to the shortened operating season after a record-setting winter. However, the Forest saw a substantial increase in the number of individual and group volunteer agreements.	None
Theme 5: Climate Change and other Stressors		
CC01. How are high-elevation white pines responding to the effects of climate change and other stressors?	This question is answered every third monitoring period and will be reported again for the 2026-2027 reporting period.	NA
CC02. What changes have occurred to the timing, amount, and duration of natural and managed runoff into the national forest's waterways?	Uncertain. Annual run off was very high in 2023 following the biggest winter in recorded history. There was a slight trend toward both the highest daily mean and center mass of runoff occurring earlier in the season, meaning that snow is melting earlier, and the streamflow peaks earlier, and recedes earlier. More data are needed over time and in other watersheds to accurately identify a trend.	Gather more years of data and for additional undisturbed watersheds.
Theme 6: Fire Conditions		
CC03. How are fire regimes changing compared to the desired conditions and the natural range of variation?	Partial. Data for 2021-2022 (2023 data largely unavailable) indicate that there was little to a relatively small increase since 2017-2022 in the proportion of the montane zone that is highly departed from natural fire return interval, burning too infrequently. A large proportion of the subalpine and alpine and arid	Answer this monitoring question every four years rather than every two years. Consider opportunities to manage wildfires for objectives other than full suppression, including resource objectives. Conduct full suppression actions for

Monitoring Questions	Results consistent with plan direction?	Recommended action, adaptive management, or change
	shrublands and woodlands zones are not departed or are only moderately departed.	wildfires in the arid shrublands and woodlands ecological zone and when conditions are unsafe or unlikely to meet Inyo Forest Plan objectives.
PC02. What management actions are contributing to the achievement of desired conditions relating to fire regimes?	Yes. The Inyo continues to implement prescribed burning and fuel reduction treatments towards achieving plan objectives. Although all wildfire acres in 2022 were managed under a full suppression strategy, nearly all acres in 2023 (fewer than in 2022) were managed for objectives other than full suppression.	None
Theme 7: Social and Economic Sustainability		
PC01. What are the economic conditions in local communities and what are the economic contributions of forest-based uses such as recreation, forest products, mining and grazing, and ecological services, to the local community?	This question is answered every third monitoring period and will be reported again for the 2026-2027 reporting period.	NA

Opportunity for Public Engagement and Partnerships

We welcome your questions, suggestions, and feedback. We also welcome opportunities for partnerships to implement this plan monitoring program. Please reach out to the Natural Resources/Planning Staff Officer, Nathan Sill at Nathan.Sill@usda.gov to share your ideas and feedback. This biennial monitoring evaluation report describes the key results from our monitoring; in depth results, including additional graphics and tables, are available in the supplemental report and raw data is available upon request.

What Comes Next

Biennial monitoring evaluation reports should include relevant information from the regional broader-scale monitoring strategy. The Pacific Southwest Region broader-scale monitoring strategy (version 1) was published in June 2020. Results from this strategy will be published in the spring of 2024, around the time that this report is released. Some of the results will assist in evaluating our monitoring questions. We will include applicable results from the strategy in a future biennial monitoring evaluation report.

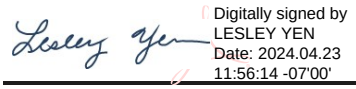
The next reporting cycle for Inyo National Forest's plan monitoring program would cover monitoring activities conducted during fiscal years 2024 and 2025.

Forest Supervisor's Message

This report describes the results of monitoring activities that occurred from fiscal years 2022 and 2023 on the Inyo National Forest.

I have found that there are no recommended changes to the plan components contained within the 2019 Land Management Plan and management activities. I am recommending modifications to improve the plan monitoring program which is part of the land management plan.

I plan to accomplish a deeper examination of the recommended changes to the plan monitoring program through engagement with resource specialists and the public. Information about recommended changes and ways to comment will be posted at: https://www.fs.usda.gov/main/inyo/landmanagement/planning



Lesley Yen **Date**

Forest Supervisor

Watershed Conditions

The Inyo National Forest was established in 1907 for the purposes of protecting lands needed to build the Los Angeles Aqueduct. The headwaters and tributaries into Mono Lake, the Owens River, and Owens Lake are important for the supply of water to the City of Los Angeles and local communities. At a regional level, water runoff from the national forest also flows into the Upper San Joaquin River to the west and the Upper Kern River to the south. Water on the Inyo is used for development of hydroelectricity that powers homes and businesses in the region. Water from the Inyo is also important to local communities and Tribes, providing drinking water, recreational amenities, and economic and cultural opportunities.

Protecting water and soil quality are key components of National Forest management. Water and soil quality can be affected by most management activities and are integral in supporting healthy ecosystems. While water and soil quality are assumed to be good overall on and downstream of the Inyo National Forest, data is needed to understand where that may not be the case and which management activities need to be altered to better protect watershed conditions.

Monitoring Questions

- WS01. To what extent are watersheds in proper functioning condition being maintained, and watersheds in altered or impaired condition being improved? The indicator associated with this question includes the Watershed Condition Framework Classification. ***Not assessed in 2022-2023.***
- AE03. What is the status of water quality in national forest waterbodies? The indicators associated with this question include bacteria levels and Clean Water Act (CWA) § 303(d) status. ***No new data in 2022-2023.***

- WS02. To what extent has erosion from temporary and permanent roads and trails affected water quality and soil sustainability in the national forest? The indicators associated with this question include: (1) road and motorized trail condition, (2) implementation and effectiveness monitoring results from the Best Management Practice Evaluation Program, and (3) number and type of stream crossing and bank stabilization projects.
- PR01. How does soil disturbance differ from pre- and post-activity for timber management? The indicators associated with this question include soil compaction, displacement, and erosion.

Key Results

In terms of roads and motorized trails, the indicators monitored during the 2022-2023 period indicate that more erosion is occurring on roads and motorized trails over the past 3 years than before. These impacts may be temporary in nature and are likely due to the unusually big monsoon seasons during the summer of 2022 and 2023, and record high precipitation levels during the winter of 2022/2023, including multiple rain on snow events. Although we have stabilized some streambanks, work is episodic in nature and constrained due to staff capacity.

- Since 2021, the proportion of roads with moderate and high erosion levels have begun to exceed those in good condition (low erosion) (Figure 1, Table 2).
- During Best Management Practices evaluations, four of six roads had evidence of erosion and sediment deposited into adjacent stream channels. All seven trails assessed were in good condition with little to no evidence of detrimental erosion reaching waterbodies.
    - Road 05S01 (Crooked Creek Road) was in very poor condition, with the road capturing the stream for about 1000 feet of stream flow. Although improvements have been planned, they are on hold due to higher priorities and the difficult access to the remote area.
    - Road 30E302 (Sand Canyon) has been completely washed out with a 4 to 5-foot gully that runs roughly 1000ft and is impassable. This damage occurred from the record winter of 2023.
- We stabilized 600 ft^2 of streambank at motorized trails in 2022 (3).

Data from eight monitored sites indicate that timber and prescribed fire projects are adhering to the forest plan desired conditions and standards and guidelines.

- Two mechanical thinning sites had minor erosion at a few points, but there was no widespread erosion and no corrective action recommended.
- Seven units that had been thinned the previous year showed some level of compaction. No compaction was observed in the prescribed burn unit. The compaction was minor compaction (outside of skid trails), and not enough to cause detrimental effects to soil water holding capacity, runoff, or vegetation growth.
- Forest floors remain intact except on main travel paths (skid trails and landings). Minor

forest floor impacts, including topsoil displacement and rutting, are common in the treated units. The duff layer is partially removed, displaced and/or compacted in areas where equipment traversed. Impacts are minor and will likely recover within a few years and are not expected to cause detrimental effects to soil productivity, erosion, or vegetation growth.

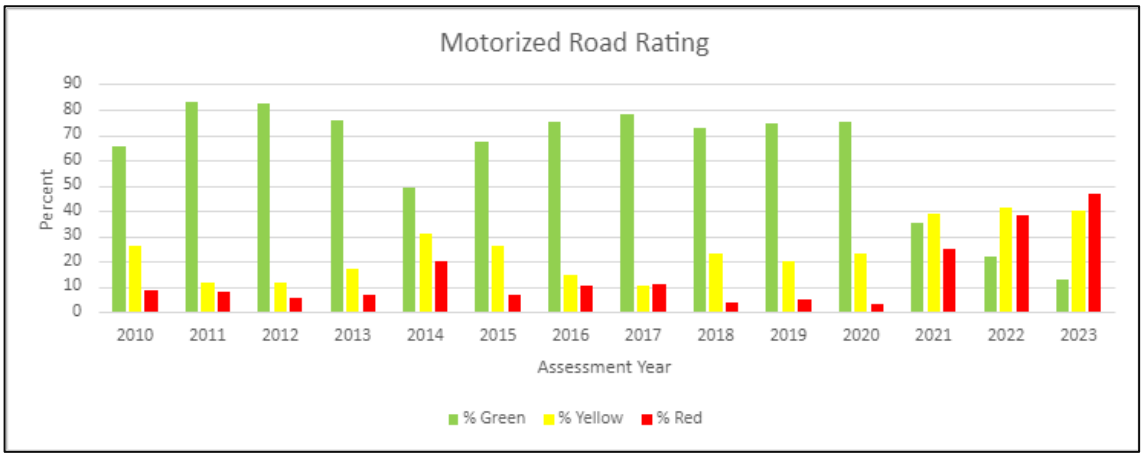


Figure 1. Ratings of road and motorized trail condition, using the California State OHV Division Trail Condition Evaluation method. Red indicates high levels of erosion and green indicates little to no erosion.

Table 2. Number, percent, and the average percent for red, yellow, green roads for each year since 2010.

Year Assessed	**Total Number of Red, yellow, green Roads**	**Number of Green**	**% Green**	**Number of Yellow**	**% Yellow**	**Number of Red**	**% Red**
2010	95	62	65	25	26	8	8
2011	244	203	83	29	12	19	8
2012	793	653	82	94	12	46	6
2013	1115	846	76	191	17	78	7
2014	392	192	49	121	31	79	20
2015	219	147	67	57	26	15	7
2016	391	294	75	57	15	40	10
2017	262	205	78	28	11	29	11
2018	459	335	73	107	23	17	4
2019	421	315	75	86	20	20	5
2020	253	190	75	58	23	8	3
2021	206	73	35	81	39	52	25
2022	212	46	**22**	86	**41**	80	**38**

2023	128	17	**13**	51	**40**	60	**47**
Average Percent			**62%**		**24%**		**14%**

Table 3. Summary of all the motorized and non-motorized stream crossing and bank stabilization work completed since 2014.

Stream Crossing Repair		
Motorized	**Year Completed**	**Amount of Stream Stabilized (sqft)**
01S15A (North Canyon)	2022	300
01S15 (Baxter Springs)	2022	300
09S102 (Little Pine Creek)	2021	200
32E303 (Onion Creek)	2020	2000
04S54 (Birch Creek)	2019	300
04S54 (Witcher Creek)	2015	300
32E302 (Sand Canyon Trail)	2018	160
20S08 (Soda Creek, Monache)	2015	500
20S03 (Soda Creek, Monache)	2015	100
20S07A (Monache Creek)	2015	50
Total		4210
Non-Motorized		
Middle Fork Bishop Creek	2019	120
Hilton Creek Trail Stream Crossing	2014, 2015	200
Lower Lamarck Trail Crossing	2018	50
Total		370

Recommended Changes

Water Quality (AE03)

- Remove the current two indicators (bacteria levels and CWA § 303d listing status). The testing for bacteria is very inconsistent. Furthermore, these analyses are very episodic and only become detectable during or directly after runoff events or if testing is done near the bacterial source. The listing of CWA § 303(d) impaired waterbodies is regulated by the Lahontan Regional Water Quality Control Board. For this reason, it is not advised to use this indicator as a basis for management direction in aiming toward maintaining or reaching stated desired conditions.
- Last monitoring period we recommended testing water quality for site-specific project

work within watersheds. However, in trying to implement this approach, we realized that this will only show elevated levels of turbidity from increased sedimentation. These elevated levels will be temporary and very short-lived both spatially and temporally.

- Last monitoring period we removed question FS02 which used macroinvertebrate diversity to meadow trends towards the same desired condition as AE03. However, since removing the question, due to inconsistent data collection on the forest, we have learned that the measurement (California Stream Condition Index (CSCI)) will be available from the Region 5 Broader-scale Monitoring Strategy and can be used to rate stream health for the Inyo. We recommend re-instating this metric. Instead of using these data just for areas sampled on the Inyo, the analysis expands this out to the Southern Sierra ecological province which incorporates data from the Sierra, Sequoia and the Inyo National Forests. While the data is not specific to the Inyo National Forest, meaningful trends can be gathered from this area as a whole and applied to the Inyo National Forest.

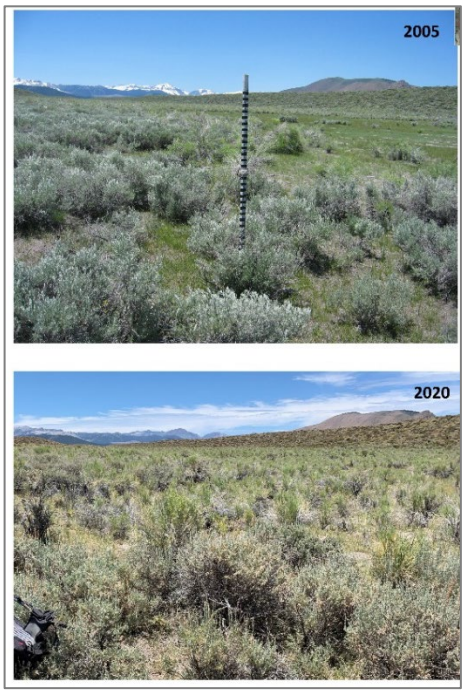
Motorized Road and Trail Erosion (WS02)

- Continue to develop local partnerships with various Off Highway Vehicle (OHV) groups and users to maintain and repair OHV routes and educate users. As of 2024, the Forest has developed beneficial partnerships with OHV groups such as Valley Outdoors and Tread Lightly.

Soil Disturbance (PR01)

- Sample at least three pre- and four post-fuels reduction units per year, as practical, and monitor additional types of timber activities (e.g., light vs. intense mechanical activities) to provide a greater representation of disturbance types and environmental/soil settings that can inform plan monitoring and project effects analysis.

Status of Select Ecological Conditions and Focal Species



The 2019 land management plan focuses on desired conditions for various ecosystems, and on improving their resilience to various stressors, such as climate change, grazing, fire suppression and uncharacteristic fire. These ecosystems provide a variety of ecosystem services including wildlife habitat, carbon sequestration, and biodiversity, and are closely related to the monitoring questions related to at-risk species. There are unknowns and remaining questions about the condition and status of old forests/large trees, pinyon-juniper woodlands, sagebrush communities, non-native grasses, and meadows across the Forest, and how stressors and management may be affecting the trends in those ecosystem conditions.

Monitoring Questions

- TE01. What is the status and trend of large trees and old forest in the Sierra Nevada montane forest? The indicators associated with this question include proportion of area with large trees and number of large trees, snags, large downed logs per acre by forest type. ***Monitored every third reporting cycle; the next evaluation will be in 2026-2027.***
- TE02. What is the status of pinyon-juniper woodlands? The indicators associated with this question include pinyon-juniper spatial extent and number, type, and extent of disturbance events in pinyon-juniper woodlands (such as wildfire, disease, drought). ***Monitored every third reporting cycle; the next full evaluation will be in 2026-2027.***

However, this monitoring report evaluates trends in mortality (disturbance events).

- TE03. What is the condition of sagebrush communities? The indicators associated with this question include: (1) proportions of seral classes, sagebrush cover, (2) acres of treatment to improve age class distribution, (3) acres of wildland fire, (4) percent native understory vegetation, (5) percent sagebrush community lost to development by ecological subregion, and (6) acres of sagebrush regeneration.
- FS01. How is the abundance of cheatgrass and red brome (nonnative Bromus spp.) changing? The indicators associated with this question include the spatial extent and percent cover of cheatgrass and red brome.
- AE01. What is the vegetative condition of selected grazed and ungrazed meadows? The indicators associated with this question include: (1) rangeland ecological condition; (2) species richness, species diversity, and plant functional groups; (3) range greenline monitoring; and (4) vegetation community types.
- AE02. To what extent are riparian areas functioning properly across different management areas and levels of disturbance? The indicators associated with this question include vegetation cover, structure, and composition as well as floodplain and channel physical characteristics.

Key Results

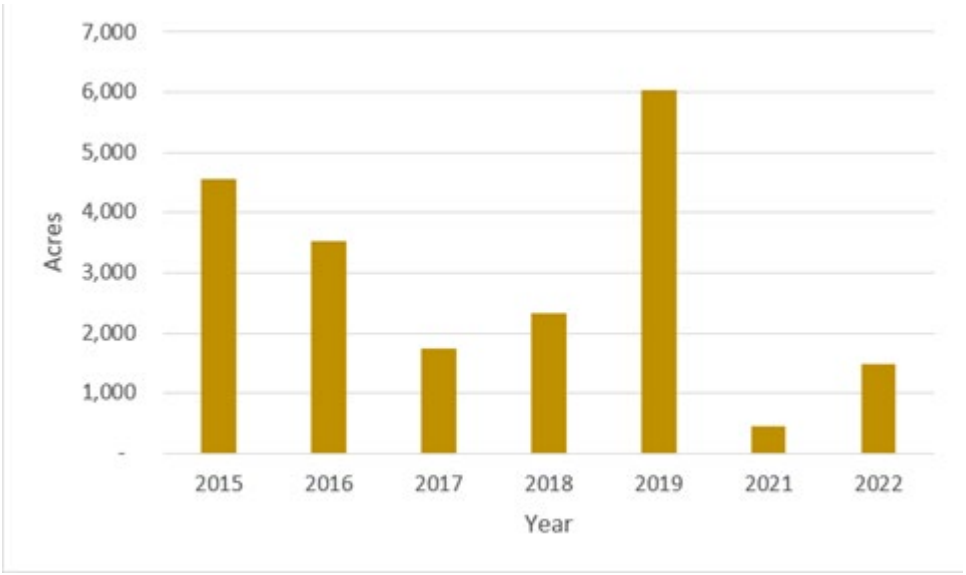
Pinyon-juniper woodlands (TE02)

Pinyon-juniper woodlands on the Inyo National Forest are not currently meeting the Forest Plan desired conditions. particularly in the White and Inyo Mountains where there has been a recent pattern of canopy cover loss and tree mortality (Figure 2). The data suggest that pinyon-juniper woodlands are experiencing a decline in response to several interacting stressors, including drought and insect outbreaks. A declining trend is also evident on adjacent Bureau of Land Management and National Park Service lands. Pinyon pine health on the Sierra Nevada side of the forest and northward was generally better than southerly locations. Some key findings from the monitoring include:

- There was an increase in pinyon tree mortality in 2022 compared to previous years (Figure 3). The estimated number of dead pinyon pine trees increased from fewer than ~2,000 trees to over 70,000 dead trees.
- The estimated number of dead pinyon pine trees was much greater in certain highly visible locations that are important for recreation and cultural purposes.
- The total acres of pinyon-juniper woodlands are now 510,000, nearly 2,000 acres less than during the 2020-2021 monitoring period. This reduction is from the transition from pinyon-juniper to juniper-dominated woodlands that now have less than 10% pinyon tree cover.
- Relatively few restoration activities or fires occurred in pinyon pine over this reporting period as compared to some prior years (Figures 4 and 5).
- No data were available for the extent of pinyon-juniper expansion into shrublands.

Therefore, it cannot be determined if the spatial extent of these arid woodlands is experiencing an upward or downward trend.

Figure 2. Spatial extent of pinyon-juniper woodlands on the Inyo National Forest.



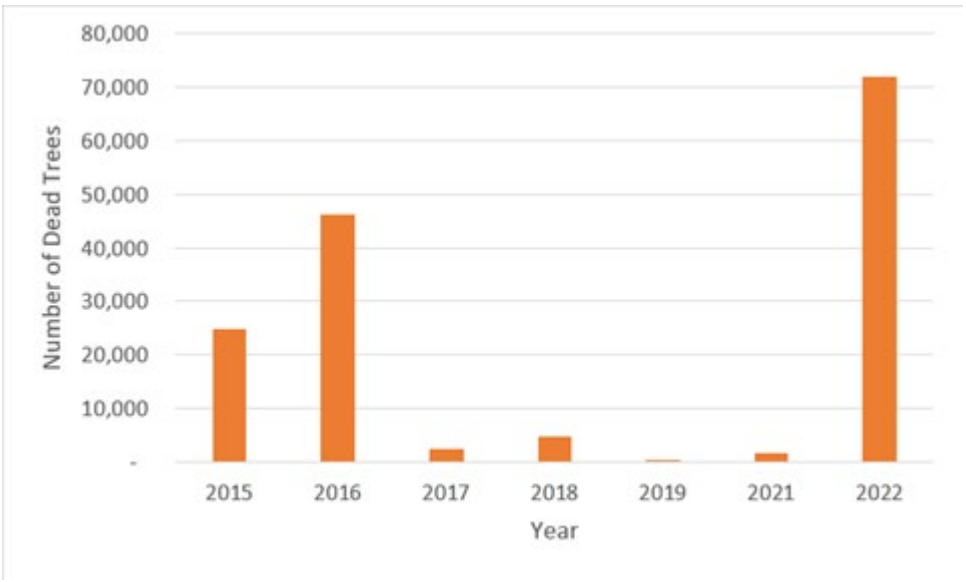


Figure 3. Aerial Detection Survey (ADS) results for acres affected by pinyon mortality (top) and number of dead pinyon pine trees (bottom) on the Inyo National Forest from 2015-2022.

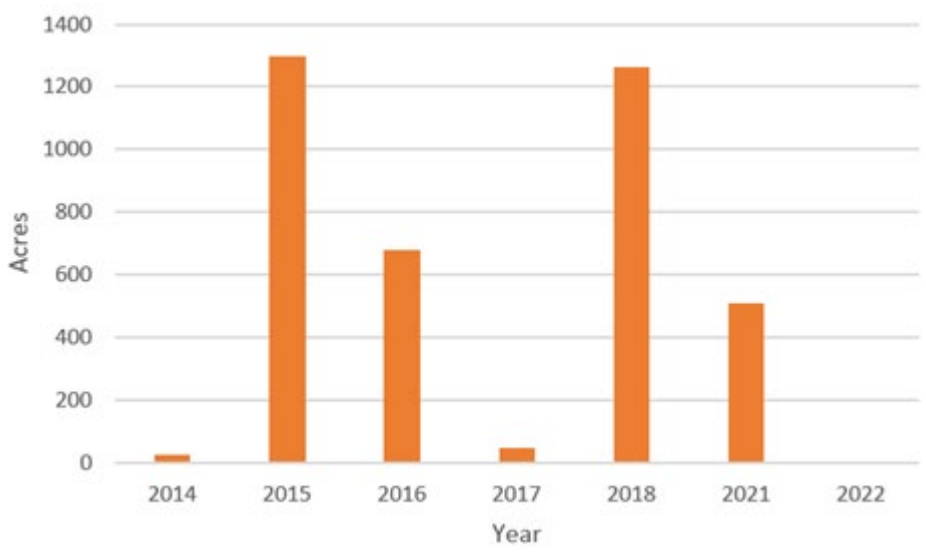


Figure 4. Acres of wildland fire, by year, within pinyon-juniper extent, Inyo National Forest, for years 2014-2022.

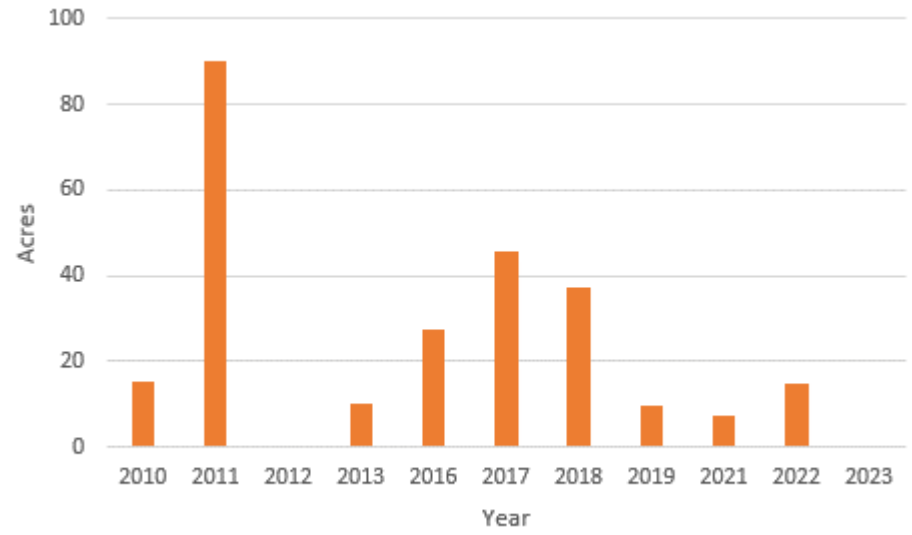


Figure 5. Acres of treatments, by year, within pinyon-juniper extent, Inyo National Forest, as documented in the FACTS database.

Sagebrush (TE03)

Inyo National Forest Ecology plot (hereafter referred to as 'ecology plot') measurements of sagebrush cover were available for 2020 and 2023 for Long Valley and the Glass Mountains. These localities were prioritized for monitoring because they serve as important habitat for the

bi-state sage grouse.

Plots selected for resampling were stratified evenly among land type associations as delineated in the Terrestrial Ecological Unit Inventory, to ensure different substrates and climates were represented. Plots were stratified among the different seral stages (Table 4). In addition, all plots within a recorded fire perimeter (CalFire FRAP 2023) were resampled because they likely experienced change in indicators such as a sagebrush cover, native herb proportion, and seral class since the last reporting cycle.

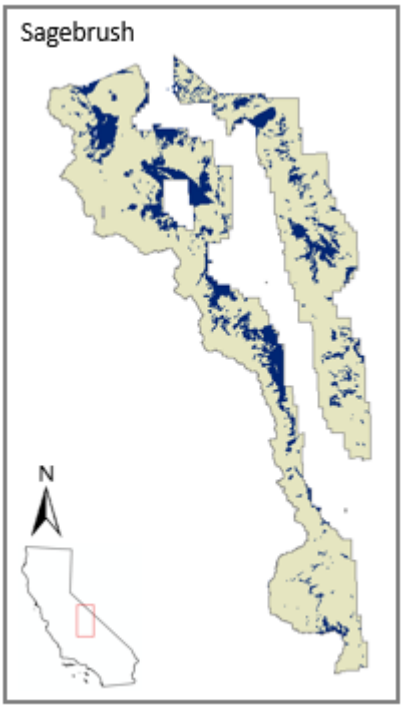


Figure 6. Sagebrush ecosystems on the Inyo National Forest as mapped in the Inyo National Forest Terrestrial Ecological Unit Inventory.

Table 4. Ecology plot measurements of sagebrush seral stage class ranks, based on 2023 plot data collection in Long Valley/Glass Mountains area. Seral stage categories were assessed qualitatively in the field, based on visible evidence of disturbance of any kind, and presence of early seral indicator species. One additional plot was measured in 2023 as compared to 2022 (within the footprint of the 2016 Owens River Fire).

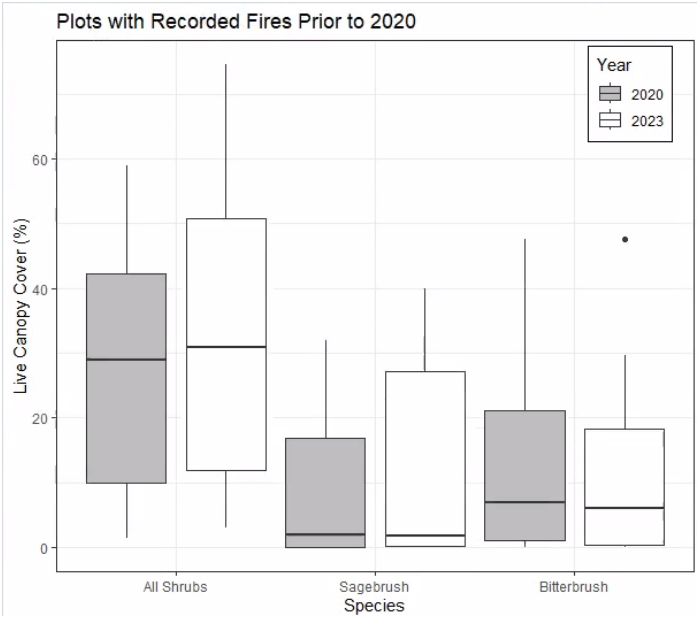
Seral Stage	2020 Count of Plots	2020 Proportion per class (%)	2023 Count of Plots	2023 Proportion per class (%)
Early	4	13%	8	24%
Mid	19	59%	13	39%
Late	3	9%	11	33%
Decadent (very late)	6	19%	1	3%
Total	32		33*	

Cover and Recovery

The Inyo National Forest is meeting the desired conditions for sagebrush except in areas that are burned by wildfires that are larger than just a few acres. In these areas, the fire effectively removes the seed source, prolonging sagebrush re-establishment to >50 years.

Proportions of seral classes showed a relatively complex trend over time that can be attributed to a combination of post-drought shrub recovery and regeneration, increase in cover following fires that occurred prior to 2020, and the occurrence of the 2021 Dexter Fire (Table 4). These effects on sagebrush are shown below in a series of photo points. Key monitoring findings include:

- There was an increase in the percentage of plots classified as late seral from 9% in 2020 to 33% in 2023.
    - Number of plots classified as decadent (i.e. dominated by dead or dying shrub cover and little or no regeneration) declined from 2020 to 2023 and were reassigned as late seral. This reassignment was due to the recovery of live cover, likely in response to the large precipitation year 2022-2023, after which sagebrush and other shrubs showed a strong crown recovery and recruitment (Figure 7).
    - Concurrently, several plots that had been assigned to mid seral stages in 2020 rapidly progressed toward late seral condition, driven both by the intensive drought that first increased dead cover and species turnover from 2020-2022 and then by the large precipitation year (2022-2023) that increased cover of herbs and enhanced growth of surviving sagebrush and resprouting of other shrub species.
- Mean sagebrush cover in measured plots changed very little from 2020-2023 both within and outside of previously burned areas, although some plots did exhibit an increase (Figure 7).
    - In general, sagebrush recovery is progressing slowly in burned areas of any age, unless a nearby seeding (i.e. reproducing) adult is present. Bitterbrush, often a rapid resprouter following fire, also did not exhibit much increase in cover either within or outside of burn perimeters over the last three years. Most increase in shrub cover can be attributed to growth of rabbitbrush, snowberry, prickly phlox, buckwheat, and other less common species.
    - Key finding: resilience of sagebrush relies upon nearby (i.e. within 20 meters) sagebrush seed sources. Most fires in the study area (e.g. McLaughlin, Owens River) have been large and contiguous enough that no nearby sagebrush seed has been available to support recruitment.



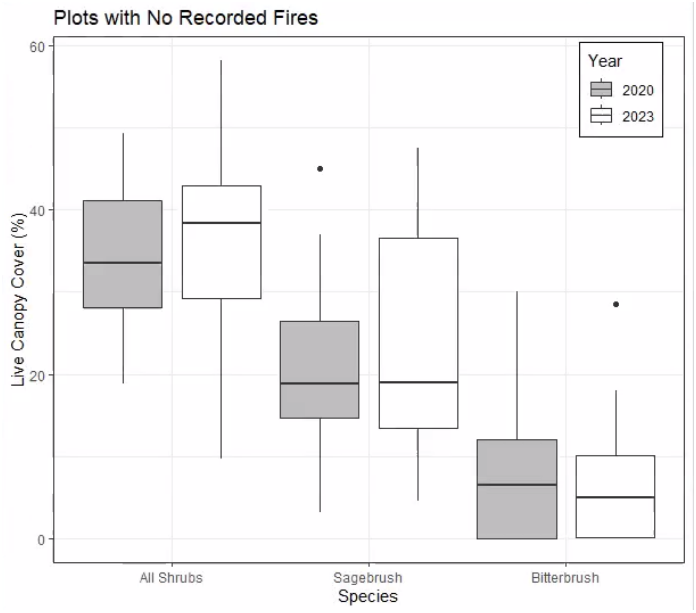


Figure 7. Change in live canopy cover of sagebrush, bitterbrush, and total shrub cover from 2020 to 2023 based on plot data collection in Long Valley/Glass Mountains area in plots with either no recorded fires prior to 2020, or within recorded burn perimeters, which range in date from 1960's to present.

Good changes: Effect of a nearby parent seeder

Mclaughlin Fire 2001 – Plot 446

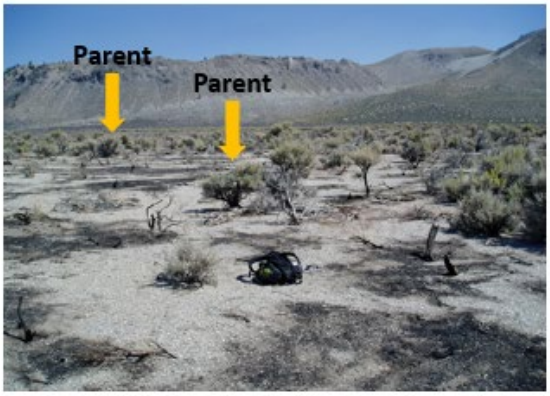
2005

2020

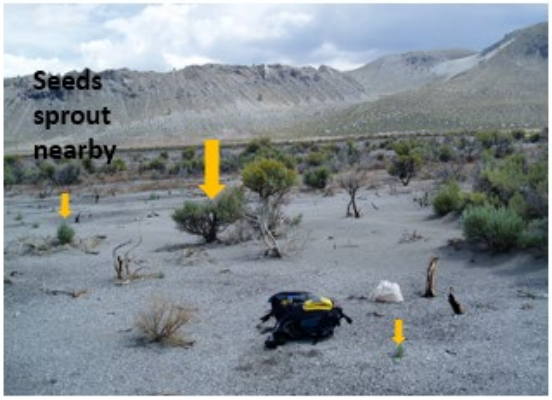
2023: post-fire seedlings now with strong seed production

Mono Fire 2010 – Plot 585

2010



2015



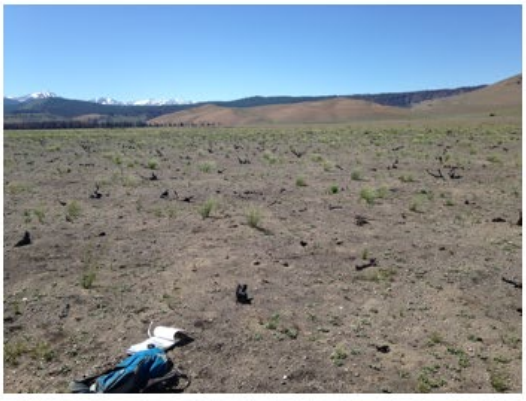
2023: abundant infilling established from nearby seed sources

Not so good changes: larger contiguous fires with slower recovery time

Owens River Fire (Plot 278)

2004

2017: post fire, no adult sagebrush patches



2023: native vegetation cover, but dominated by bitterbrush and horsebrush (no sagebrush)

Owens River Fire 2016 (Plot 439)

2005

2017: post fire, no adult sagebrush patches

2023: mix of cheatgrass and native plants (snowbrush, bitterbrush, but no sagebrush)

Sagebrush Treatments

Acres of treatments within sagebrush ecosystems since 2020 have varied but have been lower in the past several years (2020-2023) compared to the prior decade (2010-2019) (Figure 8). Effectiveness has only been monitored well near the town of Mammoth Lakes, where mechanical treatments in sagebrush ecosystems have, over the long-term, effectively decreased fuels, maintained habitat conditions for sage-grouse, increased seral stage diversity, and restored native herbaceous plant biodiversity and cover while maintaining low (<1%) cover of non-native plant species.

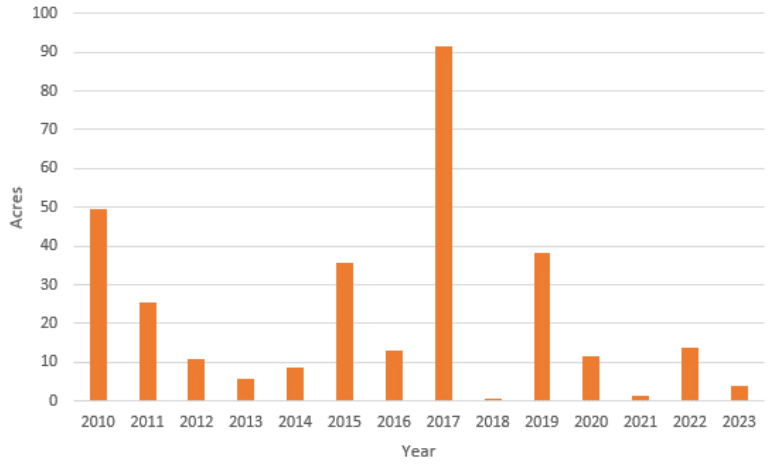


Figure 8. Acres of treatments to improve age class distribution, from the FACTS database in sagebrush ecosystems for the Inyo National Forest.

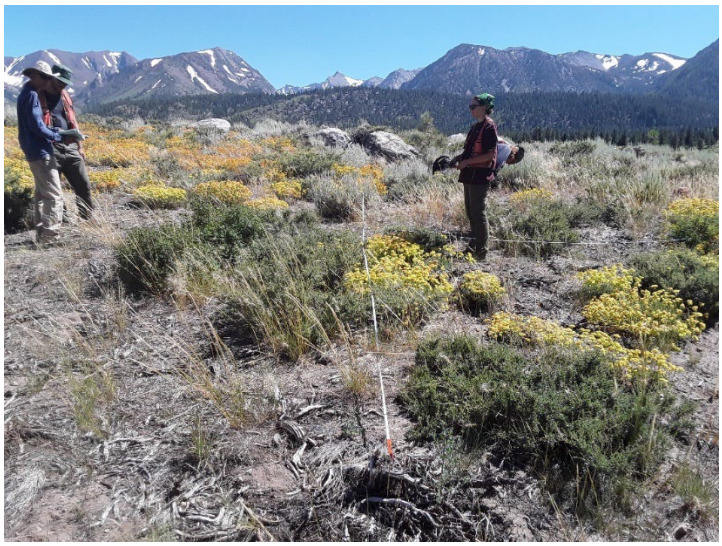


Figure 9. Changes in shrub cover, fuels, and native and non-native composition are monitored in a mowing treatment near Mammoth Lakes.

Wildfires in Sagebrush

Acres of wildland fire in sagebrush ecosystems have varied from 0 to over 6,000 acres per year between 2010-2023 (Figure 10). Since 2020, the Dexter Fire (2021) burned some sagebrush in the upper elevations of the Glass Mountains. Native herbs and shrubs are currently dominant in most burned areas, but cheatgrass is often prevalent on steep, south-facing slopes.

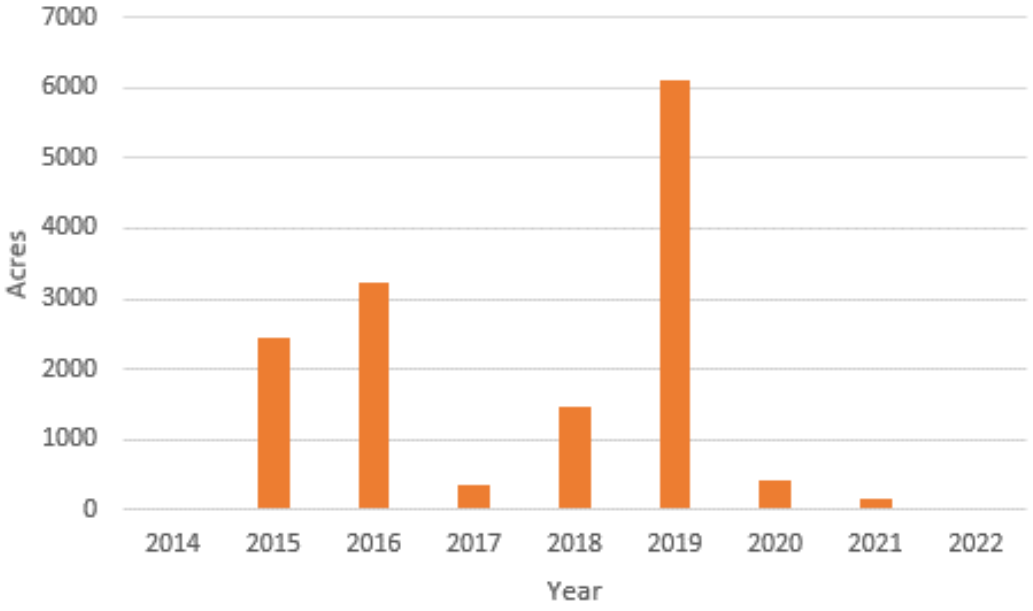


Figure 10. Acres of wildland fire in sagebrush ecosystems for the Inyo National Forest.

Native Understory Vegetation

Understory cover in sagebrush ecosystems is dominated by native species in most locations, with averages over 95% native cover (Figure 11). A very slight increase in native herbaceous cover proportion occurred from 2020 to 2023, which can be attributed mostly to the strong positive response of native perennial grasses and annual forbs to large precipitation events of the 2022-2023 winter.

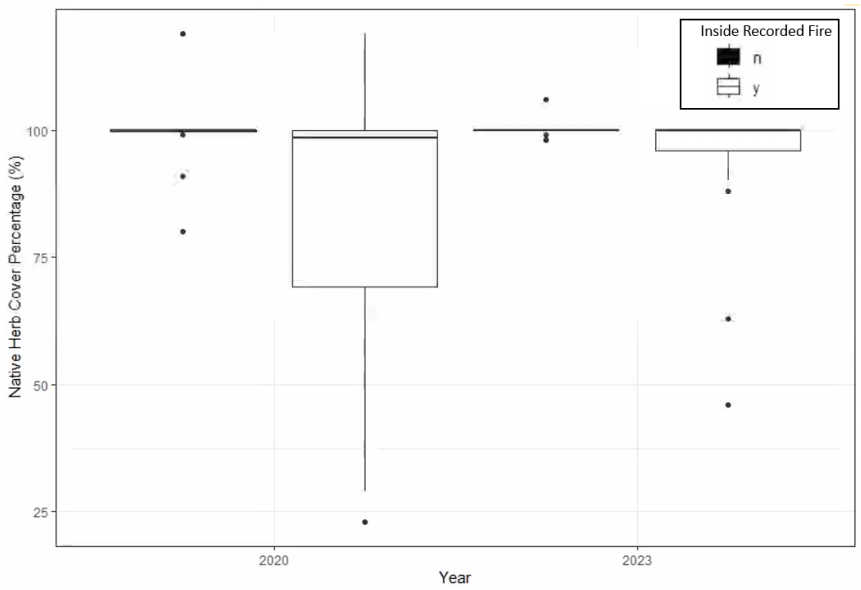


Figure 11. Box and whisker plots of the proportion of herbaceous herb cover that is native for Inyo National Forest ecology plots in sagebrush ecosystems of Long Valley/ Glass Mountains. Boxes include median, two hinges for 1st and 3rd quartiles, whisker to largest value no further than 1.5 the interquartile range, and outliers.

Non-Native, Invasive Grasses (FS01)

In a sample of 324 ecology plots across the forest, mean non-native, invasive grass cover increased from 2.8 +/- 0.5% in 2020 to 3.2 +/- 0.5% in 2023. The very small increase, though not significant, could be in part attributed to the historic precipitation event of the winter of 2022-2023; field surveys generally indicated higher densities, especially at lower elevations of the Sierra Nevada. However, the precipitation event did generally favor native over non-native herbs in sagebrush environments (see TE03). Despite these moderate numbers, cheatgrass density is high (>30% cover) in some disturbed areas, particularly on some south-facing slopes in Long Valley, Mono Basin, and the Owens Valley.

The modeling procedure used in the previous reporting period could not be followed for this cycle due to the historic precipitation event that limited the availability of clear imagery free of snow cover and increased herbaceous production so heavily that the spectral differences in phenology of native v. non-native species could not be discerned. We recommend improvements in modeling efforts going that focus on methods designed to be robust through a range of climate conditions.

Meadows (AE01)

We conducted Inyo National Forest Utilization Standards monitoring at two grazed meadows in 2022 and eight grazed meadows in 2023. The Region 5 Range Monitoring Team collected data on vegetation condition scores in six meadows, including some ungrazed meadows. Additionally, information on ungrazed meadows is included in the Proper Functioning Condition ratings in AE02. Future, additional data on ungrazed (and grazed) meadows may be available as part of the forthcoming Region 5 Broader-Scale Monitoring Strategy. Key findings from meadow monitoring include:

- Davis Creek and Trail Canyon allotments received downgraded ratings in two meadows (Table 5) primarily due to widespread headcuts, hummocking, and presence of upland vegetation abundant in the meadows. Diaz M eadow in the Mulkey allotment received a downgraded rating due to a significant migrating headcut at the bottom of the meadow and major instability and lack of vegetation in the main creek channel.
- Vegetation condition scores for the Region 5 Range monitored meadows show one meadow improved and two meadows downgraded from their previous rating (Table 6). The upper Casa Vieja Meadow, where grazing occurred, had a rating downgraded from excellent to good. Agnew Meadow, a wilderness packstock grazing meadow, was also downgraded.
- The Ratliff score for Casa Vieja inside the pasture fence improved from good in its first rating to excellent in its most recent two ratings.

Dutch Meadow (left) in fully functional condition with well vegetated and saturated inset floodplain; Diaz Creek (right) in degraded condition with large active erosion, little vegetative cover and channel instability. Photos: July 31, 2023.

Table 5: Forest Monitoring Team Meadow Condition Ratings. All meadows are grazed.

Allotments	Meadow	Year	Elevation (ft)	Grazed?	Meadow Condition	Previous Rating
Davis Creek	Lower Chiatovich	2023	7300	Yes	Functioning At Risk	NA
Davis Creek	Upper Chiatovich	2023	8800	Yes	Degraded	Non-functional
Trail Canyon	Lower Trail Creek	2023	9050	Yes	Functioning At Risk	At risk
Trail Canyon	Upper Trail Creek	2023	9700	Yes	Degraded	At risk
McMurry Meadows	McMurry Meadow	2023	6400	Yes	Fully functional	Fully functional
Mulkey	Dutch Meadow	2023	9880	Yes	Fully functional	Fully functional
Mulkey	Diaz Meadow	2023	9600	Yes	Degraded	Fully functional
Mulkey	Ash Meadow	2023	10000	Yes	Functioning At Risk	Fully functional
Indian Creek	Cabin Creek Upper	2022	10800	Yes	Functioning At Risk	At Risk
Perry Aiken	Busher Canyon	2022	10500	Yes	Functioning At Risk	Degraded

Table 6: Region 5 Range Monitoring Team Meadow Vegetation Condition Ratings from monitoring conducted in 2023. All meadows are mesic (dry).

Plot Name	Livestock grazing?	Ratliff Score[1]	Vegetative Condition Class	Rating past 1-5 years	Rating past 6-10 years	Rating past 11-20 years
Casa Vieja Inside fence (INY0119)	Ungrazed	80	Excellent	Excellent	Good	Good
Upper Casa Vieja (INY0120)	Grazed	63	Good	Excellent	Excellent	Excellent
Beer Keg Meadow (INY0122)	Grazed	54	Good	Good	Good	Good
Thousand Island Delta (INY0301)	Ungrazed	111	Excellent	NR	Excellent	Excellent
Shadow Creek (INY0304)	Ungrazed	109	Excellent	NR	NR	Excellent
Agnew Meadow pasture (INY0305)	Ungrazed	67	Good	NR	NR	Excellent

[1] See Ratliff (1985) for an explanation of condition ratings, based on rooted frequency and species composition.

Ratliff, Raymond D. 1985. Meadows in the Sierra Nevada of California: state of knowledge. Gen. Tech. Rep. PSW-GTR-84. Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture; 52 p

Proper Functioning Condition of Riparian Areas (AE02)

PackStock Grazing Meadow Monitoring

The Inyo National Forest began conducting regular packstock meadow monitoring trips in 2022. Seven packstock grazing meadows were evaluated in 2022 and eight in 2023.

- In 2022, six meadows rated in proper functioning condition and one functional at risk.
- In 2023, four meadows rated as proper functioning condition, three as functional at risk, and one in non-functional condition.

Moving forward, we plan to conduct this monitoring on a consistent basis so we can see trends over time. And we plan to use these monitoring data to help develop future restoration on more reaches in these allotments, particularly those rating as non-functional or functional at risk.

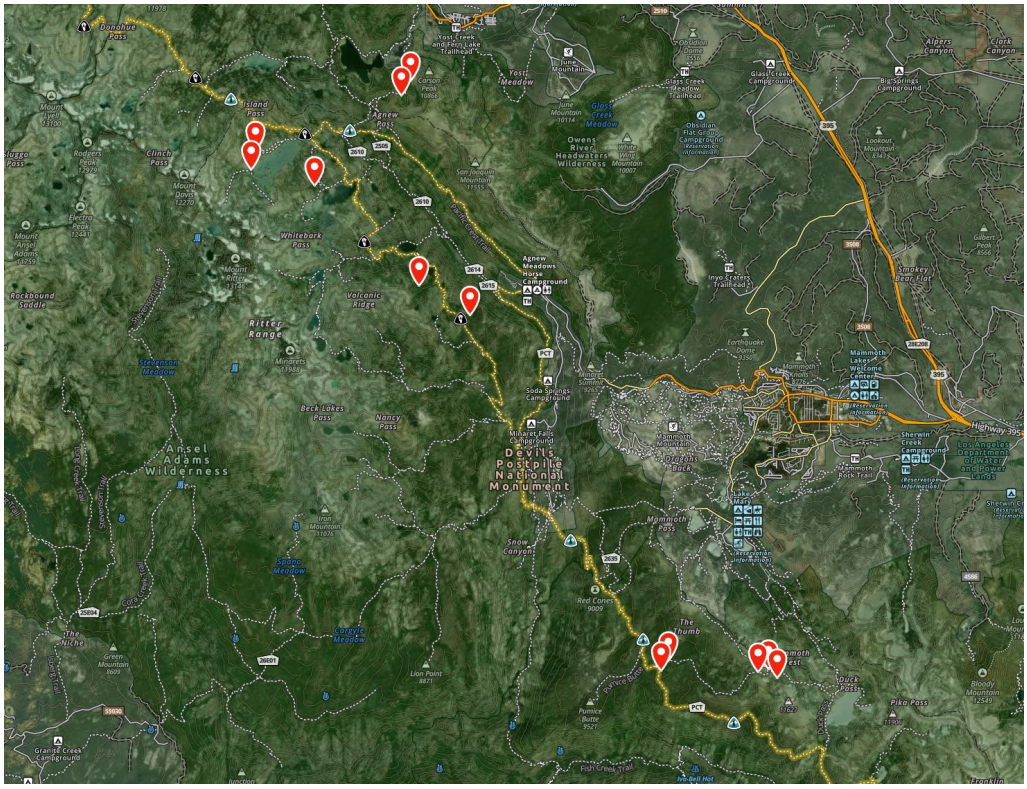


Figure 2: Map of Wilderness Packstock Grazing Meadow Monitoring Locations

Table 7: Wilderness Packstock Grazing Meadow Assessments where PFC= Proper Functioning Condition, FAR = Functional – At risk, and NF = Not Functional.

Meadow	Year	Elevation (ft)	Grazing Allowed?	Assessment
Alger Meadow Upper	2023	11000	Open	PFC
Alger Meadow Lakeside	2023	10600	Closed	FAR
North Garnet Bay Meadow	2023	9700	Closed	NF
North 1,000 Island Stringer	2023	9800	Open	PFC
West End 1,000 Island Meadow	2023	9800	Closed	PFC
Upper Spooky Meadow (Lentic)	2023	9900	Closed	PFC
Upper Spooky Meadow (Lotic)	2023	9900	Closed	FAR
Lower Spooky Meadow	2023	9600	Closed	FAR
Deer Creek Meadow South	2022	9200	Closed	FAR
Deer Creek Meadow North	2022	9200	Closed	PFC
Trinity Meadows Complex	2022	9360	Closed	PFC
Deer Lakes Meadow (between lake 1 and 3)	2022	10630	Closed	PFC
Deer Lakes Meadow (below lake 1)	2022	10550	Open	PFC
Deer Lakes Meadow (between lake 1 and 2)	2022	10600	Closed	PFC
West of Gladys (Rosalie)	2022	9600	Open	PFC

Livestock Grazing Meadow Monitoring

We monitored three livestock grazing meadows in active allotments in 2022 and nine livestock grazing meadows in 2023 (Figure 6, Table 8). Overall, most meadows remained at their previous rating, while two meadows moved down one rating, from proper functioning condition to functional – at risk. One meadow was visited for the first time in 2023 and rates as not functioning (Table 8, Figure 7). The meadows with lower ratings had various reasons associated with the change.

- In Trail Canyon, the meadows have experienced increased pressure from wild horses and concentrated livestock presence, particularly during dry years. This has led to increased hummocking, bare ground, and new active headcuts that raised concerns for the forest monitoring team.
- The only meadow within a grazing allotment that received a non-functional rating was Diaz Meadow in the Mulkey Allotment. This is due to active headcutting, massive gully erosion and multiple signs of instability as the system has not shown indications of the capacity for self-repair.

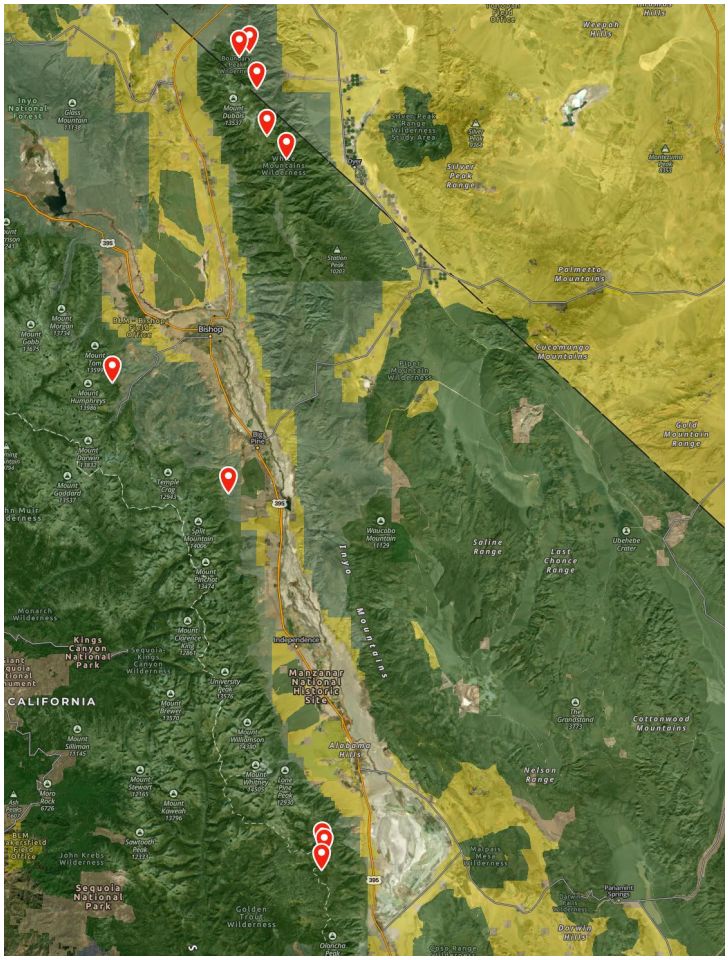


Figure 6. Map of Livestock Grazing Allotment Meadow Monitoring Locations

Lower Chiatovich Creek (left) in Proper Functioning Condition, with connection to floodplain and ability to withstand high flows. Upper Trail Creek (right), Functional – At Risk, with deep channel, active headcuts and upland species on hummocks adjacent to stream.

Table 8. Proper Functioning Condition Ratings for Livestock Grazing Meadows where PFC= Proper Functioning Condition, FAR = Functional – At risk, and NF = Not Functional.

Allotment	Meadow	Year	Elev (ft)	Grazed?	PFC	Previous Rating
Davis Creek	Lower Chiatovich	2023	7300	Yes	PFC	PFC
Davis Creek	Upper Chiatovich	2023	8800	Yes	FAR	FAR
Trail Canyon	Lower Trail Creek	2023	9050	Yes	FAR	PFC
Trail Canyon	Upper Trail Creek	2023	9700	Yes	FAR	PFC
McMurry Meadows	McMurry Meadow	2023	6400	Yes	PFC	NA
Mulkey	Dutch Meadow	2023	9880	Yes	PFC	PFC
Mulkey	Diaz Meadow	2023	9600	Yes	NF	NA
Mulkey	Ash Meadow	2023	10000	Yes	PFC	PFC
McGee Packstation (packstock meadow)	McGee Pack Meadow	2023	7760	Yes	PFC	NA
Indian Creek	Cabin Creek	2022	10800	Yes	PFC	PFC
Perry Aiken	Busher Canyon	2022	10500	Yes	FAR	FAR
Buttermilk	Birch Creek	2022	8550	Yes	PFC	NA

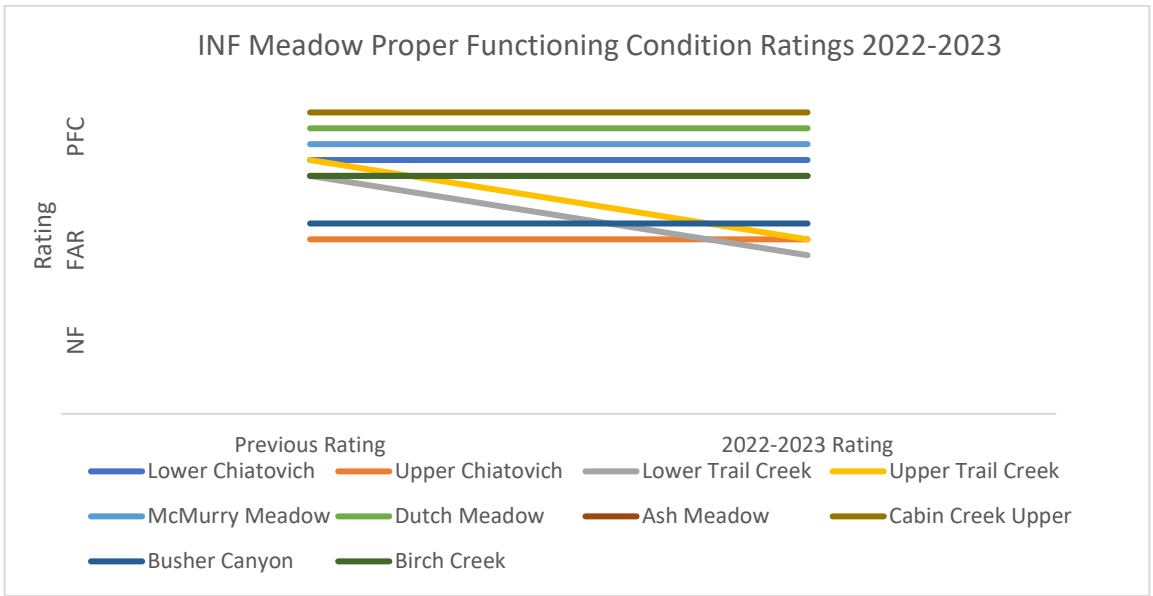


Figure 7: Trend in PFC rating for Livestock Grazing Meadows on the Inyo National Forest where PFC= Proper Functioning Condition, FAR = Functional – At risk, and NF = Not Functional.

In terms of general permit compliance and allowable trampling and chiseling standards, streambank trampling and chiseling monitoring was done on the Coyote, Mulkey, Crooked Creek, Indian Creek, Buttermilk and Monache Allotments in 2022 and 2023. No allotments exceeded the 20% allowable trampling and chiseling standards for most streams and none exceeded the 10% allowable trampling and chiseling standards for wild and scenic rivers and wild trout waters.

Recommended Changes

Pinyon pine (TE02)

- Develop a separate, focused monitoring plan for pinyon pine in collaboration with local tribes, other federal agencies, academic researchers, and other partners. Use monitoring results to develop potential restoration and climate adaptation actions for pinyon pine on the Inyo National Forest. This recommendation is repeated from the 2020-2021 monitoring period because although the recommendation resulted in targeted site visits and focused discussions with agency service area Forest Health Protection specialists and tribal members, forest staffing shortages have constrained the development of the associated strategic monitoring and restoration plan for pinyon pine woodlands.
- Adapt the spatial scale of the indicator 'spatial extent and number, type, and extent of disturbance events in pinyon-juniper woodland' – separating indicators for areas of high tribal importance, recreation, and other values from the forest-wide extent. This revision would support potential future recommendations targeting management action or monitoring at a more feasible scale.

Sagebrush (TE03)

- Conduct small, strategically placed prescribed burns or fire surrogate (i.e., mechanical fuel reduction) treatments in sagebrush to reduce the likelihood of large wildfires that could exclude sagebrush for 40+ years. Data presented in this report illustrates that sagebrush recruitment is strongly dependent on nearby healthy seed sources, meaning that narrow, strategically designed treatments could improve the long-term resilience of sagebrush by encouraging recruitment, while reducing hazardous fuel loads.
- Continue targeted monitoring of sagebrush vegetation affected by fuel reduction treatments and wildfires to evaluate their effects to ecosystem structure, composition, diversity, and resilience, including the cover and occurrence of sagebrush and non-native plant species such as cheatgrass.
- Revise the indicator "acres of sagebrush regeneration" to "sagebrush seedling density". The latter metric is currently measured in ecology plots and provides a more readily interpreted measure of sagebrush recruitment and resilience following disturbance.

Non-Native, Invasive Grasses (FS01)

- Continue improvements to the model that focus on developing methods to be robust through a range of climate conditions.

Meadows (AE01)

- Take corrective action in Davis Creek, Trail Canyon, and Mulkey allotments in meadows receiving a functional - at risk or degraded rating (AE02 recommendation also). Work with grazing permittees and District Rangers to evaluate ways to improve meadow condition scores. Prioritize utilization monitoring in the Casa Vieja meadow.

Status of Ecological Conditions for At-Risk Species

Special habitats and the at-risk species like Sierra Nevada bighorn sheep and bi-state sage grouse are locally unique and specifically called out in the land management plan as important to manage. While bighorn sheep and sage-grouse are extensively studied by other agencies, special habitats are the focus only of the Inyo National Forest. Quantitative data on special habitat extent and condition is generally lacking or has not been compiled, and systematic tracking and monitoring is limited for most habitat types. This monitoring program attempts to improve our understanding of threats to special habitats and any management changes that could improve their condition.

There may be a need for expanding habitat connectivity in the winter range of Sierra Nevada bighorn sheep by decreasing pinyon pine and other conifer canopy. The uncertainty is whether vegetation management, specifically managed fire, will be adequate for improving bighorn sheep winter range to minimize or mitigate threats to bighorn sheep. This importance is supported by the USFWS Recovery Plan for the Sierra Nevada (2007).

Sagebrush ecosystems dominate the lower elevation landscapes of the plan area and provide habitat for several at-risk species, including the bi-state sage grouse. However, there are large areas that have decreased fire resilience due to invasion by non-native annual grasses (such as cheatgrass and red brome) that increase susceptibility to more frequent fires and disrupt native vegetation composition and structure. Monitoring of sage-grouse habitat will help the Inyo National Forest understand where management changes may be possible to improve resilience of sage-grouse habitats.

Monitoring Questions

- AR01. To what extent is the integrity of special habitats for at-risk plants and animals being maintained or improved? The indicators associated with this question include special habitat extent (acres) and health (e.g., species composition), and number, type, and extent of disturbance events (e.g., adverse effects from authorized or unauthorized use).
- AR02. What is the quality of bighorn sheep critical habitat? The indicators associated with this question include acres of vegetation management (prescribed fire, mechanical and hand thinning) in critical habitat for bighorn sheep and tree cover in bighorn sheep critical habitat.
- AR03. How is the condition of seasonal sage-grouse habitats and connectivity changing? The indicators associated with this question include spatial extent (acres) of area with annual grasses

and percent cover of annual grasses.

Key Results

Special Habitats (AR01)

Special Habitat (Bats)

Gar Watt mine on White Mountain Ranger District is considered special habitat and provides bat roosting habitat. There are three adits that are identified as maternity roosts for bats. All adits pose a risk to recreation without permanent closures (bat gates). Additionally, recreation at the site poses a disturbance to the bat colony. This site is within designated wilderness and Bureau of Land Management administered by Inyo National Forest.

Gar Watt mine is surveyed annually is has been documented to host a bat maternity colony and have ongoing recreational activities. Bats have shifted roosting locations over the years between the various adits and bat biologists believe these shifts are likely due to high recreational use. Prolonged disturbance to maternity roosts would be very detrimental to the Gar Watt bat population.

Gar Watt mine has been proposed for mitigation since 2022. In February 2024, the forest took the initial steps to prioritize this mine for bat gate closures. This special habitat is provided the protections found in the Inyo Forest plan components as a Potential Management Approach - “Protect known bat hibernacula or maternity colonies that may be adversely affected by recreational, management, or other activities by either installing bat gates at the entrances of caves and mines or restricting access by other means.”

Extent of Special Habitat (Vegetation)

In 2023, we identified and mapped a new special habitat unit, volcanic-warm soil, totaling 7.62 acres. We removed *Quercus kelloggii* and seep special habitat units resulting in a reduction of total special habitat types to 22 types. *Quercus kelloggii* is included under the forest plan black oak and canyon live oak ecosystem type and has its own Desired Conditions (TERR-OAK-DC) and Standards (TERR-OAK-STD). Seeps are covered in the forest plan under Riparian Conservation Areas and do not qualify as a special habitat unit.

Updated special habitat types occurring across the Inyo National Forest total just over 100,000 acres (Table 9, Figure 8). The distribution is restricted to one or a few areas of the forest. For example, dry forb is concentrated south of Mono Lake and on the Kern Plateau; limestone is only found in the White and Inyo mountains. Just under half of the special habitat area (42,630 acres) is located within designated wilderness areas. The Mono Lake and Mt. Whitney Ranger Districts have higher acreage of special habitat than Mammoth or White Mountain Ranger Districts, but special habitats do occur on all four districts.

Limestone rock type is by far the most abundant special habitat, while volcanic-warm soils and several specific roof pendant and other metamorphic rock types are the least abundant.

Overall, targeted monitoring has only occurred on ~0.1% of special habitat acres. Therefore, conclusions about overall trends in special habitat health are likely to be less meaningful than trends in condition of specific sites.

Table 9: Area of special habitats, by type, known across the Inyo National Forest. Acres are shown in total and by Ranger District. Additions from the 2020-2021 monitoring period shown in green and removals in red.

Special Habitat	Special Habitat (acres)	# of Sites (polygons)	Mono	Mammoth	White Mountain	Mt. Whitney
Alkali Flat	9,376	17	9,113	234	29	
Banded calc-hornfels and pelitic hornfels	210	2			210	
Bloody Mountain formation	2,174	17		2,032	142	
Bright Dot formation	1,207	8		1,061	145	
Dry Forb	11,580	64	9,093	522	15	1,950
eolian - dune field	1,469	12	1,469			
eolian - sand sheet	2,377	4	2,377			
Gull Lake Roof Pendant	1,202	14	1,202			
Hornfels	1,172	2	1,172			
Limestone	48,550	22			15,775	32,775
Log Cabin Mine Roof Pendent	88	3	88			
Marble	381	5	28		352	
Metasediment of the Bishop Creek Roof Pendant	39	2			39	
Metasediment of the Gull Lake Roof Pendant	7,032	12	7,032			
Metasediments	400	2	400			
Mount Aggie formation	1,648	14		725	923	
Mount Baldwin Marble	1,473	27		1,086	387	
Mount Morison Sandstone	554	6		516	37	
~~Quercus kelloggii~~	~~541~~	~~16~~	-	-	-	~~541~~
Sand dune deposits	7	1	7			
Sand dunes	9,035	40	9,035			
~~Seep~~	~~297~~	~~13~~	~~61~~	~~96~~	~~100~~	~~40~~
Siliceous calc-hornfels	480	3			480	
Volcanic- warm soils	8	1		8		
Totals	100,454	278	41,016	47,261	18,534	34,725

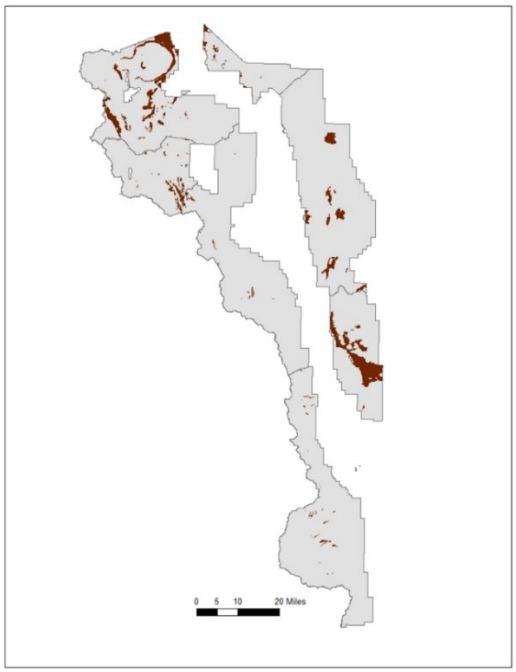
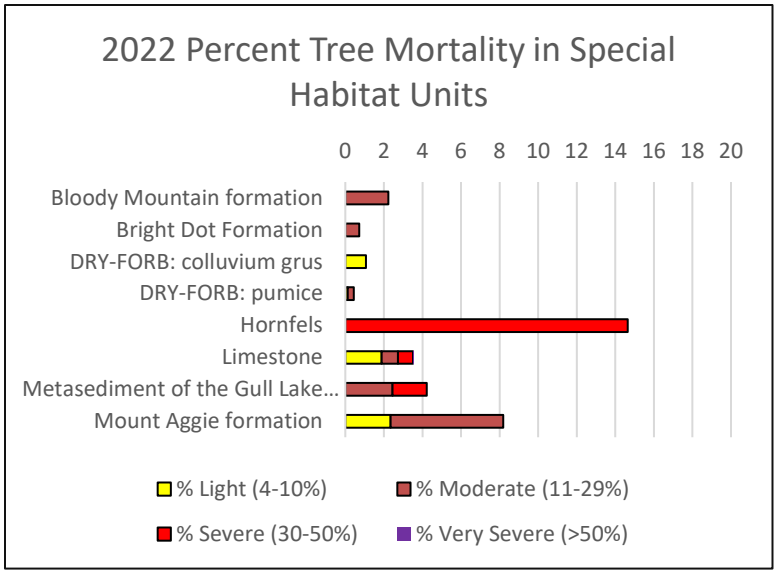


Figure 8: Spatial extent of special habitat units on the Inyo National Forest

Special Habitat Health (Vegetation) – Tree Mortality

- Aerial detection surveys identified tree mortality in a total of 2,431 acres within special habitat units in 2022 and 1,559 acres in 2023. This accounts for 3,989 acres (~4%) of total special habitat area with tree mortality.
- In 2023, a large defoliation event occurred in the Bright Dot Formation, Mount Baldwin Marble, and Mount Morrison Sandstone special habitat units in Lodgepole pine (*Pinus contorta)* from Lodgepole Needleminers (*Coleotechnites milleri).* This totaled 1,284 acres across the three special habitat units (Figure 9).
- The most severe individual mortality event occurred in the Hornfels special habitat unit in 2022 with whitebark pine (*Pinus albicaulis*) mortality from mountain pine beetle (*Dendroctonus ponderosae*) (Figure 9).
- The Limestone special habitat unit had the most total acres of mortality (2,967 acres) (Figure 9). However, it is also the largest special habitat unit so impacts comprise only 6% of the unit.
- Overall, leading causes of mortality across all special habitat units were mountain pine beetles, affecting over 2,054 acres of whitebark pine and limber pine (*Pinus flexilis*) (Figure 10).



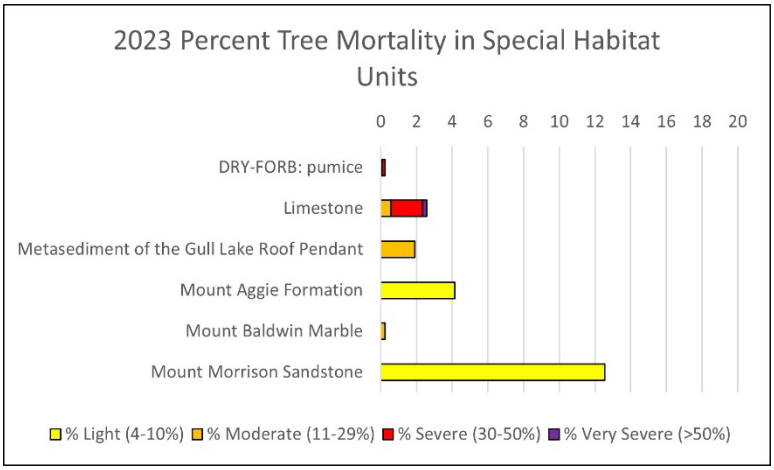


Figure 9: Percent tree mortality in special habitat units by year

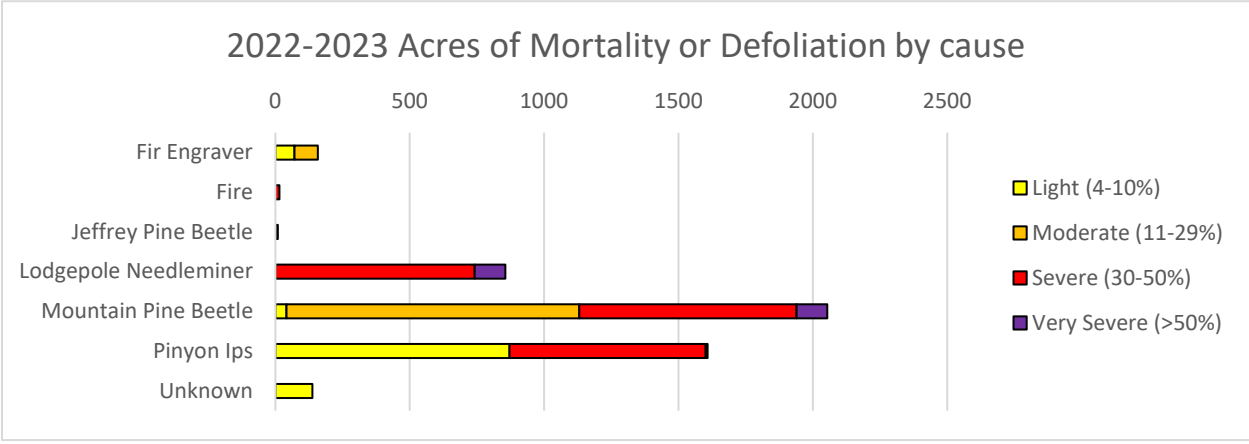


Figure 10: Acres of mortality or defoliation by cause. All defoliation was caused by Lodgepole needleminers.

Whitebark pine mortality across special habitat units is particularly concerning (Table 10). Although mortality is localized to a small area (0.7%) of trees within special habitat units, the overall health of whitebark pine across its range is declining. These special habitat units should be closely monitored for increasing mortality.

Table 10. Acres of whitebark pine mortality by special habitat unit and percent of trees affected.

Special Habitat Unit	Percent Affected	Acres
Mount Aggie Formation	Moderate (11-29%)	96.27
Mount Baldwin Formation	Moderate (11-29%)	3.41
Metasediment of the Gull Lake Roof Pendant	Moderate (11-29%)	306.4
Metasediment of the Gull Lake Roof Pendant	Severe (30-50%)	125.28
Hornfels	Severe (30-50%)	171.65
Total		703.01

Lodgepole pine defoliation by lodgepole needleminers in the Bright Dot Formation, Mount Baldwin Marble and Mount Morrison Sandstone special habitat units should also be closely monitored in the future. The large proportion of these special habitat units is the primary driver for concern. A single defoliation event is unlikely to kill most mature Lodgepole trees, but repeated outbreaks may lead to widespread mortality.

Special Habitat Health (Vegetation) – Invasive Species

Surveys for invasive plant species are sporadic and not all special habitats have 100% survey coverage. Volcanic- warm soils has the greatest amount of survey coverage, primarily due to its small extent and accessibility (Table 11). The following are key findings based on the surveys conducted:

- Known invasive species occupancy in special habitats does not exceed 1% total cover for any of the types.
- Highest priority species for management include perennial pepperweed, Canada thistle, Russian olive, and tamarisk, in the alkali flat and limestone special habitat types.
- In 2022, one new invasive plant infestation, yellow salsify, was mapped (0.06 acres) in the dry forb special habitat unit. No new invasive plant infestations in special habitat units were mapped in 2023.

Table 11. Percent of special habitats surveyed with priority invasive species. IPS = Invasive Plant Species

Special Habitat	Special Habitat - Area (acres)	Percent of Special Habitat surveyed for IPS (%)	IPS Max. Extent, All Species - Area (acres)	IPS Max. Extent, Priority 1&2 Species- Area (acres)	IPS Species Present
ALKALI-FLAT	9,376	50	314	152	Bouncing bet, perennial pepperweed, Canda thistle, cheatgrass, dandelion, mullein, curveseed butterwort, fivehorn smotherweed, herb sophia, lenspod whitetop, prickly Russian thistle, Russian olive, tamarisk, saltlover, shortpod mustard, sweetclover, tumble mustard
Banded calc-hornfels and pelitic hornfels	210	1	0	0	
Bloody Mountain formation	2,174	1	0	0	
Bright Dot formation	1,207	0	0.03	0	cheatgrass
DRY-FORB	11,580	52	34	0	prickly Russian thistle, dandelion
eolian - dune field	1,469	0	0.01	0	prickly Russian thistle
eolian - sand sheet	2,377	0	0	0	
Gull Lake Roof Pendant	1,202	2	2	0	cheatgrass
Hornfels	1,172	23	42	0	cheatgrass, prickly Russian thistle
Limestone	48,550	4	872	0.2	cheatgrass, herb sophia, prickly Russian thistle, red brome, redstem stork's bill, tamarisk, sweetclover
Log Cabin Mine Roof Pendent	88	31	0	0	
Marble	381	1	0	0	
Metasediment of the Bishop Creek Roof Pendant	39	0	0	0	
Metasediment of the Gull Lake Roof Pendant	7,032	1	193	0	cheatgrass

Special Habitat	Special Habitat - Area (acres)	Percent of Special Habitat surveyed for IPS (%)	IPS Max. Extent, All Species - Area (acres)	IPS Max. Extent, Priority 1&2 Species- Area (acres)	IPS Species Present
Metasediments	400	45	5	0	cheatgrass
Mount Aggie formation	1,648	0	2	0	
Mount Baldwin Marble	1,473	4	0	0	
Mount Morison Sandstone	554	0	0	0	
Sand dune deposits	7	0	0	0	
Sand dunes	9,035	0	2	0.5	cheatgrass, prickly Russian thistle, saltlover
Siliceous calc-hornfels	480	2	0	0	
Volcanic- warm soil	7.62	100	3.41	0	cheatgrass

Disturbance in Special Habitats (Vegetation)

In 2022 and 2023, a total of 35 acres of disturbance were recorded in special habitat units (Table 12). Impacts to the volcanic- warm soil habitat likely pre-date 2022 but are included here as this area is a new addition to forest special habitat units.

Recorded OHV trespass and unauthorized routes were documented in dry forb habitats on the Mammoth and Mono Lake Ranger Districts. Vehicles drove cross country off established routes and expanded existing pull outs and road widths. Incursions are more widespread than were recorded.

There were no major wildfires in special habitat units in 2022 or 2023. There was a single small fire (0.1 acres) in the Gull Lake roof pendant caused by a campfire. Impacts were limited and minor. No forest species of conservation concern were impacted.

In 2023, an unauthorized airstrip was constructed in the dry forb special habitat unit in Monache Meadows impacting 1.96 acres. This area was plowed and graded, removing vegetation and disturbing the soil. Vegetation in this special habitat unit is extremely fragile due to the poor soils and harsh growing conditions. Natural restoration of this site is unlikely to occur in the foreseeable future. The airstrip was decommissioned and will not be utilized in the future.

Utility infrastructure maintenance and operations has resulted in some short-term effects to volcanic- warm soils special habitat units, in cases where equipment has traveled off system roads to complete maintenance work. These projects incorporate minimization strategies to travel the shortest distance possible, and disguise tracks and spread vegetation after the work is completed.

Wild horses ranging outside of the Montgomery Pass Wild Horse Territory have also had a significant negative impact to vegetation and soils in multiple special habitat units including alkali flats, dry forb, eolian sand sheets, eolian dune field, sand dunes, and sand dune deposits. Severe trampling and heavy grazing are ongoing. Wild horses are also likely spreading seeds from invasive plant populations to new areas and increasing the severity of existing infestations.

While some level of natural and anthropogenic disturbance is ongoing in a variety of special habitats, the forest plan components (TERR-SH-DC-01, 02, 03, and TERR-SH-STD-01) provide rationale for management and restoration that would address these impacts. For example, forest staff review and monitor utility infrastructure maintenance to ensure compliance. These projects also incorporate minimization strategies to travel the shortest distance possible, and disguise tracks and spread vegetation after the work is completed. Removal of horses outside of the Montgomery Pass Wild Horse Management Area is currently undergoing review with a target implementation date of fall 2024. Additionally, OHV and botany staff are collaborating to reduce OHV trespass in special habitat units and to restore impacted areas.

Table 12. Acres of known disturbance in Special Habitat Units across Districts of the Inyo National Forest in 2022 and 2023.

Ranger District	Special Habitat Unit	Total Acres	Impacted Acres	% Impacted	Impacted SCC populations	Type of impact
Mammoth	Dry-Forb:Pumice	533.71	5.58	1.05	7	OHV Incursion
Mono Lake	Dry-Forb:Pumice	9234.62	21.68	0.23	11	OHV Incursion
Mt. Whitney	Dry-Forb:Pumice	52.11	1.96	3.76	0	Unauthorized airstrip
Mammoth	Volcanic-warm soils	7.62	5.18	67.98	0	Invasive species likely related to SCE use
Mammoth	Volcanic-warm soils	7.62	5.88	77.17	0	Unauthorized SCE use
Inyo National Forest	All		35.1		18	

Bighorn Sheep Critical Habitat (AR02)

The Forest did not create a gap in forest cover greater than 10 acres in size in subalpine and alpine ecosystems between 2020 and 2023.

No wildfires occurred in critical habitat in 2022-2023. Wildfires in the subalpine and alpine zone are not far departed from their natural return interval; 57% of this zone within its natural fire return interval. In comparison, 32% of the subalpine/alpine ecological zone are highly departed with wildfires burning too infrequently. Between 2021 and 2022 (note 2023 data were not available), about 133 acres of wildfire burned in the subalpine/alpine zone.

Management in the subalpine and alpine zones is infrequent. Additionally, critical habitat for the species is largely in designated Wilderness and Inventoried Roadless Areas. Therefore, not much management action is expected to occur in critical habitat.

Wildfires managed for objectives other than full suppression are important for bighorn sheep habitat and are important for answering this question. For example, where wildfires provide management opportunities that overlap with bighorn sheep range (wilderness), often strategies will be considered to allow burning in wilderness to improve vegetation forage value, increase escape terrain, and create unforested patches of opening for movement between herd units and dispersal corridors. These opportunities are rare but the forest recognizes the benefits.

Such actions are aligned with California Department of Fish and Wildlife (CDFW) bighorn sheep unit. In December 2023, communications with CDFW lead bighorn sheep researcher indicated, anecdotally, that wildfire footprints in wilderness within the range of Sierra Nevada bighorn sheep are creating areas that provide forage and travel corridors post-fire based on signs from browsing, tracks, and other telemetry data.

Sage grouse Seasonal Habitat (AE03)

The results associated with TE03 (sagebrush condition) indicate that sagebrush experienced overall positive effects of the heavy precipitation associated with the 2022-2023 winter. A key finding from this question is that wildfires in sagebrush habitat greater than a few acres can substantially delay (>50 years) the re-establishment of sagebrush because of the removal of the seed source. This is a critical finding relevant to sage grouse habitat conservation.

About 15 acres of treatment in sagebrush habitat were conducted in 2022 and fewer than <10 acres were accomplished in 2023.

A very slight increase in native herbaceous cover proportion occurred from 2020 to 2023, which can be attributed mostly to the strong positive response of native perennial grasses and annual forbs to large precipitation events of the 2022-2023 winter.

Although native herbaceous cover uncreased, non-native, invasive grass cover also increased in sagebrush habitat. In a sample of 324 ecology plots across the forest, mean non-native, invasive grass cover increased from 2.8 +/- 0.5% in 2020 to 3.2 +/- 0.5% in 2023. The very small increase, though not significant, could be in part attributed to the historic precipitation event of the winter of 2022-2023; field surveys generally indicated higher densities, especially at lower elevations of the Sierra Nevada. Despite these moderate numbers, cheatgrass density is high (>30% cover) in some disturbed areas, particularly on some south-facing slopes in Long Valley, Mono Basin, and the Owens Valley.

Recommended Changes

Special Habitats (AR01)

- Prioritize monitoring in dry forb habitat impacted by off highway vehicles and whitebark pine mortality across all special habitat units.

Visitor Use, Satisfaction, and Progress on Recreation Objectives

The Inyo National Forest is a popular destination, and recreation is what draws the majority of visitors and their associated economic benefits to the area. The Inyo is within a 4-hour drive of nearly half of the 37 million people who live in California. This large pool of potential visitors is one of the most ethnically diverse in the world, challenging the staff of the Inyo to look at nontraditional methods of providing service. Over 2 million users visit the Inyo National Forest yearly, with the majority of visitors coming from southern California and the Bay Area. The Inyo also receives many international visitors.

Effective communication is necessary to ensure that visitors can access the information they need to enjoy the forest responsibly. Long term changes in visitor use patterns and satisfaction metrics can indicate the need for greater access to specific recreational activities or the need to improve the quality of services and opportunities available to the visiting public.

Monitoring Questions

- VU01. What are the trends in visitor use and satisfaction? The indicators associated with this question include visitor use and satisfaction and visitor recreational activity type.
- VU02. To what extent are trails providing access to the activities as intended? The indicators associated with this question include total miles of motorized and nonmotorized roads and trails and percentage of miles maintained.

- VU03. How effective have Forest communications with the public been in considering diverse backgrounds? The indicators associated with this question include Number and types of public outreach activities and visitor demographics.
- VU04. To what extent is designated wilderness being managed to preserve wilderness character? The indicators associated with this question include wilderness performance measures and elements classification.
- PC03. To what degree is the national forest using partnerships to provide additional capacity for visitor services? The indicators associated with this question include the number of agreements with partners that are supporting visitor services and the number of volunteers, partner personnel, hours contributed, and value of contributions by partners that are supporting visitor services.

Key Results

- **Visitor Use and Satisfaction**: Due to the Covid-19 pandemic, the National Visitor Use Monitoring (NVUM) program did not conduct in-person interviews on the Inyo National Forest in 2021. Therefore, data are available only for number of national forest visits.

  The Inyo experienced 2,309,000 visits in 2016 and 2,092,000 visits in 2021. The decrease in visitation is likely partly due to the global pandemic, resultant state travel restrictions, and national forest facility closures. During 2021 the state of California was "strongly discouraging" non-essential travel, including travel that is considered tourism or recreational in nature. Additional reductions in visitation likely resulted from Forest Service Pacific Southwest Region Regional Forester closing all forests in the region for public safety due to wildfires. The next Inyo NF NVUM survey is scheduled for 2026.

- **Access:** The Inyo NF has 1,057 miles of nonmotorized system trails and 457 miles of motorized system trails.

  In 2022, the Inyo National Forest and partners were able to complete 6% more miles of non-motorized trail maintenance than in the past year (Table 13). In total, we completed annual maintenance on 536 miles of non-motorized trails (includes 6 miles of heavy maintenance) and 13 miles of motorized trails. An increase in our work may have been partially due to the absence of extended forest closures and a light winter allowing for a longer working season in the high country. Major projects included Taboose Pass, Little Lakes Valley, and John Muir Trail connectors out of Reds Meadow.

  In 2023, the Inyo National Forest and partners completed annual maintenance on 486 miles of non-motorized trails (includes 7 miles of heavy maintenance) and 7 miles of motorized trails (Table 13).

  - The record snowpack in 2023 limited access and resulted in extensive damage to trail infrastructure from avalanches and heavy spring runoff. For example, destroyed Pacific Crest Trail bridges, both within Inyo National Forest and in Sequoia-Kings Canyon National Park led to detours.
  - Major projects included repair of Lower Rock Creek Trail following significant

damage from spring runoff, building and repair of multiple bridges at McGee Creek, rock work on the Mount Whitney Trail as well as the Pacific Crest Trail near Cottonwood Pass, and clearing of avalanche debris from Bloody Canyon Trail.

- For motorized trails, our partners included Valley Outdoors and Doug Clair Construction.
- The new Inyo National Forest OHV/Over-Snow Vehicle Program Manager hired in 2023 is developing volunteer partnerships to increase the amount of motorized trail miles maintained in 2024.

Table 13. Miles of Trails Maintained

Trail types maintained	2021 miles (percent of total)	2022 miles (percent of total)	2023 miles (percent of total)
Non-motorized	477 (45%)	536 (51%)	486 (46%)
Motorized	No Data	13 (3%)	7 (2%)

- **Communications**
  - **Tribal engagements**: During 2022-2023 the Inyo National Forest continued quarterly forums with tribal governments and tribal organizations to share information about projects and concerns. Tribal engagement also included field trips to visit project areas such as Reds Meadow where wildfire risk reduction treatments are underway. The Inyo National Forest hired a Tribal Relations Program Manager in summer of 2023 to continue to improve communication with tribal governments, including individual leadership meetings with tribes on a government-to-government basis. The Forest staff also worked with local tribes on agreements to modernize the cultural displays at the Mono Basin Visitor Center and to help monitor water quality for Wild and Scenic Rivers.
  - **Youth engagement**: The Inyo National Forest continued the annual partnership with the Eastern Sierra Interpretive Association and Eastside Sports to host the Eastern Sierra Youth Outdoor Program which strives to reach a representative youth population and provide free opportunities to learn outdoor skills. The Forest also engaged annually with families and youth at several local festivals and events, including the Lone Pine Paiute-Shoshone and the Bishop Paiute Tribal Earth Day events.
  - **Overall outreach**: In 2023, public outreach efforts included 54 news releases, four radio interviews with local stations, and more than 300 social media posts on current forest activities.
  - Recently, the Inyo National Forest hired new public affairs and visitor information staff that have been improving and tracking communication and other public information products.
- **Wilderness character**: The national wilderness character monitoring program will measure trends in wilderness character within the Forest Service to provide a coherent understanding of how wilderness character is changing over time. Monitoring occurs on

a five-year cycle. For the Inyo National Forest, wilderness character initial baseline assessments are completed for Owens River Headwaters, Boundary Peak, Ansel Adams, John Muir, and Hoover wildernesses. The first five-year trend assessment for these five wildernesses will begin in 2026. Baseline assessments are in progress, but not yet complete, for White Mountains, Golden Trout, South Sierra, and Inyo Mountains wildernesses. The first five-year trend assessment for these four wildernesses will not begin until 2028.

- **Volunteers and partners** are critical for the successful delivery of visitor services on the Inyo National Forest. Many tasks such as trail maintenance, visitor education, interpretive presentations, campground hosting, archeological site surveys, wilderness campsite restoration, trash and solid waste removal, and sign installation at recreation sites, would not be possible without their support.

  Both 2022 and 2023 saw the successful hiring of a resource assistant who filled the role of volunteer coordinator. The emphasis of this role is partnership development, volunteer recruitment, and accomplishment reporting.

  In 2023, the Inyo National Forest experienced a major decline in the number of volunteers, volunteer hours, and the value of contributed time compared to 2021 and 2022 (Table 13). This decline is likely due to the shortened operating season after a record-setting winter. The massive snowpack pushed back the opening dates of facilities, roads, and trails by a month and reduced the period for volunteer work to only about two months. However, a positive trend is that the forest saw a substantial increase in the number of individual and group volunteer agreements. New volunteer agreements included off-highway vehicle groups who increased their work with the Inyo National Forest after extensive storm damage to roads forced closures.

Table 13. Volunteer and Partner Contributions 2019-2023.

	2019	**2020**	**2021**	**2022**	**2023**
# volunteers & partner personnel	852	228	863	805	255
Volunteer & partner hours	32,778	18,949	85,630	37,700	14,667
Value of contributed time	$833,545	$514,413	$2,443,880	$1,129,115	$466,411
# individual & group volunteer agreements	33	25	37	33	50
# partner agreements	6	6	17	6	10

Recommended Changes

- Continue to improve annual tracking of public outreach communications in 2024/2025.

Climate Change and Other Stressors

Climate change has the potential to drastically alter all ecosystems on the Inyo National Forest, and some measurable changes are already occurring. The Inyo National Forest, along with all National Forests, needs to adapt its management strategies.

Changes in spatial extent, health, and regeneration of high-elevation white pine woodlands are essential indicators of subalpine ecosystem function and integrity. There is uncertainty regarding the degree and extent of negative impacts of climate change and associated stressors (e.g., insect outbreaks) on subalpine ecosystems dominated by white pines.

Landscapes with elevated levels mortality could be targeted for ecological restoration treatments (e.g., prescribed fire or managed wildfire) to improve ecosystem resilience, or focused field-based monitoring of the impact of interactive stressors.

While the impacts of climate change on runoff are generally known at a regional scale, the local effects on the Inyo National Forest are not fully understood. Understanding how runoff will change, both in volume and in timing, may help the Forest adapt its management to changes in water supply, infrastructure impacts, or ecosystem impacts from changing runoff regimes.

Monitoring Questions

- CC01. How are high-elevation white pines responding to the effects of climate change and other stressors? The indicators associated with this question include: (1) spatial extent, by forest type, (2) tree mortality, incidence of insects, disease, and pathogens, and (3) spatial extent of tree regeneration. ***Monitored every third reporting cycle; the next evaluation will be in 2026-2027.***

- CC02. What changes have occurred to the timing, amount, and duration of natural and managed runoff into the national forest's waterways? The indicators associated with this question include annual in-stream flow regime (center of mass runoff and highest mean daily flows) for selected waterways (not those regulated by the Federal Energy Regulatory Commission).

Key Results

Predictions indicate that the total annual runoff from the Sierra Nevada will be low during years of prolonged droughts and punctuated by extremely wet years (high runoff) (Swain et al. 2018). The Inyo National Forest has demonstrated this pattern – there were low levels of annual runoff from 2012 to 2016 during a period of drought, high runoff during 2017 following a peak winter (2016/2017), low runoff again in 2021 and 2022, and high runoff in 2023 following the biggest winter in recorded history in 2022/2023.

Annual runoff for the Eastern Sierra is divided into two basins: the Owens River Basin and the Mono Lake Basin (11). For the thirteen years on record, annual runoff has varied from a low of 148,600 acre-feet to a high of 950,600 acre-feet for the Owens River Basin (12) and a low of 30,400 acre-feet and a high of 268,100 acre-feet for the Mono Lake Basin (13).

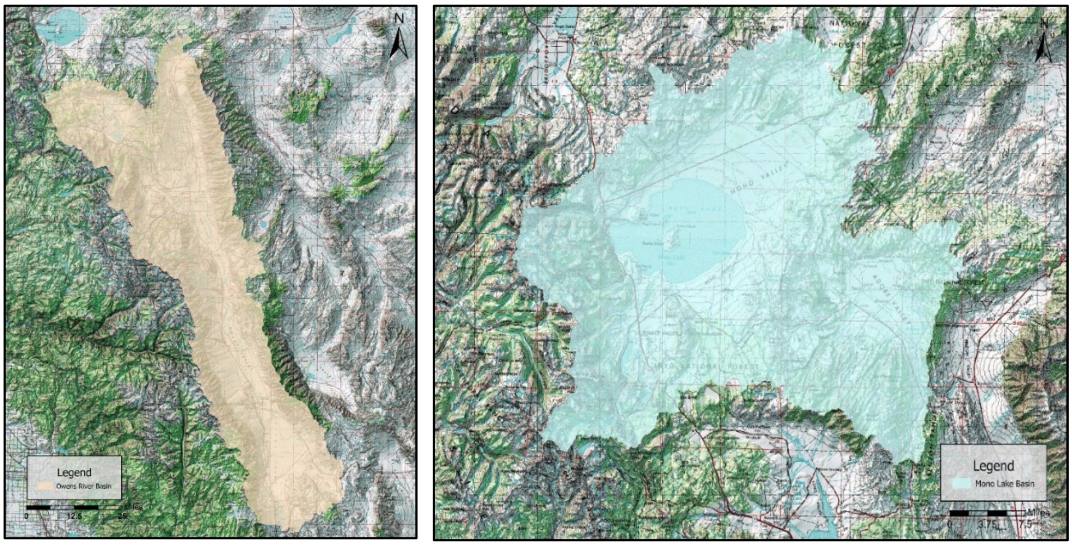


Figure 11. The Owens River Basin (left) and the Mono Lake Basin (right).

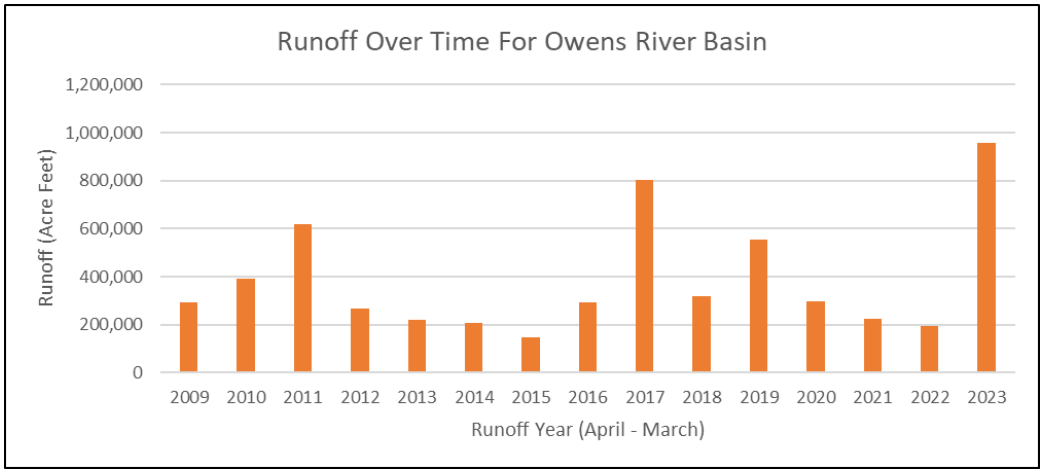


Figure 12. Owens River Basin annual runoff.

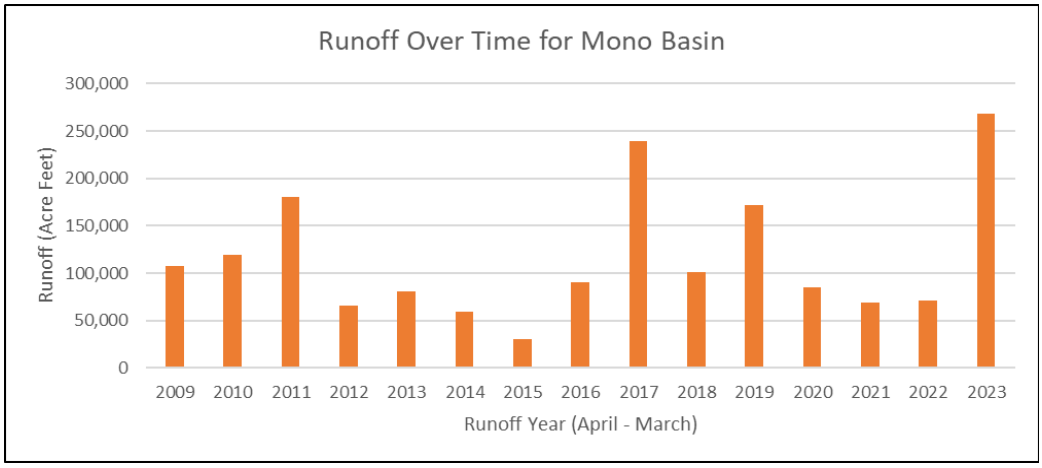


Figure 13. Mono Lake Basin annual runoff.

It is predicted that climate change will impact the timing and duration of instream flows. As the snowpack diminishes with a warming climate and precipitation occurs more in the form of rain versus snow, a shift in the center mass of runoff and highest daily mean should occur. These shifts should start to occur earlier in the water year as the slow release of meltwater from the diminishing snowpack happens sooner due to an increase in atmospheric temperature.

We selected two streams in undisturbed watersheds, Parker Creek (Figure 14) and McGee Creek, to measure the trend in annual in-stream flow coming off the Forest. We found a slight trend toward both the "highest daily mean" and "center mass of runoff" occurring earlier in the season (trendline shifting higher to the left in Figures 15 and 16), meaning that snow is melting earlier, and the streamflow peaks earlier, and recedes earlier. As a result, there is lower flow in late summer.

Snow in the Sierra Nevada is an extremely important water source, especially because it stores water that gradually melts and feeds streams and rivers all summer long. With earlier snowmelt, there is less water available later in the summer when it is needed the most. Our data is based on

two creeks in two watersheds; more data collected during future monitoring (and for more watersheds) will provide a stronger foundation upon which to identify a robust trend.

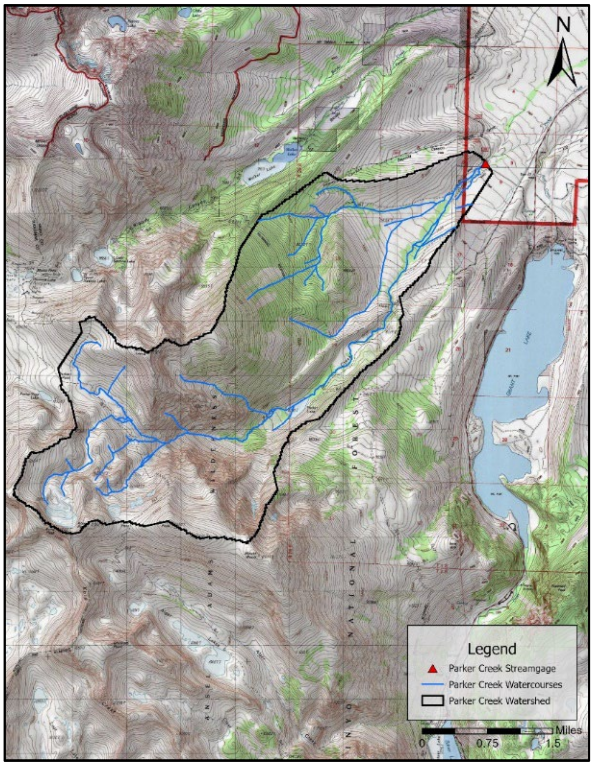


Figure 14. Parker Creek stream gauge site and contributing watershed.

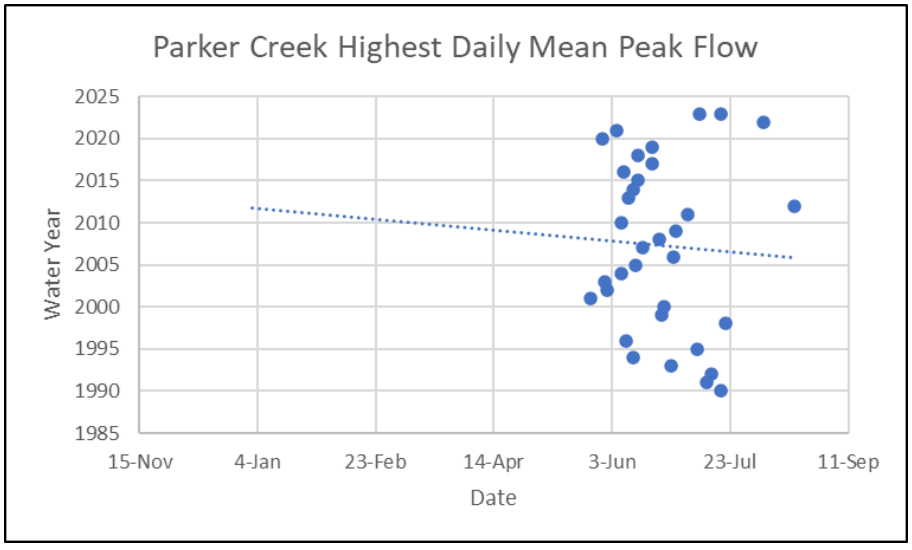


Figure 15. Highest daily mean for the Parker Creek with trendline. Graph represents 30yrs of flow data going back to 1990.

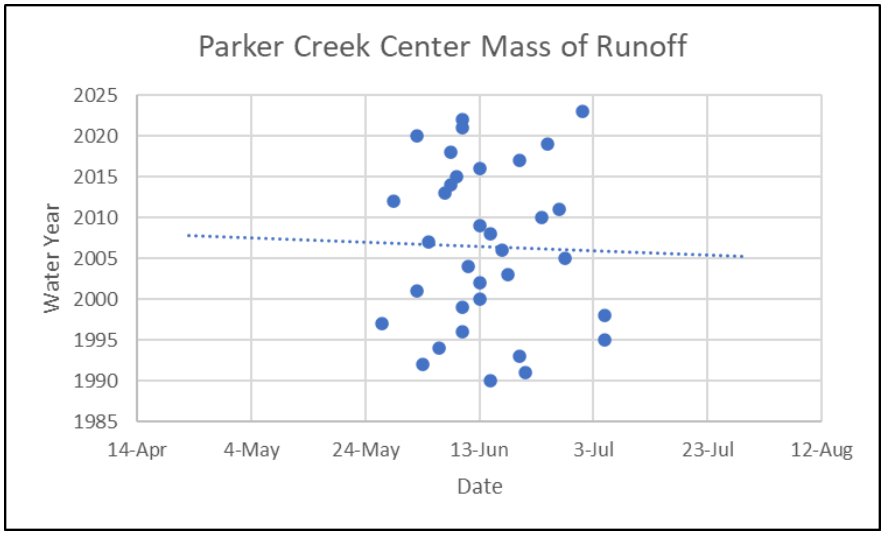


Figure 16. The center mass of runoff for Parker Creek with trendline. Graph represents 30yrs of data going back to 1990.

References

Swain, D.L., Langenbrunner, B., Neelin, J.D. and A. Hall. 2018. Increasing precipitation volatility in twenty-first-century California. Nature Clim Change 8,427–433.https://www.nature.com/articles/s41558-018-0140-y#citeas

Recommended Changes

- Gather data from LADWP for more watersheds, and for more years, to help evaluate the trend in in-stream flows.

Fire Conditions

Wildland fire is a necessary ecological process, integral to the sustainability of fire-adapted ecosystems. The wildland fire regime has been altered in many terrestrial and riparian ecosystems by decades of fire suppression. For example, some forest ecosystems (e.g., eastside Jeffrey pine) are burning too infrequently and severely compared to the natural range of variation (NRV), resulting in the loss of forest ecosystem resilience and health. The Inyo Land Management Plan is interested in moving the landscape towards the NRV for fire regimes and testing whether management actions contribute to this trend.

Monitoring Questions

- CC03. How are fire regimes changing compared to the desired conditions and the natural range of variation? Indicators associated with this monitoring question include: (1) fire return interval departure, (2) number and acres of fire by ecological zone, and (3) fire severity by ecological zone.
- PC02. What management actions are contributing to the achievement of desired conditions relating to fire regimes? Indicators associated with this monitoring question include: (1) acres of fires managed for resource objectives by ecosystem type, (2) acres of fire by objective within each fire management zone, (3) acres of prescribed fire including pile burning, and (4) acres of mechanical and hand treatment.

Key Results[2]

Wildfire Regimes (CC03)

There has been very little change in the fire return interval departure (FRID) condition classes between the 2020 and 2022 reporting cycle due to the relatively low amount of fire activity 2021-2022. Consistent with regional patterns observed by Safford and Van de Water (2014), fire return interval departure patterns on the Inyo National Forest in 2022 indicate widespread fire exclusion and moderate to high levels of fire return interval departure. Data were not available for 2023.

- The Sierra Nevada montane zone is especially departed; 78% of this landscape is classified as moderately to highly departed from the lack of natural fires (Table 14).
- The subalpine and alpine and arid shrublands and woodlands zones are less departed than the montane zone. About 53% of arid shrublands and woodlands and 43% of the subalpine and alpine landscapes are burning too infrequently. The subalpine and alpine zone is the least departed with about 57% of this zone within its natural fire return interval.
- Across all three zones, very few areas (1% of the Inyo National Forest) are currently burning too frequently compared to historical fire regimes (Figure 17). However, with projected increases in fire frequency and seasonality associated with climate change (Chambers et al. 2017, Safford and Stevens 2017, Meyer and North 2019), future monitoring will be needed to evaluate whether these areas increase in size over time resulting in an upward trend in vegetated landscapes burning too often.

[2] Data for this analysis uses 2021 and 2022 data because 2023 data were not available for this monitoring report and 2021 data were not available for the last report.

Table14. Fire Return Interval Departure (FRID) condition classes (CC) by ecological zone on the Inyo National Forest (2022 data). The 'too frequent' category includes both moderately and highly departed fire return interval departure categories (i.e., CC -2 and -3). The 'too infrequent' categories include vegetation types within each ecological zone where the current fire regimes are burning much less frequently than the historical fire regimes.

Ecological Zone and FRID Condition Class	Acres in Zone	Percent of Zone (2022)	Percent of Zone (2020)
Arid Shrublands and Woodlands:			
Too frequent (CC -2, -3)	11,420	1	1
Not departed (CC 1, -1)	469,162	46	46
Too infrequent, moderate departure (CC 2)	111,602	11	11
Too infrequent, highly departed (CC 3)	423,581	42	42
Sierra Nevada Montane:			
Too frequent (CC -2, -3)	4819	2	2
Not departed (CC 1, -1)	62,052	20	20
Too infrequent, moderate departure (CC 2)	45,847	15	14
Too infrequent, highly departed (CC 3)	195,139	63	64
Subalpine and Alpine:			
Too frequent (CC -2, -3)	1,745	1	1
Not departed (CC 1, -1)	127,748	57	57
Too infrequent, moderate departure (CC 2)	24,066	11	11
Too infrequent, highly departed (CC 3)	72,377	32	32

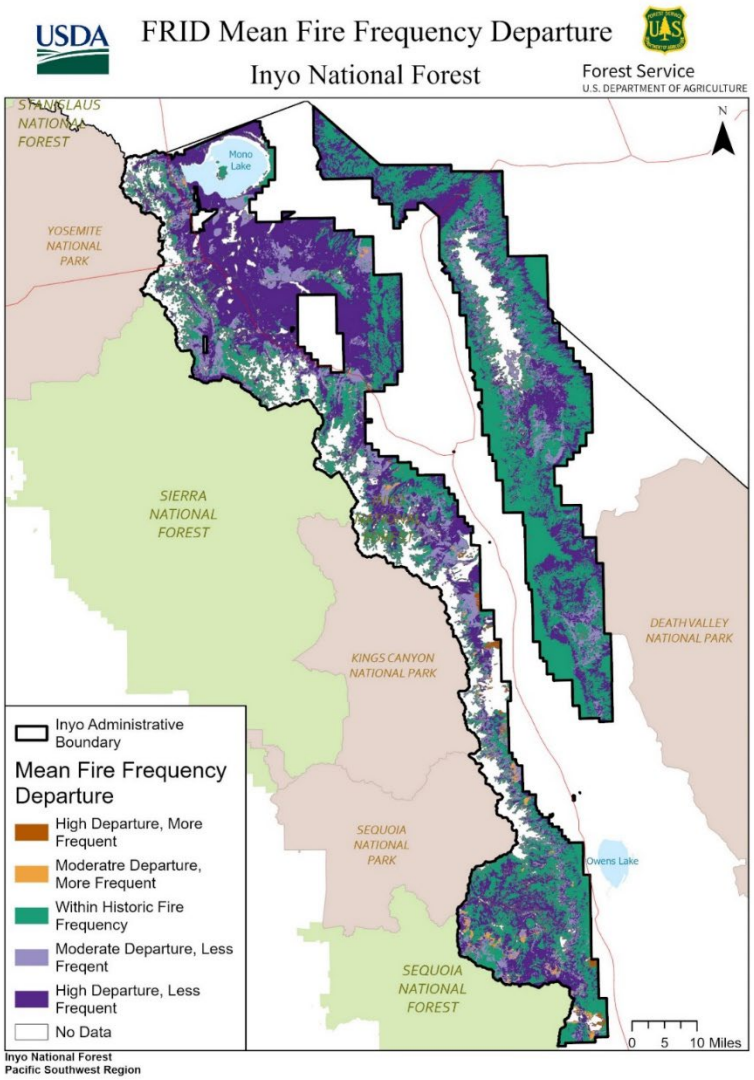


Figure 17. Fire Regime Interval Departure (FRID) condition classes for the Inyo National Forest in 2022 (includes 2022 fire season). Warmer colors indicate vegetation types where the current fire regimes are burning much less frequently than the historical fire regimes.

Overall, there were 5.7 times more acres burned per year in 2017 to 2020 compared to 2021 to 2022, owing to the highly active fire season of 2020 and minimal fire activity in 2022 in California. The greatest number and acres of wildfires during 2021 and 2022 occurred in the Sierra Nevada montane zone (68% based on acres), followed by the arid shrublands and woodlands zone (28% based on acres) (Table 15). Only 4 percent of the burned area occurred in the subalpine and alpine zone.

One hundred percent of the area burned in wildfires on the Inyo National Forest between 2021 and 2022 was managed with a full suppression strategy. The largest wildfire that burned on the Inyo National Forest in 2021-2022 was the 2021 Dexter Fire, which burned approximately

3,000 acres in the montane zone of the Glass Mountains.

Arid shrublands and woodlands may especially benefit from the use of full suppression strategies, since this zone is less departed from their historical fire frequency and ecosystem types in this zone (e.g., sagebrush steppe, pinyon-juniper woodlands) may be negatively impacted by large wildfires that result in increased spread of nonnative invasive grasses, habitat fragmentation, and poor post-fire recruitment rates of native woody vegetation (Chambers et al. 2017).

Unlike in 2020 and 2021, nearly all the acres burned in 2023 were managed for objectives other than full suppression (see PC02 below). Although the 2023 fire season had relatively few acres burned by wildfires, especially by large fires, the Inyo National Forest experienced the ~320 acre Cowtrack Fire that was managed for objectives other than full suppression including resource objectives. Based on field observations, the fire effects were mostly low severity and likely benefited the Jeffrey pine forests that burned.

Table 15. Total number and acreage of wildfires by ecological zone on the Inyo National Forest (2021-2022). Wildfires are classified as managed under a full suppression strategy or multiple objective (e.g., suppression, resource objectives) strategy. Wildfires <10 acres in size are not included.

Fire Management Strategy and Ecological Zone	Number of Wildfires	Total Burned Area (acres)
Full Suppression:		
Arid shrublands and woodlands	5	1,038
Sierra Nevada montane	3	2,546
Subalpine and alpine	4	133
Other (not evaluated)	0	0
Total number of full suppression fires	5	3,717
Multiple Objective:		
Arid shrublands and woodlands	0	0
Sierra Nevada montane	0	0
Subalpine and alpine	0	0
Total number of multiple objective fires	0	0

Fire severity patterns in 2021-2022 in the Sierra Nevada montane zone were consistent with recent regional patterns and patterns from the previous reporting period (2017-2020), showing severe fire effects outside the Natural Range of Variation (NRV), particularly in the yellow pine and mixed conifer forest types (Safford and Stevens 2017).

Nearly half (46%) of the montane zone burned at high severity in 2021 and 2022, which is much higher than NRV and desired conditions in the Inyo Forest Plan (both generally below 15% high severity) (Figure 18).

Nearly half (48%) of the 2021 Dexter Fire (shown in Figure 19) burned at high severity, and 57% of these stand-replacing patches were greater than 250 acres in size, which is outside NRV and desired conditions in the Inyo Forest Plan (most patches should be less than 10 acres and all patches should be less than 100 to 200 acres). The maximum high severity patch size in the

2021 Dexter Fire was approximately 683 acres. These severe fire effects often result in the loss of forest resilience due to the failure of conifers to naturally regenerate, increased carbon emissions and reduced carbon carrying capacity, and the loss of habitat connectivity for forest-dependent species.

In contrast, past fire severity patterns in wildfires managed for multiple objectives (e.g., 2019 Springs Fire, 2017 Lions Fire) were mostly consistent with Inyo Forest Plan desired conditions and NRV, like other multiple objective wildfires observed in the Southern Sierra ecoregion (Meyer 2015).

Future fire severity monitoring and research will help address this question and elucidate fire severity trends and potential long-term impacts to forest ecosystems resulting from full suppression and multiple objective wildfires on the Inyo National Forest.

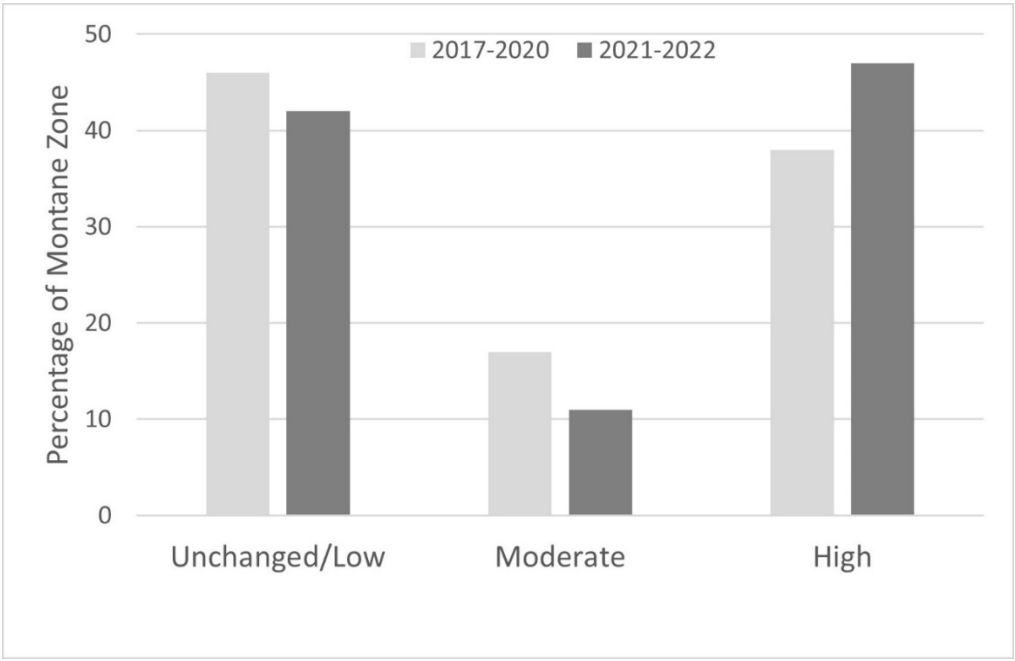


Figure 18. Percentage of the montane zone that burned at different fire severities in 2017 to 2020 and 2021 to 2022, Inyo National Forest. Fire severity data is based on RAVG basal area mortality categories: unchanged (0% basal area mortality), low (1-25% mortality), moderate (25-75% mortality), and high (>75% mortality).

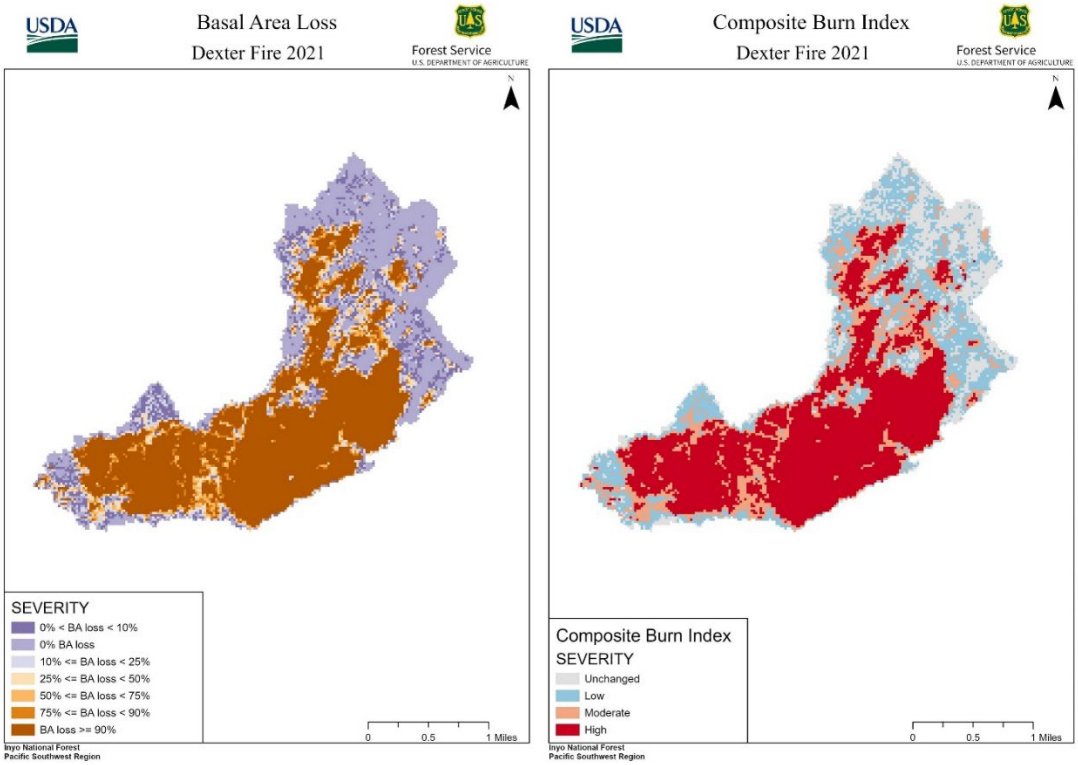


Figure 19. Fire severity patterns derived from percent basal area loss (left panel) and composite burn index (right panel) in the 2021 Dexter Fire on the Inyo National Forest (based on RAVG data).

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Management Actions (PC02)

Wildfire acres: 334 acres from 2022-2023 on the Inyo National Forest. The very wet spring during 2022 resulted in increased fuel moistures and low rates of fire spread. During 2023, the forest received a record amount of snow fall resulting in a second year of high fuels moistures at all elevations and minimal fire behavior.

- 11 acres (3%) under a full suppression strategy in the Community Wildfire Protection (1 acre), General Wildfire Protection (2 acres), Wildfire Restoration (5 acres), and Wildfire Maintenance Zones (3 acres).
- 323 acres (97%) under a strategy other than full suppression in the General Wildfire Protection Zone.

Table 16. Acres of wildfire implemented from 2015 through 2023, by fire management zone.

	Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total Acres
Acres of Wildland Fire by Strategic Fire Management Zone	Community Wildfire Protection	132	1182	2	22	12	1	134	1	0	1486
	General Wildfire Protection	2633	4233	62	1731	4987	4482	2093	1	1	20223
	Wildfire Restoration	2114	2889	272	1052	10509	3022	1324	3	2	21186
	Wildfire Maintenance	1003	151	2444	1700	2372	9875	12	0	3	17560
	Grand Total of Acres Per Year	5882	8456	2779	4504	17880	17380	3563	5	6	60456
Acres by Management Strategy per Year	Full Suppression	5882	8456	2779	4504	9390	17380	3563	5	6	60456
	Managed for Objectives other than Full Suppression	0	0	0	0	8490	0	0	0	323	8813

Prescribed fire: 2,749 acres of prescribed fire from 2022-2023 on the Inyo National Forest. All acres burned in 2022 were from pile burning. An increase in acres burned during this monitoring period, and especially in 2023, was due to favorable weather windows, new fuels staff, and with increased funding to acquire assistance from outside resources.

- 986 acres in the Community Wildfire Protection Zone,
- 495 acres in the General Wildfire Protection Zone,
- 1251 acres in the Wildfire Restoration Zone, and
- 17 acres in the Wildfire Maintenance Zone.

Table 17. Acres of prescribed fire implemented from 2015 through 2023, by fire management zone.

	Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total Acres
Acres of **Prescribed Fire** by Strategic Fire Management Zone	Community Wildfire Protection	0	0	1	36	184	0	0	350	636	1207
	General Wildfire Protection	0	0	81	148	42	1	0	70	425	767
	Wildfire Restoration	0	0	174	867	1149	361	0	5	1246	3802
	Wildfire Maintenance	215	0	0	262	116	0	0	17	0	610
	Grand Total of Acres Per Year	215	0	257	1313	1490	362	0	442	2307	**6386**

Fuels Reductions: 2817 acres of fuel reductions (thinning) from 2022-2023 on the Inyo National Forest. The acres thinned 2022 were mainly funded through service contracts, timber sales, and grant funding. The acres completed 2023 were funded through timber sale and grant funding. In both 2022 and 2023 new timber staff were hired into previously vacant positions. This combined with new partnerships allowed for an increase in implantation and out year planning.

- 923 acres in the Community Wildfire Protection Zone,
- 602 acres in the General Wildfire Protection Zone,
- 1292 acres in the Wildfire Protection Zone.

Table 18. Acres of fuels reduction implemented from 2015 through 2023, by fire management zone.

	Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total Acres
Acres of **Fuels Reduction** by Strategic Fire Management Zone	Community Wildfire Protection	1654	232	403	1008	1722	1474	745	787	1122	9147
	General Wildfire Protection	651	392	440	242	1111	423	410	367	730	4766
	Wildfire Restoration	344	366	338	884	8293	480	164	51	2815	13735
	Wildfire Maintenance	215	1	13	371	1965	12	147	17	0	2741
	Grand Total of Acres Per Year	2864	991	1194	2505	13091	2389	1466	1222	4667	**30389**

Recommended Changes

- Evaluate changes in fire return interval departure (CC02) every four years rather than every two years. This extended evaluation period will help with the timing of the data refresh and provide a more robust evaluation of changes in wildfire trends.
- Consider opportunities to manage wildfires for objectives other than full suppression, including resource objectives, in the montane zone when safe and effective. Wildfires that burn in the montane zone during years of higher snowpack and precipitation may be especially suitable for producing fire severity patterns within NRV and desired conditions. Prescribed fire can also be highly effective at restoring natural fire regimes and reducing elevated fuels to montane forest landscapes on the Inyo National Forest.
- Full suppression actions are recommended for wildfires that burn in the arid shrublands and woodlands ecological zone and when conditions are unsafe or unlikely to meet Inyo Forest Plan objectives, often resulting in undesirable and negative long-term impacts to terrestrial ecosystems, wildlife habitat, communities, and other high valued resources and assets.

Social and Economic Sustainability

Forests provide economic contributions to communities through activities such as forest products, recreation visitation, grazing and mining as well as through the employment of forest service staff. Monitoring changes in these contributions can provide insight as to how forest management may be supporting economic and social conditions in these communities.

The Inyo National Forest spans two states (California and Nevada) and four counties that have differing economic foundations. Understanding the conditions and trends of the diverse communities affected by forest management provides insight into community resilience to changes in management activities. Specifically, communities facing challenging economic conditions and communities more dependent on forest activities for local fiscal resources, are potentially more susceptible to changes in forest management.

Monitoring Question

- PC01. What are the economic conditions in local communities and what are the economic contributions of forest-based uses such as recreation, forest products, mining and grazing, and ecological services, to the local community? Indicators associated with this monitoring question include: (1) local economic conditions and (2) forest contributions. Monitored every third reporting cycle; the next evaluation will be in 2026-2027.