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Inyo National Forest Monitoring Guide Version 1.0

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Introduction

A forest plan monitoring program (PMP) is included in a forest plan as a requirement of the 2012 Planning Rule (FSH 12.31). Monitoring information enables the Responsible Official to determine if a change in plan components or other plan content that guide management of resources in the plan area may be needed (36 CFR 219.12).

Monitoring conducted on a forest should be dependent upon funding, personnel, and other considerations. Monitoring results are made available to the public in a written biennial monitoring evaluation report (BMER). These evaluations synthesize new information gathered through the PMP and relevant information from the broad-scale monitoring strategy to support specific questions established in the monitoring program. The monitoring evaluation report may be postponed for one year in case of exigencies but notice of the postponement must be provided to the public prior to the date the report is due for that year (§ 219.16(c)(6)). Some questions may not be evaluated biennially because of resource constraints, frequency of data collection, or availability of updated datasets. Monitoring may be performed by the Forest Service, other agencies, partners, or other interested parties (FSH 1909.12.31.2).

This document is a supplemental monitoring guide intended to provide a framework for implementing the Plan Monitoring Program (PMP). Refer to Chapter 4 of the 2019 Inyo National Forest LMP for the PMP (https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd664404.pdf).

Organization of the Guide

Each monitoring question and associated indicator(s) in the PMP are supported by a rationale statement explaining why it was selected (e.g., plan component) along with the process for collecting, analyzing, and reporting results in a BMER.

Monitoring Question:

Monitoring questions and associated indicators were developed during Forest Plan revision to inform management of resources in the plan area by testing relevant assumptions, tracking relevant changes, and measuring management effectiveness, and progress toward achieving or maintaining the plan's desired conditions or objectives (FSH 1902.31).

The guide is organized into sections based on fulfilling requirements set forth in the 2012 Planning Rule on 8 required topics: (i) Watershed Conditions, (ii) Terrestrial Ecosystems and Aquatic Ecosystems, (iii) Focal Species, (iv) Ecological Conditions for At-risk Species, (v) Visitor Use, Visitor Satisfaction, Progress toward Meeting Recreation Objectives, (vi) Climate change and other stressors, (vii) Progress toward meeting the desired conditions, objectives, or other plan components, and (viii) productivity of the land. Each of the 8 items shall include one or more monitoring questions(s) and associated indicators (s) set out in the Planning Rule at 36 CFR 219.12(a)(5)(i) through (vii). The process for evaluating indicators, methods, and reporting is described below.

WHY is this question being evaluated?

Monitoring is focused on priority management questions to track status or trend toward achieving selected desired conditions, objectives, standards, guidelines, or other plan components identified in the forest plan. Each question includes at least one plan component being evaluated in the PMP.

WHAT is the problem or uncertainty?

State the problem or uncertainty the question is trying to answer or track progress (e.g., management assumptions, information gaps, effects to ecosystems from specific forest management activities, disturbance from climate change or other stressors in the planning area, level of visitor satisfaction with forest infrastructure).

WHAT data will be collected?

Indicators and Units of Measure: Quantitative or qualitative indicators used to measure or describe trends in conditions associated to monitoring questions. The PMP includes at least one indicator for each monitoring question.

Method/Protocol: Methods used to address monitoring questions. List the methods that will be used for each indicator (i.e., Indicator 1, Indicator 2) to inform a monitoring question. Where appropriate, National Forest Service inventory and monitoring tools and reference materials (i.e., general technical reports, manuals and handbooks, corporate databases and protocols) should be used to provide consistency across the agency. Methods may also include external inventory and monitoring, research programs or monitoring efforts with partners or other efforts where data sets may be available to help determine how monitoring should be conducted to answer relevant monitoring questions (FSH 1909.32.1). Otherwise, the Responsible Official has the discretion to determine the methodology and level of precision needed to achieve credible monitoring information, ranging from statistically tested methods to documented observation and professional judgment.

Sampling design: Describe how data will be obtained (e.g., corporate databases, external reports), the scale data will be collected (e.g., project, watershed, forest wide), the frequency of data collection, and the sampling locations. Provide the relevant basis for measuring indicators, when available. List how each indicator (e.g., Indicator 1, Indicator 2) will be sampled.

Data storage: Location where data are found and stored (e.g., corporate or external databases, share point sites, Pinyon folders). Data should be entered in corporate datasets to the extent possible and results should be provided to the Regional Office to inform the broader-scale monitoring strategy.

WHEN will data be collected, evaluated, and reported?

Data collection schedule: Frequency of data collection or when corporate or other agency databases are refreshed.

Monitoring duration: State whether the monitoring duration is ongoing or the date when monitoring will end.

Reporting schedule: How often results will be available and incorporated into a BMER. Not every monitoring question can or will be included in each report. Some will be included less frequently, based on existing data collection or analysis schedules. Explain the rationale in the BMER when results for a monitoring question are unavailable.

HOW will data be evaluated for each associated indicator?

Evaluation protocol: Evaluate data using logical and analytical reasoning to thoughtfully consider how the results inform the monitoring question. Results may indicate conditions are the same since previously monitored, insufficient results to determine progress toward meeting desired conditions, possible alerts for further consideration, or a question or uncertainty has been sufficiently resolved and can be removed from the forest monitoring plan.

1. Interpret the results in the context of the monitoring question and the PMP
2. Describe general status and trends
3. Identify management activities that have positively or negatively influenced the results
4. Write a very brief narrative summary of the results
5. Describe new BASI provided by a regional synthesis, if relevant to the results and available
6. Evaluate results in other plan components that are related or linked, to the monitoring question and associated indictors (e.g., desired conditions, objectives, goals, standards, guidelines)
7. State whether the results trigger a need for further action
8. Identify trends/results that indicate a monitoring question has been resolved and the forest plan and PMP can be modified

Monitoring report: Provide visuals, if needed, to show results (e.g., graph, chart, table, maps).

Other monitoring data: Additional monitoring information may be used to supplement monitoring results (e.g., broader-scale monitoring, new models or datasets, or project level monitoring relevant to a monitoring question). Optional supplemental monitoring results should be put in an appendix.

HOW will results be applied to management?

Compare monitoring results to desired conditions to determine if the results are helping to answer the problem or uncertainty asked by each monitoring question in the PMP.

Alerts: Early warning signal based on the monitoring results that find a condition that is trending away from desired condition, does not meet desired condition, or is uncertain.

1. Alert may be a benchmark, trigger, threshold or trend
2. Identify and describe the alert that has been reached
3. Describe the PMP component associated with the alert

<u>Adaptive management</u>

When the forest is not meeting or moving toward desired conditions in the PMP, monitoring results should inform if adaptive management is needed.

1. Propose recommendations to address issues raised from alerts
2. Recommend implementable actions (e.g., treatments, mitigation, change in forest management, changes to the PMP or forest plan, more detailed analysis, or research needed)
3. Questions sufficiently addressed from monitoring results may be recommended for removal from the PMP

Literature cited: Provide the reference for manuals, publications, national protocols, and other data sources used to answer the monitoring question.

WHO developed the monitoring guide, and who is responsible for collecting the data, evaluating and reporting the results?

People involved in developing the process of evaluating a monitoring question and the roles an individual may have in monitoring and evaluation. Partners or other agencies involved in the process are identified as well.

Monitoring guide plan components, monitoring questions and indicators

Table 1. Summary of the monitoring questions and associated indicators for evaluating plan components as identified in Chapter 4 tables 18-26 of the 2019 Land Management Plan (LMP) for the Inyo National Forest.

(i) What extent are watersheds in proper functioning condition being maintained, and watersheds in altered or impaired condition being improved?			
Code	**Plan Component**	**Monitoring Question**	**Indicators**
WS01	WTR-FW-DC-03	To what extent are watersheds in proper functioning condition being maintained, and watersheds in altered or impaired condition being improved?	Watershed Condition Framework Classification
WS02	WTR-FW-DC-05	To what extent has erosion from temporary and permanent roads and trails affected water quality and soil sustainability in the national forest?	Road and motorized trail condition; Implementation and effectiveness monitoring results from the Best Management Practice Evaluation Program; Number and type of stream crossing and bank stabilization projects

(ii) The status of select ecological conditions including key characteristics of terrestrial and aquatic ecosystems			
Code	**Plan Component**	**Monitoring Question**	**Associated Indicators**
TE01	TERR-OLD-DC-03	What is the status and trend of large trees in the Sierra Nevada montane forest?	Proportion of area with large trees; Number of large trees, snags, large downed logs per acre by forest type
TE02	TERR-PINY-DC-01	What is the status of pinyon-juniper woodlands?	Pinyon-juniper spatial extent; Number, type, and extent of disturbance events in pinyon-juniper woodlands (such as wildfire, disease, drought)
TE03	TERR-SAGE-DC-01	What is the condition of sagebrush communities?	Proportions of seral classes, sagebrush cover; Acres of treatment to improve age

			class distribution; Acres of wildland fire; Percent native understory vegetation
AE01	RCA-MEAD-DC-05	What is the vegetative condition of selected grazed and ungrazed meadows?	Rangeland ecological condition; Species richness, species diversity, and plant functional groups; Range greenline monitoring; Vegetation community types
AE02	MA-RCA-DC-05	To what extent are riparian areas functioning properly across different management areas and levels of disturbance?	Vegetation cover, structure, and composition; Floodplain and channel physical characteristics
AE03	WTR-FW-DC-02	What is the status of water quality in national forest waterbodies?	Indicator bacteria levels; 303(d) status

(iii) The status of focal species to assess the ecological conditions required under the Code of Federal Regulations, specifically 36 CFR 219.9

Code	Plan Component	Monitoring Question	Associated Indicators
FS01	TERR-SAGE-DC-02, SPEC-SG-DC-06	How is the abundance of Cheatgrass and red brome (nonnative Bromus spp.) changing?	Spatial extent and percent cover of Cheatgrass and red brome
FS02	WTR-FW-DC-02	How are aquatic benthic macroinvertebrate communities indicating stream ecosystem integrity is being maintained in high quality waters or improved in degraded waters?	Benthic macroinvertebrate diversity, species composition, and related metrics

(iv) The status of a select set of ecological conditions required under 36 CFR 219.9 to contribute to the recovery of federally listed threatened and endangered species, conserve proposed and candidate species, and maintain a viable population of each species of conservation concern.

Code	Plan Component	Monitoring Question	Associated Indicators
AR01	TERR-SH-DC-01	To what extent is the integrity of special habitats for at-risk plants and animals being maintained or improved?	Special habitat extent (acres) and health (e.g., species composition); Number, type, and extent of disturbance events (e.g., adverse effects from authorized or unauthorized use)
AR02	SPEC-SH-DC-01	What is the quality of bighorn sheep winter range?	Acres of vegetation management in the winter range for bighorn sheep; Tree cover in winter bighorn sheep range.

AR03	SPEC-SG-DC-01	How is the condition of seasonal sage-grouse habitats and connectivity changing?	Sagebrush stand condition from monitoring plots (e.g., cover, species composition); Acres of treatment (e.g., conifer removal, meadow restoration, invasive removal)

(v) The status of visitor use, visitor satisfaction, and progress toward meeting recreation objectives.

Code	Selected Plan Component	Monitoring Question	Associated Indicators
VU01	REC-FW-DC-03	What are the trends in visitor use and satisfaction?	Visitor use and satisfaction (National Visitor Use Monitoring survey); Visitor recreational activity type
VU02	REC-FW-DC-11	To what extent are trails providing access to the activities as intended?	Total miles of motorized and nonmotorized roads and trails; Percentage of miles maintained
VU03	VIPS-FW-DC-04	How effective have Forest communications with the public been in considering diverse backgrounds?	Number and types of public outreach activities; Visitor demographics (National Visitor Use Monitoring survey)
VU04	DA-WILD-DC-01	To what extent is designated wilderness being managed to preserve wilderness character?	Wilderness performance measures and elements classification

(vi) Measurable changes on the plan area related to climate change and other stressors that may be affecting the plan area.

Code	Selected Plan Component	Monitoring Question	Associated Indicators
CC01	TERR-ALPN-DC-03	How are high-elevation white pines responding to the effects of climate change and other stressors?	Spatial extent, by forest type; Tree mortality, incidence of insects, disease, and pathogens; spatial extent of tree regeneration
CC02	WTR-FW-DC-01	What changes have occurred to the timing, amount, and duration of natural and managed runoff into the national forest's waterways?	Annual in-stream flow regime for selected waterways (not those regulated by the Federal Energy Regulatory Commission)

CC03	FIRE-FW-DC-01	How are fire regimes changing compared to the desired conditions and the natural range of variation?	Fire return interval departure; Number and acres of fire by ecosystem type; Fire severity by ecosystem type

(vii) Progress toward meeting the desired conditions and objectives in the plan, including for providing multiple use opportunities

Code	Selected Plan Component	Monitoring Question	Associated Indicators
PC01	LOC-FW-DC-03	What are the economic conditions in local communities that could affect the impact of national forest contributions to local economies?	Economic health; Economic diversity; Local fiscal conditions
PC02	LOC-FW-DC-03	What economic contributions are national forest-based recreation, forest products, mining and grazing making to local communities?	Conditions in forest-based sectors; Forest contributions
PC03	FIRE-FW-GOAL-01	What management actions are contributing to the achievement of desired conditions relating to fire regimes?	Acres of fires managed for resource objectives by ecosystem type; Acres of fire by objective within each fire management zone; Acres of prescribed fire; Acres of mechanical treatment
PC04	VIPS-FW-DC-01	To what degree is the national forest using partnerships to provide additional capacity for visitor services?	Number of agreements with partners, by activity type, that are supporting visitor services; Number and type of projects completed with partners

(viii) The effects of each management system to determine that they do not substantially and permanently impair the productivity of the land

Code	Selected Plan Component	Monitoring Question	Associated Indicators
PR01	WTR-FW-DC-04	How does soil disturbance differ from pre- and post-activity for timber management?	Soil compaction, displacement, and erosion

Watershed Conditions (i)

WS01: To what extent are watersheds in proper functioning condition being maintained, and watersheds in altered or impaired condition being improved?

WHY is this question being evaluated?

Desired condition:

WTR-FW-DC -03: Watersheds are fully functioning or trending toward fully functioning and resilient; recover from natural and human disturbances at a rate appropriate with the capability of the site; and have a high degree of hydrologic connectivity laterally across the floodplain and valley bottom and vertically between surface and subsurface flows. Physical (geomorphic, hydrologic) connectivity and associated surface processes (such as runoff, flooding, in-stream flow regime, erosion, and sedimentation) are maintained and restored. Watersheds provide important ecosystem services such as high-quality water, recharge of streams and shallow groundwater, and maintenance of riparian communities. Watersheds sustain long-term soil productivity.

WTR-FW-OBJ-01: Priority watersheds achieve or are moving toward a higher functioning condition class, as defined by the National Watershed Condition Framework within 10 years of plan approval.

WHAT is the problem or uncertainty?

This question was designed to address the uncertainty to what degree management activities performed or permitted by the forest, or activities that visitors engage in, affect trends in watershed condition overtime.

WHAT data will be collected?

The 2011 Watershed Condition Classification Technical Guide (WCCTG) will be used to track watershed functional condition. The WCCTG provides the framework to systematically track and report watershed conditions for performance accountability. In the framework, Indicators and their attributes are evaluated as surrogate variables that represent the underlying ecological functions and processes that affect soil and hydrologic function.

Indicators and Units of Measure:

The Watershed Condition Classification (WCC) system is outlined in the WCCTG (FS-978, 2011). It evaluates 12 indicators related to watershed processes.

Method/Protocol: A Forest ID team will use the protocols in the WCCTG. The protocol mainly uses professional judgment relying on existing information, maps, and GIS coverage. The result is a rapid, coarse filter office assessment, based on existing data that may have been collected in the field over the past five years. The protocol is a qualitative assessment conducted every 5 years on all watersheds that overlap the Forest and can be done more frequently on specific watersheds if they have a major change that warrants re-analysis. The ID team completes a score card on a 6th-level HUC watershed based on a core set of 12 national watershed indicators outlined in the WCCTG (Table, p.7). Each watershed will receive one of the following aggregate ratings:

1. Class 1 = Functioning Properly (Good)
2. Class 2 = Functioning at Risk (Fair)
3. Class 3 = Impaired Function (Poor)

Data are recorded in the Watershed Classification and Assessment Tracking Tool (WCATT) , a web-based application developed by the natural resource manager program staff.

For a detailed description of the methods of the WCC, refer to the WCCTG.

Sampling Design: All watersheds with a majority of the area overlapping the Forest will be evaluated every 5-years to update watershed condition classifications and track any changes. Some individual watersheds may be evaluated outside of that 5-year recurrence if there is a major change that warrants re-evaluation, focusing on the following:

i. Priority watersheds where improvement activities have been implemented
ii. Watersheds that have experienced large fires since the previous year
iii. Watersheds that have experienced extensive natural disturbance

Data storage: Data are stored in the national database as outlined in the WCATT manual.

WHEN will data be collected, evaluated, and reported?

Data collection schedule: Every 5 years or as needed if watershed conditions change
Monitoring duration: Ongoing
Reporting schedule: Biennial report

HOW will data be evaluated for each indicator?

Evaluation protocol: Evaluate all HUC 6 watersheds on the Forest every 5 years. Evaluate individual watersheds more frequently if there is a substantial change in conditions and the forest prioritizes an evaluation.

Monitoring report: The Forest will complete the classification process using the WCATT, a Web-based application, developed by the natural resource manager program staff. The WCATT will be queried for reporting results to include in the monitoring report. Results will also be shown as trend over time, over the current and past WCATT evaluations.

HOW will results be applied to management?

The desired condition is that all watersheds are in or trending toward Proper Functioning Condition, with an emphasis on priority watersheds. If some watersheds are not trending toward proper functioning condition, assess to determine if the indicators leading to the deficiencies are under the control of management. If so, determine what management actions or Forest Plan components could improve conditions.

Alerts: Downward trend in overall watershed classifications between evaluations (over 5 years). Evaluate further if one key indicator with more relevant consequences (such as water quality due to road erosion) has a downward trend.

Adaptive management: Any changes will need to be investigated further, since sampling is highly variable in time and space.

WHO populated the template, and who is responsible for collecting the data, evaluating the results, and issuing the report?

Todd Ellsworth populated the template.

The data will be collected and evaluated by a Forest IDT, led by watershed staff.
The results will be compiled, and reports will be completed by the watershed staff.

Literature Cited

United States Forest Service. (2011) Watershed Condition Framework: A Framework for Assessing and Tracking Changes to Watershed Condition, FS-978. Available for download: https://www.fs.fed.us/naturalresources/watershed/condition_framework.shtml

WS02: To what extent has erosion from temporary and permanent roads and trails affected water quality and soil sustainability in the national forest?

WHY is this question being evaluated?

Desired condition:
WTR-FW-DC-05: Infrastructure (administrative sites, recreation facilities, and roads) has minimal adverse effects to riparian and aquatic resources.

WHAT is the problem or uncertainty?

This question addresses erosion and sedimentation issues occurring on Forest Service roads and trails. Numerous Forest Service roads and trails have been degraded or are currently in a degraded condition due to an increase in severe weather events and lack of maintenance. This degradation can cause excessive erosion and sedimentation, which can adversely impact water quality and soil productivity.

WHAT data will be collected?

Indicators and Unit of Measure:
Indicator 1. Soil Conservation Monitoring: Green/Yellow/Red (GYR) indicators from monitoring form. The data form captures the following variables: water breaks, erosion Off Trail, sediment traps, tread wear, tread Width, off-trail travel, stream channel crossings, channel section, and outboard fill.

Indicator 2. Roads Management National Best Management Practices (BMPs) Evaluation Program: Erosion and Sedimentation (Roads a-i).

Indicator 3. Stream Crossing and Bank Stabilization: Record the number of road stream crossing repairs completed on the Forest, and the length of stream bank stabilized.

Method/Protocol:
Indicator 1. Soil Conservation Monitoring

GYR Soil Conservation Monitoring: Monitoring and protocol standards and guidelines can be found here: https://ohv.parks.ca.gov/pages/1140/files/2008%20soil%20cons.%20standard%20and%20guidelines.pdf

Indicator 2. Roads Management National BMPs: The monitoring and protocol forms can be found here: http://fsweb.wo.fs.fed.us/wfw/watershed/national_bmps/bmp_docs-roads.html

Indicator 3. Stream Crossing and Bank Stabilization: This addresses water quality more directly than indicators 1 and 2, because it includes only road work at stream crossings. Record the number of road stream crossing projects in the past 2 years, and the length of stream bank stabilized.

Sampling design:
Indicator 1. GYR Soil Conservation Monitoring: Annually, GYR Soil Conservation Monitoring is implemented on the Forest as a stipulation of the OHV grants. A list of roads that have not been assessed in the past five years is developed and then assessed based on the indicators stated above and rated on the ground. Roads receiving a rating of “yellow” or “red” are then assessed by a watershed specialist and prescriptions are developed to address the indicators receiving a detrimental rating.

Indicator 2. Roads Management National BMPs: Annually, the Regional Office assigns a number of BMP evaluations to be completed for each Forest. At least 50% of the evaluation types are randomly selected, and the rest can be selected by the Forest based on Forest concerns. Every year the Forest completes at least one roads BMP evaluation. The Forest will summarize findings of any road-related BMP evaluations completed.

Indicator 3. Stream Crossing and Bank Stabilization: Report on all stream crossing stabilization projects.

Data storage:
Indicator 1. GYR Soil Conservation Monitoring: The GYR Soil Conservation data are collected using Survey123. After the data is compiled it is stored on the T: drive and can be found here: T:\FS\NFS\Inyo\Program\7700TravelMgmt\GIS

Indicator 2. Roads Management National BMPs: National BMP data is stored on Citrix in the National BMP database, which can be found here: https://citrix.fs.usda.gov/Citrix/StoreWeb/

Indicator 3. Stream Crossing and Bank Stabilization

Any reports and other information relating to stream crossing and bank stabilization work can be found in the OHV Program accomplishment folder here: https://usfs.app.box.com/folder/105410631015

*WHEN will data be collected, evaluated, and reported**?***

Data collection schedule: Summer season when roads are snow free, usually May through Nov. If the weather and resources permit, roads lower in elevation can be assessed earlier.
Sampling duration: Ongoing
Reporting schedule: Biennial

HOW will data be evaluated for each indicator?

Evaluation protocol:
Indicator 1. GYR Soil Conservation Monitoring. Summarize results of annual GYR monitoring and how many previous red and yellow roads were repaired. This is already done annually as part of the OHV Soil Conservation Plan.

The desired target is a rating of "green." The report will contain the number and percent of roads that were found to be rated yellow or red, and the trend in ratings over the past 6 years.

Indicator 2. Roads Management BMPs

The desired target is minimal to no erosion or sedimentation. Summarize previous 6 years (2 monitoring periods) results for Roads BMP evaluations, and report trend over that period, if any.

Indicator 3. The report will evaluate trend over time for the previous 2 reporting periods (6 years).

Monitoring report: Data would be displayed in tabular form for Soil Loss Conservation Monitoring. Also reports would be compiled for the Soil Loss Conservation Monitoring and the stream crossing and bank stabilization work. For the BMPs, the information would be stored in the database and can be queried as needed.

Other monitoring data: None

HOW will results be applied to management?

Compare results over time to determine whether erosion and sedimentation has been reduced. If trends are moving away from desired conditions, assess further to determine the cause. Results may point to need for committing more resources to road repairs, changing Forest Plan guidance to better protect soil resources, or prompt further monitoring needs.

Alerts:

Any roads assessed that receive a rating of "yellow" or "red" will trigger an assessment by a hydrologist/watershed specialist. The assessment will usually conclude with the development of treatments to implement in order to address the indicators assessed and bring them to a rating of "green."

Adaptive management:

Roads receiving a rating of "yellow" or "red" are then assessed by a watershed specialist and prescriptions are developed to address the indicators receiving a detrimental rating.

WHO populated the template, and who is responsible for collecting the data, evaluating the results, and issuing the report?

Michael Wiese, Hydrologist populated the template.

Watershed staff, including temporary staff are responsible for collecting the data. The Forest Hydrologist or Watershed Program Manager is responsible for evaluating the results and issuing the report.

Terrestrial Ecosystems and Aquatic Ecosystems (ii)

TE01: What is the status and trend of large trees in the Sierra Nevada montane forest?

WHY is this question being evaluated?

Desired condition:
TERR-OLD-DC-03: Between 40 and 80 percent of the forested landscape contains old forest areas. Old forest areas are clumps and patches of old forest components such as old trees, snags and large downed logs. These areas are irregularly distributed across the landscape and interspersed with stands of younger trees, shrubs, meadows, other herbaceous vegetation and unvegetated patches.

WHAT is the problem or uncertainty?

This question was designed to address the condition and trend of old forests, which provide a variety of ecosystem services including wildlife habitat, carbon sequestration, and biodiversity. There is uncertainty in the status of old forests due to interacting stressors associated with uncharacteristic wildfires, insect outbreaks, pathogens, and climate change. Landscapes with declining large tree trends could be targeted for forest restoration treatments to improve stand resilience to stressors or focused field-based monitoring to identify causal mortality agents.

WHAT data will be collected?

Indicators and Units of Measure:

Indicator 1. Proportion of area with large trees
Indicator 2. Number of large trees, snags, large downed logs per acre by forest type

Method/Protocol:
Indicator 1. Methods for deriving the proportion of area with large trees include:

1. CWHR data will be extracted for all forested vegetation types in the montane zone on the Inyo NF, and the proportion of this area containing CWHR classes 5 and 6 will be estimated; or
2. LANDFIRE data will be extracted for forest vegetation types in the montane zone on the Inyo NF, and the proportion of this area containing late successional classes ('s-classes') D (late seral, open canopy) and E (late seral, closed canopy) will be estimated
3. F3 data from the R5 RSL could be used to help identify old forest areas with large trees. Additional data sources (e.g., LiDAR-derived products) could also be helpful
4. Changes in the proportion of area with large trees over time could also be evaluated using eDaRT

Indicator 2. Number of large trees, snags, large downed logs per acre by forest type obtained from Forest Inventory and Analysis (FIA) data summaries.

Important caveat/change: These density estimates may be difficult or impossible to stratify by forest successional class, so summaries may only be the overall densities of these old forest structures across the full array of FIA plots located on the entire Inyo NF, unless new technologies permit a more refined analysis (e.g., F3 data).

Sampling design:
Indicators 1,2. Data will be collected for the full array of montane forest vegetation types, including eastside Jeffrey pine, (dry) mixed conifer, red fir, and lodgepole pine (127 FIA plots total with 50% of these located in eastside Jeffrey pine). The most recent CWHR, FIA, or F3 data will be used for comparison with desired conditions and possibly with a prior period of data collection if available.
Data storage:

1. CWHR: FS R5 geospatial data, OR LANDFIRE: https://www.landfire.gov/
2. FIA: https://www.fia.fs.fed.us/tools-data/
3. F3: Contact R5 RSL for data location

WHEN will data be collected, evaluated, and reported?

Data collection schedule:
Indicator 1. CWHR data are updated every 10 to 15 years by USFS R5 Remote Sensing Lab. F3 data would be updated more frequently
Indicator 2. FIA data are completely updated every 10 years (10% of plots are resampled annually in CA) by the USFS Forest Inventory and Analysis program

Monitoring duration: Ongoing
Reporting schedule: Results will be available for reporting in every 3rd biennial monitoring evaluation report because of the long time period for CWHR and FIA data updates. These data will next be evaluated and reported as early as 2022. Results will be available for reporting earlier than every 3rd biennial report If data refreshes occur more frequently.

HOW will data be evaluated for each indicator?

Evaluation protocol:
Indicator 1. CWHR: The proportion of the montane forest landscape in CWHR classes 5 and 6 will be estimated (status) and compared to previous estimates (trend).

Note: In the future F3 data may be able to quantify this indicator and eDaRT could be used to more accurately detect change over time.

Indicator 2. FIA/F3: The density of large trees, snags, and downed logs will be summarized

Monitoring report:
Indicator 1. CWHR: CWHR classes 5 and 6 (or LANDFIRE s-classes D and E) can be mapped to display the spatial distribution of older forests (or similarly done with LANDFIRE data). CWHR classes could also be graphed over time to display trends.

Indicator 2. FIA/F3: Tree, snag, and log densities (no./acre) will be displayed as follows:

1. Trees: ≥20", ≥30", ≥40" diameters – for comparison with desired conditions (Table 4 in Inyo NF LMP)
2. Snags: ≥20", ≥30" diameters – for comparison with Table 3 in Inyo NF LMP (possibly)
3. Logs: ≥15" diameter – no comparison available
4. All structures could be graphed over time to display trends

Other monitoring data:

1. LANDFIRE – Alternative data source already noted above to address monitoring question 1 (also potential future data products – see above)
2. F3 – USFS R5 RSL could potentially provide estimates of large tree, snag, and log densities (monitoring question 2) using F3 data products that incorporate changes in vegetation structure associated with recent disturbances using a change detection algorithm and other analytical processes
3. Forest Structure, which may include some of this information Draft Region 5 Broader-scale Monitoring Strategy

HOW will results be applied to management?

Success will be observed if:

Indicator 1. CWHR classes 5 and 6 comprise 40-80% of the montane forest landscape on the forest, or display an increasing trend in the proportion of these classes over time

Indicator 2. Large tree and snag densities meet the desired conditions displayed in Table 4 (large trees) and Table 3 (snags and logs) of the Inyo NF LMP.

Note: Suggest removing reference to logs as an indicator since log desired conditions are given in tons/acre but monitoring question is no./acre, resulting in an inconsistency. Moreover, the monitoring question is focused on large trees rather than large downed logs.

Alerts: If the proportion of CWHR classes 5 and 6 is decreasing or large tree, snag, and log densities are decreasing, then this could trigger a need to conduct a more targeted evaluation using finer scale data (e.g., see other monitoring data, additional vegetation monitoring plots) to determine reliability of the trend. If the trend persists with more targeted evaluation, then this may require a change in management activities, such as more focused restoration treatments in old forests with a declining trend of large tree densities.

It is unlikely that the desired condition (DC) this question is addressing would require a Forest Plan amendment; however, there may be a need to refine the use or interpretation of CWHR data if it appears to underestimate the proportion of old forests within the montane forest landscape. Quick review of the LANDFIRE data summaries (see the Vegetation Condition Assessment supplemental report) appears to provide a relatively reliable estimate of the proportion of old forests across the landscape (i.e., S-classes D and E).

Adaptive management: Assuming an accurate estimate is achieved and a declining trend is observed, it is possible that a plan amendment may be required to improve the trend of old forest extent and structure (e.g., stricter diameter limits for TERR-FW-STD 01, or increase in the pace of restoration treatments in TERR-FW-OBJ 01 & 02).

WHO developed the monitoring guide, and who is responsible for collecting the data, evaluating and reporting the results?

Primary Contact: Province Ecologist, Marc Meyer, 760-873-2447, marc.meyer@usda.gov
Secondary Contact: RSL Ecologist, Michèle Slaton, 760-873-2498, michele.slaton@usda.gov

TE02: What is the status of pinyon-juniper woodlands?

Desired condition:

TERR-OLD-DC-5: Pinyon-juniper types have a mosaic of trees and open areas that provide wildlife habitat, contribute to functional soils, and are resilient to disturbances such as fire, invasive species and climate change.

WHAT is the problem or uncertainty?

Pinyon pine (Pinus monophyla) is an understudied species that may benefit from management (or be deleteriously impacted). There are two competing problems or uncertainties to consider for meeting the desired conditions in TERR-OLD-DC-5. Pinyon pine populations are simultaneously contracting in their former range due to drought but are also expanding within former sagebrush sites.

Pinyon pine is vulnerable to drought and subsequent insect outbreak. Pinyon pine has experienced extensive mortality in the past 20 years. To the south of the Inyo NF area, entire stands died in 2013 and 2014. To the north, in Nevada, stands are being lost to increased fire frequency due to the establishment of the easily ignitable invasive cheatgrass.

Both persistent woodlands and expanding pinyon areas occur in the area of interest. The juniper species present on the Inyo National Forest are much more drought tolerant than pinyon pine (Floyd et al. 2009), and when they succumb to drought it is usually due to direct water stress rather than insect outbreak. Due to this, juniper is less of a concern in our monitoring.

While there is some evidence that higher pinyon stand density results in more pinyon mortality (Flake and Weisberg 2019) it remains to be seen how well fuel reduction treatments can reduce mortality in pinyon stands, mitigate wildfire risk and if there are any unforeseen consequences. Given the widespread nature of pinyon stands on the Inyo National Forest and the initiation of fuel reduction work within them, it will be important to monitor ecological effects of treatments.

WHAT data will be collected?

Indicators and Units of Measure:

Indicator 1. Pinyon insect/drought mortality – how many trees have died or acres of dead trees due to any cause (e.g., insect, drought, fire). Mortality agents in pinyon– presence of insects, signs of disease, fire occurrence. *Note: change this to Pinyon specifically in PMP, currently identified as P-J woodlands*

Indicator 2. Pinyon/juniper response to management - pinyon/juniper spatial extent– change in pinyon/juniper occurrence using remote satellite imagery.

Method/Protocol:

Indicator 1. Pinyon/juniper mortality will be initially evaluated using Ecosystem Disturbance and Recovery Tracker (eDaRT) and Aerial Detection Survey (ADS) data to monitor stand mortality and change (Indicator 1).

1. Change/mortality data will be combined with EVEG data to assess where pinyon-juniper stands occur on the Inyo National Forest relative to these data.
2. R5 Ecology plots will be investigated if an uptick is observed in change/mortality from baseline levels, to determine mortality agents (indicator 2). An in-depth investigation would be

recommended in locations affected and potential factors (e.g., stand structure, topography, and disease) at play.

Indicator 2. The R5 RSL will develop a map to display persistent pinyon woodlands derived through a combination of remote sensing data and monitoring plots. This map will help us understand where exactly pinyon expansion is occurring and to assess a change in spatial extent. Once this tool is developed, it can potentially be included in forest plan related monitoring.

Sampling design:
Baseline will be the number of trees that have died or acres of dead trees due to any cause (e.g., insect, drought, fire).

Indictor 1. Insect/Drought mortality – Review past eDaRT and ADS data to establish baseline mortality numbers in known pinyon/juniper locations. Review eDaRT and ADS data annually or biennially depending on capacity and document number of occurrences, intensity and sizes of events. In locations that are in higher than the range of baseline mortality, set up a grid of plots (n = 10 per area of high mortality, dispersed to capture variation) to examine mortality agents.

Indicator 2. Pinyon/juniper response to management – grid of R5 Ecology plots will be placed before and after treatments using a modified stand exam approach. Pinyon seed production estimates can be classed so that they can be rapidly assessed. Plots will be monitored the year following treatment, and then every three years of the next nine.

Data storage:

1. Aerial Detection Survey Data: https://www.fs.fed.us/foresthealth/fhm/dm/maps/aerial.shtml
2. Forest Inventory and Analysis Data: https://apps.fs.usda.gov/fia/datamart/datamart.html

Storage locations not defined yet for other data products.

WHEN will data be collected, evaluated, and reported?

Data collection schedule:
Indicator 1. Insect/drought mortality will be reviewed annually or biennially depending on capacity. Mortality agents will be assessed in the event of high tree mortality.
Indicator 2. Changes in spatial extent for pinyon-juniper expansion will be reviewed every five years.
Sampling duration: Mortality, and treatment effectiveness monitoring will be ongoing.

Reporting schedule:
Indicator 1. Reporting should occur every two years for tree mortality monitoring. Mortality agents will be assessed in the event of high tree mortality.
Indicator 2. Changes in spatial extent will be reviewed and reported every five years.

HOW will data be evaluated for each indicator?

Evaluation protocol:
Indicator 1. Document pinyon insect/drought mortality above baseline.

1. Mortality agents – observations will be classed by number of occurrences of evidence of different agents
2. Pinyon/juniper spatial extent– change in pinyon/juniper occurrence using imagery

Indicator 2. Pinyon/juniper response to management – Change in variables will be evaluated over time. Post treatment data will be compared to pre-treatment data. Fuel reduction treatment effects will be monitored when treatments occur, given capacity. A subset of treatments may be selected (field monitoring).

Monitoring report: This will be refined over time. Indicators 1,2: Mortality data, pinyon/juniper spatial extent, and response to management can be displayed in maps and in tables (i.e., acres of mortality).

Other monitoring data:

1. F3 data, Forest Inventory and Analysis data, cheatgrass occurrence, BSMS Q2 tracks vegetation extent and incorporates different structure metrics
2. A Pinyon Monitoring Strategy effort is being developed on the Inyo National Forest based on support and funding. Implementation of the pinyon monitoring plan should be incorporated into forest plan monitoring to provide more detailed information to answer the monitoring questions and adaptively managed for pinyon on the forest. An example of implementing the Pinyon Monitoring Strategy would be an additional indicator and associated units of measure:
   Additional indicator: Pinyon/juniper response to management. Fuel reduction treatment monitoring should be reported every two years but can be reported as seldom as five years given capacity and funding.
   Units of measure: stand structure, mortality, seed production, recruitment, understory and overstory composition.

HOW will results be applied to management?

Alerts: If pinyon insect/drought mortality is significantly higher than baseline or if treatments in pinyon are having significant negative impacts causing tree mortality or introduction of invasive species.

Adaptive management: If any of the alerts are reached, a further investigation is warranted to develop a strategic approach to reduce the risk of mortality or negative consequences to high-value pinyon areas. The Pinyon Monitoring Strategy would have recommendations for enhancing pinyon and mitigating effects of management practices or climate change.

WHO populated the template, and who is responsible for collecting the data, evaluating the results, and issuing the report?

Amarina Wuenschel populated the template.

The Region 5 Ecology program and Region 5 Forest Health and Protection will collect the data, evaluate results and produce the report with support from Inyo National Forest Staff.

Literature Cited

Flake, S. W., and P. J. Weisberg. 2019. Widespread Mortality and Defoliation of Pinyon Pine in Central Nevada Mountains. Bull Ecol Soc Am 100(2).

Floyd ML, Clifford M, Cobb N, Hanna D, Delph R, Ford P, Turner D. 2009. Relationship of stand characteristics to drought-induced mortality in pinyon – juniper woodlands in Colorado, Arizona and New Mexico. Ecological Applications 19: 1223–1230.

TE03: What is the condition of sagebrush communities?

WHY is this question being evaluated?

Desired condition:
TERR-SAGE-DC-01: The sagebrush type has a diversity of age classes, stand structure, cover classes and understory composition.

WHAT is the problem or uncertainty?

Sagebrush communities are widespread on the Inyo National Forest and provide important habitat for sage-steppe species such as the bi-state sage-grouse, a species of concern (SCC). Although widespread, the condition of sagebrush communities is unknown and some areas have decadent stands with larger proportions of dead shrubs, typically taller in height, and greater cover than would have been present historically. Sagebrush recruitment is often limited in these stands, thus creating concern for the persistence of this vegetation type in those locations.

Additionally, sagebrush communities are jeopardized by nonnative invasive annual grasses, altered fire regimes (more frequent larger fires), conifer encroachment, livestock grazing, climate change, or a combination of factors. To what extent these threats have on the persistence of sagebrush communities is uncertain.

WHAT data will be collected?

Indicators and Units of Measure:
Indicator 1. Proportions of seral classes, sagebrush cover
Indicator 2. Acres of treatments to improve age class distribution
Indicator 3. Acres of wildland fire
Indicator 4. Percent native understory vegetation
Indicator 5. Percent sagebrush community lost to development by ecological subregion
Note this is a new indicator not included in the PMP

Method/Protocol:

Indicator 1. R5 RSL produces annual summaries of annual grass cover (proxy for cheatgrass cover) and shrub structure. Each product utilizes Landsat imagery and may incorporate data from additional sensors as they become available; the products are raster datasets for the entire plan area with 30m cells assigned an annual grass % cover value and shrub cover. The annual grass model relies on the intra-annual variation in spectral indices, which characterizes the strong phenology of annual grasses. The shrub cover model, on the other hand, relies more upon spectral information that is sensitive to vegetation structure (height and roughness). Limited field plots are required to validate the model, which include shrub and native herb structure and composition in addition to invasive annual grass cover.

The mapping product will indicate where sagebrush cover and seral stages are lacking in diversity. The product will be examined within each ecological subregion, because expected diversity in structure and seral stage varies by soil type, climate regime, and other biogeographic factors.

Indicator 2. FACTS database queried for acres of treatment and overlapped with RSL mapping product (i.e., sagebrush cover and diversity with seral stage class) to determine results.

Indicator 3. Wildfire acres in sagebrush landscapes should be documented as wildfires occur. EVEG data will be used to identify where sagebrush occurs in relation to CAL FIRE FRAP (Fire and Resource Assessment Program) data to evaluate wildfire extent.

Indicator 4. Percent native understory vegetation. Invasive annual grass cover for a proxy of native grass cover (refer to methods for Indicator 1).

Indicator 5. Comparing methods of Indicator 1 with development.

Sampling Design:
Indicators 1, 2. Analysis of sagebrush systems will happen at the forest-scale, stratified by ecoregion. Only locations where sage grouse occur (currently or previously) will be evaluated for proportions of seral classes.

Indictor 4: Field plots will be sampled to validate annual grass and shrub structure models to the specifications of the R5 Remote Sensing Lab. Validation field plots will be required to address multiple monitoring questions (e.g., invasive grasses), and thus some efficiency between questions will be gained. We are anticipating needing between 5 – 20 plots per ecoregion per year.

Data storage: Raster products to be obtained from R5 RSL and stored in the appropriate forest GIS library.

Indicators 1, 2, 4, 5. RSL products
Indicator 3. CAL FIRE FRAP
Fire perimeter data: https://frap.fire.ca.gov/mapping/gis-data/

EVEG:
https://www.fs.usda.gov/detail/r5/landmanagement/resourcemanagement/?cid=stelprdb5347192

WHEN will data be collected, evaluated, and reported?

Data collection schedule: Wildfire, development, and treatment acres should be reported biennially. Field plots to support annual grass and shrub structure models should be done according to the R5 RSL requirements (5-20 plots per ecoregion). If adequate sagebrush recruitment is observed at one sampling period, then future sampling can be foregone if resources are limited. R5 RSL modeling outputs will be produced every two years.

Monitoring duration: Ongoing
Reporting schedule: Biennial

HOW will data be evaluated for each indicator?

Evaluation protocol: This threshold level should be evaluated upon completion of shrub structure model in comparison to known areas of mature sagebrush and re-evaluated over time. During re-evaluation any new science relevant to sagebrush cover should be considered when revising desired conditions. A starting point for a threshold is a minimum of a 30% standard deviation in the amount of shrub cover within a given ecological sub-region of sage-grouse habitat.

Variability of sage-grouse cover depends upon sage-grouse habitat use (i.e., breeding, foraging, wintering). Loss of sagebrush communities to development or fire within a given ecological subregion should not exceed 30%.

Percent native herbaceous vegetation should be present in most pixels and exceed cover of non-native invasive grasses.

This question is partially answered by AR03: How is the condition of seasonal sage-grouse habitats and connectivity changing?

Monitoring report: Tables, maps
Other monitoring data: None

HOW will results be applied to management?

Alerts: Sagebrush community loss within an ecological subregion exceeds 30% of former range, additional surveys or analyses will be conducted to determine the cause of loss.

If percent native understory is below 50% of the total vegetation relative to non-native vegetation within an ecoregion, active restoration should be considered.

Adaptive management: if thresholds are met for any of the alerts listed above, additional surveys and additional analyses should be conducted to determine the cause of loss to sagebrush communities, sagebrush cover and native understory variation. Active restoration should be considered to restore native understory vegetation and enhance sagebrush cover.

WHO populated the template, and who is responsible for collecting the data, evaluating the results, and issuing the report?

Amarina Wuenschel, Southern Sierra Associate Province Ecologist, amarina.e.wuenschel@usda.gov. Sagebrush monitoring will be conducted jointly by Region 5 Ecology Program, R5 Remote Sensing Lab, and Inyo National Forest Staff.

Literature Cited

Baker, William L. 2006. Fire and restoration of sagebrush ecosystems. Wildlife Society Bulletin. 34(1): 177-185.

Baker, William L. 2011. Pre-Euro-American and recent fire in sagebrush ecosystems. In: Knick, Stephen T.; Connelly, John W., eds. Greater sage-grouse: Ecology and conservation of a landscape species and its habitats. Studies in Avian Biology No. 38. Berkeley, CA: University of California Press: 185-201.

Aquatic Ecosystems (ii)

AE01: What is the vegetative condition of selected grazed and ungrazed meadows?

WHY is this question being evaluated?

Desired condition:
RCA-MEAD-DC-05: Meadows have substantive ground cover and a rich and diverse species composition, especially of grasses and forbs. Meadows have high plant functional diversity with multiple successional functional types represented. Perennial streams in meadows contain a diversity of age classes of shrubs along the streambanks, where the potential exists for these plants.

WHAT is the problem or uncertainty?

The uncertainty is whether grazed meadows are meeting or moving toward desired conditions in the Forest Plan.

WHAT data are being collected?

Indicators and Units of Measure:
Indicator 1. Rangeland ecological condition
Indicator 2. Species richness, species diversity and plant functional groups
Indicator 3. Range greenline monitoring
Indicator 4. Vegetation community types

Method/Protocol:
Forest Level Monitoring Team:

Indicators 1, 2 and 4 will be measured by using the using the Inyo National Forest wide Utilization Standards protocol [Inyo National Forest Supplement to USDA Forest Service Pacific Southwest Region Rangeland Analysis and Planning Guide R5-EM-TP-004 (2018)].

This protocol includes a 100-point vegetation transect that will identify species diversity, species richness, plant functional groups, and vegetation community types which will inform the rangeland ecological condition. The use of an interdisciplinary team of two to three people in the assessment part of the protocol contributes to the assessment of the meadow ecosystem to determine its functional status.

These assessments are designed to:

1. Assess the function of perennial and intermittent streams, riparian and wetland areas
2. Be used only by an experienced ID team of resource specialists
3. Provide a consistent approach for assessing the physical functioning of streams and riparian areas and meadows through consideration of hydrologic, vegetative, and geomorphic attributes relative to the potential of the stream being assessed
4. Help establish and prioritize management, monitoring, and restoration activities
5. Provide a focused and effective foundation for determining resource values and developing management goals by identifying attributes and processes that are out of balance for the landscape setting

6. Communicate fundamental riparian concepts to a wide variety of audiences. This process forms a "common vocabulary" for discussing physical stream and riparian functions as the basis for developing common understanding and vision for long-term desired conditions

Regional Rangeland Monitoring Team:

Indicators 1,2,4. The rooted frequency plant transect protocol uses a permanent transect within the monitored meadows which is visited every five years to be re-read. This method identifies plant species, frequency of species occurrence, species richness, vegetation community types, and identifies functional groups. The forest utilization standard protocol uses a 100-point toe-point vegetation transect to gather similar information and is much more robust and statistically accurate to track a specific location of a community over time. This protocol will provide information on the trend of the vegetation community and the effect of the currently used grazing management strategy. These transects can also be read by the rangeland staff or botanists on the forest if the regional team is unavailable. The regional range monitoring team will also perform a greenline monitoring transect in conjunction with the rooted frequency monitoring.

Indicator 3. Greenline monitoring, evaluates and records the different community types of vegetation that line the interface with the water's edge within the meadow systems. The protocol is described in Winward (2000). Greenline monitoring is included in the regional range monitoring program that is conducted every 5 years on each monitoring location. If needed, the forest can conduct this monitoring when collecting data during the utilization standard protocol.

Sampling Design:
Forest level monitoring: Priority meadows (2-6) will be sampled each year in similar meadow/riparian types in both grazed and rested allotments.
Regional rangeland monitoring team: Rooted frequency transects and greenline monitoring are conducted by RO on a selected group of meadows monitored every 5 years.

Data storage: Data will be collated and stored in the Forest Service Pinyon: 2200 Range Management Folder. Forest Service corporate cloud storage using standard word processing and spreadsheet software. Hard paper copies will also be stored in the Rangeland Management 2230 files.

WHEN will data be collected, evaluated, and reported?

Data collection schedule: Forest utilization protocol will be conducted annually on selected meadows during the growing season when plants are mature enough to be identified by their flowering parts. For active grazing allotments, data are collected prior to full utilization to ensure enough plants remain for identification. Depending on the elevation of the sampling location, data collection can occur from April to September. A minimum of 2 meadows would be monitored annually. Additional monitoring may occur for allotments undergoing environmental analysis as required by the Rescission Act schedule. Also, other allotments can be assessed when a change in vegetation and soil conditions are observed, with the monitoring validating or dismissing the observations.

The RO monitoring of the greenline method and the rooted frequency vegetation transects occurs every 5 years.

Monitoring duration: Occurs April to September, depending on elevation, with each sample site taking a minimum of a half day in areas with roads, to up to 3 days in Wilderness locations. Ungrazed meadows are located within the Wilderness and require multiple day trips to access and record data.

Reporting schedule:
Indicators 1,2,4: Biennial
Indicator 3: Reported every 5 years

HOW will data be evaluated for each indicator?

Evaluation protocol: Data will be reviewed and synthesized by the rangeland management specialist. Data results will be compared to the desired condition to determine if the meadows meet, move toward or depart from desired condition.

Monitoring report: Results are displayed in a table identifying:

1. Location and ecological rating of each meadow
2. Comparison of a meadow's current rating to previous years' conditions
3. Comparison of paired grazed to ungrazed meadows to determine if meadows are on a trajectory to meet desired conditions

HOW will results be applied to management?

Compare indicator results with desired targets: This will be measured against the desired condition of each type of rangeland vegetation community type.

Alerts: Departure from desired condition would trigger potential actions for adaptive management (Inyo LMP, pp. 17-18).

Adaptive management: Assessments will determine whether the recommendations were valid to attain the desired goals, which would work towards achieving desired conditions of the forest plan.

WHO populated the template, and who is responsible for collecting the data, evaluating the results, and issuing the report?

Lisa Sims and Todd Ellsworth populated the template.

Literature Cited

Revision of the Inyo National Forest Land Management Plan, Rangeland Management Supplemental Report, Inyo National Forest Supplement to USDA Forest Service Pacific Southwest Region Rangeland Analysis and Planning Guide R5-EM-TP-004 (2018)]. Available for download: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd593101.pdf

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Winward, A.H. 2000. Monitoring the riparian resources in riparian areas. General Technical Report RMRS-GTR-47. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Ogden, UT. 49 p. Available for download: https://www.fs.fed.us/rm/pubs/rmrs_gtr047.pdf

AE02: To what extent are riparian areas functioning properly across different management areas and levels of disturbance?

WHY is this question being evaluated?

Desired condition:

MA-RCA-DC-05: Riparian areas provide a range of substrates to sustain habitat for a variety of aquatic and terrestrial fauna within the natural capacity of the system.

MA-RCA-DC-06: Soil structure and function is sustained to infiltrate and disperse water properly, withstand erosive forces, sustain favorable conditions of stream flow, and cycle nutrients. Associated water tables support riparian vegetation and restrict non-riparian vegetation.

WHAT is the problem or uncertainty?

The uncertainty is whether the grazing strategy incorporated into the Forest Plan will move grazed riparian areas toward desired conditions.

WHAT data will be collected?

Indicators and Units of Measure:

Indicator 1. Vegetation cover, structure, and composition
Indicator 2. Floodplain and channel physical characteristics

Method/Protocol:

Indicator 1, 2. Measured using a combination of two different assessment methods.

1. Inyo National Forest wide Utilization Standards protocol [Revision of the Inyo National Forest Land Management Plan, Rangeland Management Supplemental Report, Inyo National Forest Supplement to USDA Forest Service Pacific Southwest Region Rangeland Analysis and Planning Guide R5-EM-TP-004 (2018)]
2. Proper Functioning Condition protocols, for either lentic or lotic, depending on the water feature associated with the meadow. (see references below)

These assessments are designed to:

1. Assess the function of perennial and intermittent streams, riparian -wetland areas
2. Be used only by an experienced ID team of resource specialists
3. Provide a consistent approach for assessing the physical functioning of streams and riparian areas and meadows through consideration of hydrologic, vegetative, and geomorphic attributes relative to the potential of the stream being assessed
4. Help establish and prioritize management, monitoring, and restoration activities
5. Provide a focused and effective foundation for determining resource values and developing management goals by identifying attributes and processes that are out of balance for the landscape setting

6. Communicate fundamental riparian concepts to a wide variety of audiences. This process forms a "common vocabulary" for discussing physical stream and riparian functions as the basis for developing common understanding and vision for long-term desired conditions

Sampling design: Minimum of two assessments will be completed per year in designated key areas for selected allotments. The number of assessments will be evaluated on a yearly basis based on forest priority.

Data storage: Data will be stored in the Forest Service Pinyon 2200 Range Management Folder. Forest Service corporate cloud storage using standard word processing and spreadsheet software. Hard paper copies will also be stored in the Rangeland Management 2230 files.

WHEN data will be collected, evaluated, and reported?

Data collection schedule: Two key areas will be monitored annually. Some allotments are monitored every 5 years in compliance with the terms and conditions identified in environmental assessments. Additional monitoring may also occur for allotments undergoing environmental analysis as required by the Rescission Act schedule. Also, other allotments can be assessed when a change in vegetation and soil conditions are observed, with monitoring validating or dismissing the observations.

Sampling duration: Variable depending on locations of key areas assessed
Reporting schedule: Biennial reports

HOW will data be evaluated for each indicator?

Evaluation protocol: The evaluation criteria used for these indicators are national and interagency protocols. Meadows will be assessed based on the following:

Indicator 1. Monitoring results from the Inyo National Forest utilization standards

Indicator 2. Proper Functioning Condition (PFC) assessments

1. Proper Functioning Condition for lotic areas (stream)
2. Proper Functioning Condition for lentic areas (i.e., ponded or spring or other non-flowing feature)

The PFC assessments are useful in identifying current conditions of a riparian area and associated floodplain and wetlands. This method is a qualitative assessment. The process utilizes a three-person interdisciplinary team, with journey level professionals in hydrology, soils, range or vegetation, to asses an area using a questionnaire protocol. The ID team is composed of professionals who are familiar with the hydrologic, soil, and vegetation characteristics of the area to assess an area and develop appropriate management to affect change on a system that does not meet desired conditions. It will also confirm if an area is functioning within the desired condition.

Monitoring report: The monitoring report will include the following:

1. Displaying trends over time
2. Excel spreadsheet with names, locations, and meadow condition ratings
3. Map visually displaying meadow locations

Other monitoring data:

1. Annual streambank trampling will also be an indicator of how conditions are moving towards desired condition.

HOW will results be applied to management?

The evaluations will show trends over time to determine if conditions are stable, moving toward, or moving away from desired conditions.

The PFC assessments can provide an early warning of problems and point to opportunities by helping to identify key management issues, focus monitoring activities to maximize efficiency, and prioritize restoration actions on "at-risk" systems or reaches of highest resource value. The protocol for the forest utilization standard identifies thresholds that will trigger a response to managing key areas including more than 10% bare soil exposed by grazing practices, a change in species composition, excessive rilling and gullying, unchecked headcuts, excessive pedestalling of soil, and others characteristics that will identify a system that is not responding positively to grazing management.

Alerts: When trends over time indicate conditions are on a downward trend or when forest utilization thresholds have been exceeded.

Adaptive management: If either of the alerts have been triggered, further investigation should focus on areas that are significantly departed from desired conditions. Recommendations should be made such as a more in-depth monitoring plan or changes in grazing practices.

WHO populated the template, and who is responsible for collecting the data, evaluating the results, and issuing the report?

Lisa Sims and Todd Ellsworth populated the template.

Literature Cited

Revision of the Inyo National Forest Land Management Plan, Rangeland Management Supplemental Report, Inyo National Forest Supplement to USDA Forest Service Pacific Southwest Region Rangeland Analysis and Planning Guide R5-EM-TP-004 (2018)].
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U.S. Department of the Interior. 2003. Riparian area management: Proper functioning condition assessment for lentic area. Technical Reference 1737-16, Revised 2003. Bureau of Land Management, National Operations Center, Denver, CO. Available for download:
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AE03: What is the status of water quality in national forest waterbodies?

WHY is this question being evaluated?

Desired condition:

WTR-FW-DC-02: Water quality supports state-designated beneficial uses of water and is sustained at a level that retains the biological, physical, and chemical integrity of aquatic systems and benefits the survival, growth, reproduction and migration of native aquatic and riparian species.

WHAT is the problem or uncertainty?

This question was designed to address whether the Inyo Forest management or activities occurring on the Forest affect beneficial uses of water, and whether there is a trend over time for water quality in the plan area. There is uncertainty about to what degree management activities performed or permitted by the Forest, or activities that visitors engage in, affect water quality.

Data will be collected by the State of California and partners who collect water quality data and report it to the State as part of the SWAMP and TMDL programs (in CEDEN database). It will be gathered from the website or personal communications with Lahontan water board or State water board staff by Inyo National Forest watershed staff, who will then evaluate the results and input the information into the monitoring report.

WHAT data will be collected?

Indicators and units of measure:

Indicator 1. Bacteria levels – all measured in cfu/100mL (colony forming units per 100 milliliters)

a. E. coli
b. Fecal coliform
c. Enterococcus or other indicator bacteria

Indicator 2. 303(d) status – water quality limited waterbodies that do not meet applicable water quality standards.

a. US EPA approved 303(d) listed streams
b. Statewide or Lahontan Water Quality Control Board proposed streams

Method/protocol:

Generally monitoring begins at a broader sampling area and when a sample is found to exceed a standard, the state takes further samples to determine whether there is a persistent water quality issue, and to attempt to find the source of the water quality degradation.

Sites that require more rigorous monitoring (multiple locations on one stream and/or repeated sampling over multiple years) are selected based on concerns about specific land uses, from the public and the Lahontan Regional Water Quality Control Board. Monitoring stations are chosen differently for various sampling efforts.

Indicator 1. Bacteria levels data sources. Data will be reported biennially.

a. California:

i. Most data is stored on the CEDEN website (https://ceden.waterboards.ca.gov/AdvancedQueryTool). A query should include the following parameters:

1. By County: Inyo and Mono Counties only (press "Ctrl" to choose more than one County)
   Note: Small portions of the Forest are in Madera and Tulare Counties, but because these areas are remote, there is little to no water quality monitoring done and we will not search for data on these unless a new monitoring station or program is begun.
2. Select stations on this website, or wait and filter out stations in Excel
3. Then, select parameters: Choose "microbiological"
4. Select all dates available.
5. Download data – it will download in Excel format.
6. Filter by stations on the Inyo National Forest only

ii. Lahontan Water Board TMDL website (https://www.waterboards.ca.gov/lahontan/water_issues/programs/tmdl/) to search for any "projects in development" to find any additional data that was not recorded in the CEDEN database

b. Nevada:

i. Nevada Division of Environmental Protection (NDEP) Water Quality Data Warehouse (https://nevadawaterquality.ndep.nv.gov/). Query for Esmeralda and Mineral counties

Indicator 2. 303(d) status

a. Lahontan Regional Water Quality Control Board water quality assessment website to search for current 303(d) listed and proposed waterbodies on the Forest. (https://www.waterboards.ca.gov/lahontan/water_issues/programs/tmdl/integrated_report/index.htmll)

i. Availability of new data will vary. The water board has a two-year cycle for proposing new 303(d) listings, in even numbered years, but sometimes does not meet that cycle

Sampling design: Based on state protocols and data collection
Data storage: See above in method/protocol section

WHEN will data be collected, evaluated, and reported?

Data collection schedule: Every 2 years, starting in August of each odd numbered year
Sampling duration: Ongoing
Reporting schedule: Biennial

HOW will data be evaluated for each indicator?

Evaluation protocol:

Indicator 1. Bacteria

Forest watershed staff will download the relevant data for indicator bacteria from partner websites. Annually data will be averaged for each measuring station. Stations with data over the past 5 years will be analyzed in each report.

Frequency of data collection varies widely. Some stations may have one measurement every three years, and others may have measurements on ten days of every year. So that the year-to-year variation can be compared and displayed, we will average the measurements for every station for every calendar year. If there are no measurements in a particular year, the data will be NA or blank. The average for each year will be calculated for each station and put into an "average" workbook. That data will be used to analyze changes over time for each station.

Indicator 2. 303(d) water quality impaired water bodies

Compile the list every two years and determine what streams have been added or removed since the last reporting period:

a. Total number of 303(d) listed streams and the stream segment name (and map)
b. Total number of proposed 303(d) streams and the stream segment name (and map)
c. Trend over time for both listed and proposed streams

Monitoring report:

Indicator 1. Bacteria:

Data will be downloaded for two years prior to the completion report date to maintain consistency with the biennial reporting requirements. Graphs will be developed for each stream and/or station for the past two years. One graph for each major watershed (such as the Mono Basin Watershed, Owens River Watershed, and Eastern White Mountain watershed) will be displayed showing results from all stations within that watershed. Station with more than one sample in one year will be averaged and displayed with standard error/deviation bars. A chart will display the percent of measurements taken annually that were over the standard of 20 cfu/100 mL for indicator bacteria. All stations monitored within a watershed will be displayed on a map One map will be produced for each watershed: Owens River basin, Mono Lake Basin, and the Eastern White Mountains.

Indicator 2. 303(d) list:

a. A map of all 303(d) listed and proposed waterbodies
b. A list of the waterbodies and the contaminants for which they are listed, along with a contaminant source if known

c. If the source is unknown, the watershed staff will list forest management actions that could potentially be contributing to that contaminant

Other monitoring data:
The Water board does project/site specific monitoring, such as their 2019 Bishop Creek monitoring report, as part of the development of a TMDL for specific waterbodies (https://www.waterboards.ca.gov/lahontan/water_issues/programs/tmdl/bishopcreek.html). Other TMDL processes might begin, which would have more intense monitoring and Forest Service involvement, which could be incorporated into the monitoring report.
Any recent publications that include water quality data for the forest area.

HOW will results be applied to management?

Compare indicator results with desired targets:

Indicator 1: Indicator bacteria levels are less than or equal to the standard (20 cfu/100mL in the Lahontan Region, 100 cfu/100 mL in Nevada). If indicator bacteria levels increase then the increase is temporary and does not continue for more than 2 years.

Indicator 2. 303(d) listed water bodies: The desired condition is for no new water bodies to be listed as 303(d) status and for the water bodies currently listed to be removed from 303(d) status in future.

Alerts:
Indicator 1. Bacteria: If the targets above are not met, then the forest will consider further investigation.

1. The investigation will refine the analysis to determine whether the increase in bacterial levels is an accurate measurement or if further sampling is needed to detect a true change.
2. Increased levels could be associated with a variety of factors including increased monitoring efforts or monitoring at a different time of year. The first step will be to determine whether there is an actual change on the ground, or a change to the sampling effort or timing. If any increases are found to be real, then evaluate ways that forest management activities may be improved to reduce water quality effects. Management activities or forest uses that are most likely to be linked to indicator bacteria include:
    a. Livestock Grazing
    b. Recreational uses
    c. Dispersed recreation
    d. Resorts/recreation residences/campgrounds with septic systems or other human waste disposal systems
    e. Pack stock grazing
    f. Development – such as houses or other developments on private or Forest land.
3. The Lahontan Water Board may be contacted to discuss a collaborative approach to further investigate the situation.

The outcome may affect specific project design criteria or lead to mitigation at a location, which would be allowable under the Forest Plan as written. It is unlikely that any indicator bacteria measurements would lead to a forest plan amendment.

If this technique of using existing data does not provide sufficient information to determine whether forest management activities are affecting indicator bacteria levels after two reporting periods, then the forest may re-evaluate this monitoring guide. Recommendations may be made to conduct site specific monitoring, potentially focusing on a particular activity type with the highest uncertainty.

Indicator 2. 303(d) listed water bodies:

If the percent of investigated water bodies increases over three reporting periods, look for commonalities or forest wide management, or natural phenomena, that could be leading to that increase. This investigation will be done in conjunction with the Lahontan Water Board. If any increases can be tied to forest management, then look into ways that management activity may be improved to reduce water quality effects. Almost all management activities could affect 303(d) listing, because it can be based on almost any contaminant. Management activities that can be investigated will depend on the contaminant. Current listings with an associated Forest management actions are related to:

b. Historical mining leading to increased mercury levels (we plan to remediate the mine site, have done a very extensive site investigation and clean-up plan)
c. Water withdrawals from Mono lake tributaries leading to increased salinity (Address through State water rights actions, not under the control of the Forest)
d. Other 303(d) listings have not yet been linked to a specific Forest management action

Adaptive management: Refer to explanation in alerts for Indicators 1 and 2.

WHO populated the template, and who is responsible for collecting the data, evaluating the results, and issuing the report?

Erin Noesser and Todd Ellsworth populated the template.
Primary contact: Erin Noesser erin.noesser@usda.gov
Secondary contact: Todd Ellsworth, watershed program manager, todd.ellsworth@usda.gov

Focal Species (iii)

FS01: How is the abundance of Cheatgrass and red brome (nonnative Bromus spp.) changing?

WHY is this question being evaluated?

Desired condition:
TERR-SAGE-DC-02: Sagebrush ecosystems are resilient to fire and other disturbances including grazing, recreation, invasive species (including cheatgrass) and climate change.

SPEC-SG-DC-06: The extent and dominance of non-native annual grass species, such as cheatgrass, is limited and does not lead toward reduction in the suitability of sage-grouse habitat.

WHAT is the problem or uncertainty?

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. Sagebrush and pinyon-juniper ecosystems invaded by cheatgrass have reduced ecological integrity and are prone to type conversion to non-native grasslands post-fire.

WHAT data will be collected?

Indicators and units of measure:
Indicator 1**.** Spatial Extent (acres) of area with annual grasses
Indicator 2. Percent cover of annual grasses (value assigned to 30m cell).

Method/Protocol: R5 RSL produces an annual summary of annual grass cover (proxy for cheatgrass cover). Cover is derived from bi-weekly LandSat imagery with initial field data collection for calibration; the product is a raster dataset for the entire plan area with 30m cells assigned an annual grass % cover value for each year, during the growing season. The high temporal resolution of the imagery collection enables the detection of phenological change through the growing season. The variability of vegetation indices, such as NDVI, and their absolute values are input to the model to estimate annual grass cover. The model has been primarily calibrated for shrublands but may also be utilized in forested settings. Retrospective estimates of annual grass cover will be created for at least two years in the decade prior to the evaluation period, to serve as a point of comparison for trends.

Sampling Design: Data will be collected for the indicators across the forest and will be summarized by vegetation type and for sage-grouse habitat and compared to previous years available as far back as (2009). For field-based data collection the primary focus area has been in the Crowley Basin, which has high priority sage grouse habitat and where a very high density of monitoring plots exist. Plot data for shrub cover, all species compositions, and invasive grass.

Steps for incorporating field data with remote sensing to develop a model for the Sierra Nevada range:

1. Collect training data to determine what invasive grass looks like in a remote sensing signature at the 30 m scale., which so far, data has been a combination of field plots and desktop high-

resolution imagery interpretation (on screen in some cases, we can actually evaluate % cover in 30 m pixels)
2. Training data are used to create a landscape/forest-wide raster map of invasive cover.
3. A balance is determined between field data collection and what can be achieved with image interpretation. Currently, model development is at this stage to determine what the minimum sample of field data is needed to develop the desktop image interpretation.

Data storage: Raster products to be obtained from R5 RSL

WHEN will data be collected, evaluated, and reported?

Data collection schedule: Landsat images are collected bi-weekly and used to produce an annual raster GIS product. RSL will provide both annual datasets for each two-year monitoring period. Field data collection is described in sampling design above.
Sampling duration: Ongoing
Reporting schedule: Biennial

HOW will data be evaluated for each indicator?

Evaluation protocol: The proportion of the Inyo NF cheatgrass presence as well as various cover classes of cheatgrass will be displayed as a map and compared to previous years, at the forest level and/or in veg types and habitat units of interest. Increasing rates of change (compared to baseline trend) in specific veg or habitat types or in areas with disturbance/management action would indicate a declining trend or departure from desired condition.

The evaluation protocol is the same for Question *TE03: What is the condition of sagebrush communities?*

Monitoring report: Maps with higher values of cheatgrass displayed in red and lower values towards green, with areas lacking cheatgrass having no color. Indicators will also be summarized numerically in a figure/table summarizing average and range of percent cover by habitat type, or proportion of habitat type within various classes of cover.

Other monitoring data: Other possible sources of annual grass data that could be used in complement with the forest-wide remote-sensing product include:

1. R5 Ecology Plots- presence/absence and cover of cheatgrass in these plots (re-sampled sporadically) (R5 Ecology)
2. FIA data for understory vegetation (FS FIA)
3. AIM plots with presence/absence of cheatgrass (INF Veg/Fuels)
4. Project-level quantitative or qualitative monitoring data on cheatgrass response to treatment (botany)
5. NRIS Invasive Species Inventory data (acres, location) (botany)
6. BAER post-fire Invasives EDRR survey findings (botany)

Compare indicator results with desired targets: Because of the ecosystem and habitat values provided by healthy sagebrush and pinyon-juniper communities, and the challenges of restoration in these ecosystems, the forest should strive to minimize the extent or percent cover of annual grasses on the landscape. If resources and effective methods are available, there should be efforts to reduce the area dominated by annual grasses, including maintenance of native shrub and perennial grass components.

Success will be obtained if trends of annual grass extent and cover are stable or decreasing during the evaluation period as compared to 5-10 years prior to implementation of the plan.

HOW will the results be applied to management?

Alerts: Annual grass cover values above ~10-20% in contiguous areas create sufficient continuity of flashy fuels to carry frequent fire and may suppress native vegetation, based on field observations from the Inyo NF. Because there is no established threshold for cheatgrass cover, this range of cover values will be used as a starting point during the first year of reporting and may be adjusted in the future. The raster dataset will be evaluated for areas of contiguous high % cover values within watersheds, fires, priority habitats, project areas, etc., to identify areas of potential concern.

Adaptive management: Annual grass cover values above ~10-20% in contiguous areas could trigger a need to conduct a more targeted assessment of grass cover using field evaluation to determine reliability of the mapping output and trend. In areas where non-native grass cover is increasing, specialists should identify the drivers of vegetation change (e.g. recent fire, fire suppression activities, recreational use, mortality due to drought, etc.) and discuss the feasibility and opportunity for lessening the impacts from the identified stressor. If the trend persists, then a change in management activities may be warranted. An example of potential actions is listed below:

Driver of increased extent and cover	**Potential management action**
Excessive fire	Aggressive fire suppression response, avoid/target prescribed burning to improve resilience, public education to reduce fire risk, limit use of recreation with high ignitions or where vegetation is recovering, reduce flashy fuels in fire prone corridors
Drought	Promote drought tolerant natives, forest health treatments, invasive plant removal to reduce competition
Other disturbances (OHV, Cattle Grazing)	Reduce recreational use, evaluate grazing regime

In instances where it is not possible to maintain or reverse the trend, a discussion of species-specific effects and actions to lessen these impacts will be important. For example, areas that are high priority habitat for sage-grouse nesting and rearing could be prioritized for restoration with native grass and shrub species that contribute structure and are more tolerant of frequent disturbance.

WHO developed the monitoring guide, and who is responsible for collecting the data, evaluating and reporting the results?

Monitoring guide was prepared by: Botanist, Inyo NF (Blake Engelhardt)
Data collection, generation, processing: Ecologist, R5 RSL (data collection, model creation and data generation); and Botanist, Inyo NF (data collection and product evaluation)
Evaluation/Reporting: Completed by INF specialists (Botanist, Wildlife Biologist) and/or Resource Officer with local knowledge of vegetation, disturbances, and habitat characteristics on the forest.

FS02: How are aquatic benthic macroinvertebrate communities indicating stream ecosystem integrity is being maintained in high quality waters or improved in degraded waters?

WHY is this question being evaluated?

Desired condition:
WTR-FW-DC-02. Water quality supports State-designated beneficial uses of water and is sustained at a level that retains the biological, physical, and chemical integrity of aquatic systems and benefits the survival, growth, reproduction and migration of native aquatic and riparian species.

WHAT is the problem or uncertainty?

This question was designed to address whether the Inyo Forest management or activities occurring on the forest affect beneficial uses of water, and whether there is a trend over time for water quality in the plan area. There is uncertainty about to what degree management activities performed or permitted by the forest, or activities that visitors engage in, affect water quality.

WHAT data will be collected?

Indicators and Units of Measure:
Indicator 1. California Stream Condition Index (CSCI) – An index that incorporates a measure of ecological structure and function as well as taxonomic completeness by incorporating the following:

1. Multi-metric index
2. Observed vs. Expected index (O/E)

Indicator 2. Springsnail monitoring – occupancy in known locations

Method/Protocol:
Indicator 1**.** Data sources:

1. Most data is found on the State of California's Bioassessment Scores Map website: (http://www.arcgis.com/home/webmap/viewer.html?webmap=31ff89c58aeb440ea63e51afc646cffe&extent=-130.8686,29.2201,-109.3354,44.0172)
   The following steps will be used to access the Bioassessment Scores Map:
   a. Zoom to the Inyo National Forest and select each site within the National Forest Boundary, data will need to be manually inputted into an excel table.
   b. Create a graph to put the results into the bi-annual report comparing previous years data.
2. Data can also be downloaded from the California Open Data Portal. A link to the biological endpoints dataset, including the CSCI index, is found here: https://data.ca.gov/dataset/surface-water-flow-targets-for-southern-california-streams/resource/4c0f703e-14f2-4cc0-a4e0-4551081fb82b. The following steps will be used to download data from the Open Data Portal.
   a. Download the biological endpoints dataset
   b. Download the CEDEN Benthic Data (https://data.ca.gov/dataset/surface-water-benthic-macroinvertebrate-results/resource/3dfee140-47d5-4e29-99ae-16b9b12a404f)

c. Load both datasets into ArcGIS and link the biological endpoints dataset table to the benthic data table by the Station Code. This will allow you to link the CSCI index to individual GPS coordinates
d. Select by location using the Inyo National Forest boundary as the layer to filter by location and export locations to an excel spreadsheet
e. Use the exported table to create a graph that shows each station with the corresponding CSCI data. This data will be compared on a bi-annual basis to track trends of benthic macroinvertebrates (BMI) communities over time

3. The Lahontan Regional Water Quality Control Board provides up-to-date data. The current SWAMP program manager is Kelly Huck (530) 542-5458.

Indicator 2. Springsnail monitoring will occur at known locations (Sierra Nevada and White Mountain escarpment)

Sampling Design:
Indicator 1. Data collection will be completed by the State of California or their partners
Indicator 2. Spring snail monitoring will be conducted during OHV grant monitoring

Data storage:
The links provided above and below will provide the relevant data:

http://www.arcgis.com/home/webmap/viewer.html?webmap=31ff89c58aeb440ea63e51afc646cffe&extent=-130.8686,29.2201,-109.3354,44.0172

https://data.ca.gov/dataset/surface-water-flow-targets-for-southern-california-streams/resource/4c0f703e-14f2-4cc0-a4e0-4551081fb82b

https://data.ca.gov/dataset/surface-water-benthic-macroinvertebrate-results/resource/3dfee140-47d5-4e29-99ae-16b9b12a404f

WHEN will data be collected, evaluated, and reported?

Data collection schedule: Biennial; starting in August of each odd numbered year
Sampling duration: Ongoing
Reporting schedule: Biennial

HOW will data be evaluated for each indicator?

Evaluation protocol:
The State of California and their partners collect benthic macroinvertebrate data, which informs the California Stream Condition Index as reported to the State as part of the SWAMP program (in CEDEN database). Downloaded data from the CEDEN database or the NRM databases will be evaluated and the results are in the monitoring report. However, the frequency of data collection is highly variable and is dependent on state program's sampling priorities and/or concerns expressed by agencies, groups or the public. There is only one permanent sampling site within the forest located on Mammoth Creek. Other sites are part of the larger random sampling methodology. The year-to-year sampling variation may be

highly variable with some years only having one sample. Stations without multiple years of sampling will not have data available for comparing trends over time. Analysis and results will occur by the following methods:

1. An average CSCI score will be calculated for each station and an overall average score for all CSCI stations
2. Results will be displayed in tabular and graphical formats to observe trends of individual stations as well as all sites, over time. All station codes that are within and immediately downstream of the Inyo National Forest, will be analyzed in each report

Monitoring report:
Tables and graphs will be generated for the report that display individual CSCI scores for sampling stations as well as the overall average CSCI score for sampling stations. Each year these tables and graphs will be updated with the additional two years of data to observe trends over time. The baseline for this analysis will be all the data that has been collected as of the first monitoring report generated.

Other monitoring data:
The water board, or other agencies or groups may collect data for project/site specific monitoring, which should be reported to the State and entered into databases available for public use. The forest will incorporate additional comparable datasets as they are made available.

HOW will results be applied to management?

Compare indicator results with desired targets:

BMI CSCI scores: index scores should reflect likely intact conditions for most stream systems. Some sites may possibly be in an altered/very altered condition and this category should be less than 15% of the total number of sites.

Alerts:
If any station has a score that drops to a less desirable condition and remains there for more than one reporting cycle, then further investigation is warranted. If any site is within the likely altered or very likely altered category, then further investigation is warranted.

Adaptive management:
If after further investigation, there is evidence that the drop-in condition is a result of management actions that will likely degrade aquatic ecosystem integrity over the long-term, a change in management actions is warranted.

WHO populated the template, and who is responsible for collecting the data, evaluating the results, and issuing the report?

Nathan Sill populated the template.
Primary contact: Nathan Sill nathan.sill@usda.gov
Secondary contact: Kary Schlick kary.schlick@usda.gov

Ecological Conditions for At-risk Species (iv)

AR01: To what extent is the integrity of special habitats for at-risk plants and animals being maintained or improved?

WHY is this question being evaluated?

Desired condition:

TERR-SH-DC-01 The integrity of special habitats is maintained or improved from current conditions. Composition, diversity, and structure are maintained in all areas, including those with multiple-use activities.

WHAT is the problem or uncertainty?

Special habitats are generally small-scale habitat or vegetation types that may support unique assemblages of plants and animals, especially at-risk species. They may be characterized by uncommon rock types or soils or represent a unique geomorphic or geologic feature. Given the localized nature of special habitats, they are challenging to address comprehensively at the forest scale since they may be uniquely affected by management activities or disturbances. For example, restoring composition and structure in Jeffrey pine forest or sagebrush surrounding a pumice flat would not necessarily enhance ecological conditions for plants and their pollinators on the pumice flat. Also, disturbance, such as OHV intrusion, may be more likely to occur in a pumice flat than the surrounding denser vegetation. 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. Below are the primary special habitat types to be included in LMP monitoring; additional types may be added in the future.

1) Pumice Flats are a unique geomorphic feature in Mono County between Mono Lake and Mammoth. There are 9,536 acres mapped on the forest on the Mono and Mammoth Ranger Districts (INF TEUI Special Types). The Pumice Flats are a special habitat because they support endemic plant species such as Mono Lake lupine (*Lupinus durannii*) and Mono milkvetch (*Astragalus monoensis*), and a high biodiversity of low-growing forbs and associated pollinators. Potential threats include OHV trespass, vegetation and fire management activities, firewood collection, and utility ROW maintenance; one even used to contain an airstrip.

2) Colluvial Aprons are a unique feature of meadows on the Kern Plateau on the Mt. Whitney Ranger District. They are granitic gravelly/sandy aprons between meadows and upland conifer forest with extreme diurnal fluctuations in soil temperature (1,949 acres; INF TEUI Special Types). The colluvial aprons are a special habitat because they support the endemic plant species Ramshaw Meadows abronia (*Abronia alpina*) and a high diversity of low-growing forbs and pollinators compared to adjacent meadow and forest habitats. Potential threats include hiking trails and traffic, equestrian use, campsites, livestock grazing, changes in hydrology (snowmelt patterns and/or stream flow), and conifer encroachment.

3) Carbonate Rock Outcrops and Soils (e.g. limestone, dolomite, marble) are not uncommon in the plan area and occur on all districts. However, they are a special habitat because there are numerous plant species that are restricted to or more abundant on carbonate outcrops or soils (e.g. bristlecone pine (*Pinus longaeva*), bristlecone cryptantha (*Oreocarya roosiorum*), limestone beardtongue (*Penstemon calcareus*), marble rockmat (*Petrophytum caespitosum ssp. acuminatum*), limestone daisy (*Erigeron*

uncialis var. uncialis)). Potential threats include invasive species, fire/fire suppression, OHV, and trampling.

4) Alkali Flats are an uncommon habitat on the forest on the Mono and Mammoth Ranger Districts (9,370 acres; INF TEUI Special Types). This a special habitat because it supports rare plant species (e.g. alkali ivesia (*Ivesia kingii var kingii*), Parish's popcornflower (*Plagiobothrys parishii*), Williams' combleaf (*Polyctenium williamsiae*), Halls' meadow hawksbeard (*Crepis runcinata ssp. hallii*)). Potential threats include OHV, road maintenance, utility maintenance, and changes in water availability (e.g. changes in diversions/water use).

5) Caliche-Covered Clay Mounds are a very uncommon habitat. They only occur in the NE Mono Basin at the forest boundary (acreage unmapped). This is a special habitat because it supports rare plant species (e.g. silver bladderpod (*Physaria ludoviciana*), many-flowered thelypodium (*Thelypodium milleflorum*)). Potential threats include OHV, wild horse and livestock trampling, invasive species, and road maintenance.

6) Caves/Mines are numerous natural caves, crevasses and mining features identified on the forest. This is a special habitat because it supports SCC animal species including bats and a pseudoscorpion. Potential threats include recreation, mining, AML closures, disease (e.g., white nose) and climbing.

WHAT data will be collected?

Indicators and Units of Measure:

Indicator 1. Special habitat extent (number and/or acres of known sites, distribution on the forest).

Indicator 2. Special habitat health (ability to support endemic/dependent species; species composition; pollinator plant hosts; lack of disease, invasives, or encroachment; intact soil and water resources).

Indicator 3. Number, type, and extent of disturbance events (e.g., OHV trespass, wildfire, project implementation, observed trampling impacts (recreation, wild horse, stock, etc.), road/trail/utility maintenance, erosion/flooding, etc.).

Method/Protocol:

Indicator 1. Extent: Compile baseline from existing datasets including TEUI, CNDDB, NRIS, soil maps, and INF records to develop basic understanding of number of sites and acres of each type, as well as their distribution across the forest. Data are based on presence of and size of known special habitat.

Indicator 2. Health: Botanists/biologists conduct qualitative field assessments to document habitat condition. Occurs at a random or representative sample of sites or is targeted based on the results of Indicator 3 from prior year(s).

Indicator 3. Disturbance: Spatially intersect (GIS exercise) known disturbance events (OHV trespass, fires, project boundaries, location of road/utility maintenance, other natural disturbance, etc.) with known special habitats to document overlap. Botanists/biologists track projects which overlap special habitats, whether these projects incorporate "maintenance and enhancement needs" into project design (per TERR-SH-STD-01) and conduct project implementation monitoring to assess efficacy of project design/design features.

Sampling Design:
Indicator 1. Extent: Document and map additional sites/acres of special habitats across the forest as part of project botanical/biological surveys, incidental to other fieldwork, or through academic/partner research/surveys.

Indicator 2. Monitoring will occur at known special habitat sites in conjunction with project surveys or other monitoring where possible (e.g. OHV HMP, Range, Abronia population, project implementation). Monitoring will occur annually for a minimum of three days.

Quantitative population monitoring of *Abronia alpina* in the colluvial aprons of Ramshaw Meadow, Golden Trout Wilderness is conducted every three years (ABAL Conservation Strategy, INF/USFWS 2015); disturbance and impacts in colluvial habitats are noted incidental to this monitoring.

Indicator 3. Monitoring will occur across the forest. See Method/Protocol section above for general disturbance monitoring. In addition, OHV data are collected in accordance with existing forest-wide standard operating procedures (SOPs) for OHV ground Operations monitoring and documentation; includes incidence of trespass (off-route travel), block monitoring, restoration, and work completed by OHV technicians as part of the ongoing annual OHV Ground Operations grants.

Data storage: Box/T-drive

WHEN will data be collected, evaluated, and reported?

Data collection schedule: Annually for most data types. Abronia monitoring occurs every third year (2018, 2021, 2024…)
Sampling duration: Ongoing
Reporting schedule: Biennial

HOW will data be evaluated for each indicator?

Evaluation protocol: The extent of known/documented special habitat is maintained or increased on the forest (e.g. there is no loss to development/degradation/habitat conversion and there are ongoing efforts to survey for and document previously unknown special habitats).

Indicator 1. Extent of special habitats will be evaluated for three factors: a) The number and acres of monitored special habitat compared to known/mapped existing special habitat; b) documentation of additional acres/numbers/locations of special habitats; and c) no net loss of acres of special habitat.

Indicator 2. Health of special habitats will be evaluated using a qualitative assessment to identify degraded condition that could trigger further field assessment (quantitative) or corrective management actions.

Indicator 3. Quantity and impact of disturbances in special habitats will be evaluated based on a) whether they are addressed by remedial actions; b) number of projects affecting special habitats and c) do projects include maintenance and enhancement needs. The objective is that there should not be loss of acres or degradation occurring.

Monitoring report: Narrative description, tables summarizing monitoring and disturbance, photos, maps

Other monitoring data: Other possible sources of monitoring data could be collected by partnering researchers, botanists, or organizations. Could develop a site-steward program for volunteers to monitor high-risk sites (e.g., pumice flats in Mono County, important caves for bat roosting).

HOW will results be applied to management?

Compare indicator results with desired targets to determine if the results are meeting desired conditions of the PMP.

Alerts: Disturbances and impacts are detected and should be corrected as soon as possible in coordination with other staff areas (e.g., recreation, fire/veg). Ongoing or increasing disturbances at a site which have been monitored but have seen little improvement.

Adaptive management:
Prioritize sites that have experienced high disturbance for vegetation treatments, additional monitoring, more frequent law enforcement patrol, or improved educational signs/barriers.
Quantitative or repeat photo monitoring could be installed at sites with ongoing impacts, or spatial datasets such as aerial photography could be used to further evaluate trends. Projects can incorporate maintenance and enhancement needs when they overlap special habitats when feasible. Additional projects could be developed specifically to enhance or restore special habitat ecological conditions (e.g. removal of conifer encroachment in colluvial aprons, treatment of invasive species).

WHO developed the monitoring guide, and who is responsible for collecting the data, evaluating and reporting the results?

Monitoring guide was prepared by: Botanist, Inyo NF (Blake Engelhardt)
Data collection: Botanist and Wildlife Biologist, Inyo NF
OHV technicians and OHV cooperators
Possibly other partners, researchers
Data Processing**:** OHV/GIS Specialist on the forest processes OHV data and provides to specialists.
Botany and Wildlife Biology staff track monitoring activities of special habitats and associated species, as well as any project design/implementation that would maintain or enhance special habitats
Evaluation/Reporting: Completed by INF specialists (Botanist, Wildlife Biologist).

AR02: What is the quality of bighorn sheep winter range?

Desired condition:
SPEC-SH-DC-01: An adequate amount of suitable habitat supports persistent populations of bighorn sheep. These habitat patches include unforested openings supporting productive plant communities with a variety of forage species and near adequate steep rocky escape terrain throughout the elevational range within mountain ranges. These areas meet different seasonal needs for each sex for feeding, night beds, birthing sites, lamb rearing, and migration routes between suitable habitat patches.

WHAT is the problem or uncertainty?

There is a need for expanding habitat connectivity in the winter range of two subspecies of bighorn sheep, desert bighorn sheep (*Ovis canadensis nelson)*, and Sierra Nevada bighorn sheep (*Orvis canadensis Sierrae)* by decreasing canopy cover and stands of pinyon pine and other conifers. Conifer expansion threatens bighorn sheep winter range because it impedes bighorn sheep movement, limits foraging availability, and increases bighorn sheep vulnerability to predation. 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 problem is supported by the USFWS Recovery Plan for the Sierra Nevada (2007).

An action item of the Recovery Plan for Sierra Nevada bighorn sheep Recovery is the following: **2.2.3 Enhance bighorn sheep winter range habitat to increase visibility where appropriate** (USFW 2007, p.50). Favorable attributes of bighorn sheep habitat are steepness, rockiness, and visual openness. Although steepness and rockiness cannot be changed, openness scan be modified via management of vegetation. In the past, fires may have burned in bighorn sheep habitat much more frequently than has occurred over the past century. Early ground and aerial photos indicate that habitats in the eastern Sierra Nevada had little vegetation tall enough to obstruct vision of bighorn sheep, and pinyon pine woodlands largely have developed since 1860 (Miller and Tausch 2001). Fire can decrease the effectiveness of mountain lions as ambush predators and, perhaps, allow bighorn sheep greater access to low elevation winter ranges that provide nutritious forage by opening up habitat.

WHAT data will be collected?

Indicators and Units of Measure:
Indicator 1: Acres of fuels treatments (prescribed fire, mechanical and hand thinning) in bighorn sheep winter range
Indicator 2. Tree cover in winter bighorn sheep range

Method/Protocol:
Indicator 1.

1. Query Forest Inventory Tracking System (FACTS) database for acres of fuels treatments (prescribed burning)
2. Overlap bighorn sheep winter range layer with FACTS output to calculate the number of acres of managed fires

Indicator 2.

1. Develop a bighorn sheep winter range layer to quantify the number of available acres (polygon between wilderness boundary and Highway 395)

2. Calculate the number of acres of tree cover by overlapping winter range with the terrestrial ecological unit Inventory (TEUI) based vegetation layer

Sampling design: Quantify the total acres of managed fires in bighorn sheep winter range

Data location:

1. FACTS database – fuels treatment acres
2. Natural Resource Management (NRM): Natural Resource Information System (NRIS) – Number of acres enhanced to improve bighorn sheep habitat

WHEN will data be collected, evaluated, and reported?

Data collection schedule: Data refreshed annually
Sampling duration: Ongoing
Reporting schedule: Biennial

HOW will data be evaluated for each indicator?

Evaluation protocol:
Track acres of fuels treatments in bighorn sheep winter range habitat to determine if the spatial extent of bighorn sheep is expanding and if habitat is improving. Follow up field visits during burned area emergency response (BAER) or prior to snow fall to determine treatment effectiveness.
Monitoring report: Tables, maps
Other monitoring data: NA

HOW will results be applied to management?

Alerts: The spatial extent of wildfire in bighorn sheep winter range is not increasing over time. Managed fire is occurring less frequently, or fuels treatments are producing less effective results than desired.

Adaptive management: Incremental changes in bighorn sheep habitat may be improving habitat but on a much smaller scale. If results are not moving toward meeting desired conditions for bighorn sheep winter range, the approach to enhancing bighorn sheep winter range may need to be re-evaluated. Recommendations may include prioritizing fuels treatments where there would be a greater likelihood of success in the most desirable areas to benefit bighorn sheep winter range.

WHO developed the monitoring guide, and who is responsible for collecting the data, evaluating and reporting the results?

Kary Schlick - Wildlife Biologist

Literature Cited

Miller, R. F., and R. J. Tausch. 2001. The role of fire in pinyon and juniper woodlands: a descriptive analysis. Pages 15-30 in K. E. M. Galley and T. P. Wilson (eds.). Proceedings of the Invasive Species Workshop: the Role of Fire in the Control and Spread of Invasive Species. Fire Conference 2000: the First National Congress on Fire Ecology, Prevention, and Management. Miscellaneous Publications No. 11, Tall Timbers Research Station, Tallahassee, FL.

United States Fish and Wildlife Service: California and Nevada Operations Office. 2007. Recovery Plan for the Sierra Nevada Bighorn Sheep, 199 pp.

AR03: How is the condition of seasonal sage-grouse habitats and connectivity changing?

Desired condition:
SPEC-SG-DC-01: Suitable sage-grouse habitat includes breeding (nesting), brood-rearing, and wintering habitats that are distributed to allow for dispersal and genetic flow, with land cover dominated by sagebrush. Suitable habitat is predominantly sagebrush shrubland and sagebrush steppe, with associated mesic habitats. Specific vegetation conditions are closely tied to local conditions and ecological site potential.

The following desired conditions were added because of the threats (invasive grasses) to sustaining quality sage-grouse habitat:

SPEC-SG-DC-06: The extent and dominance of non-native annual grass species, such as cheatgrass, is limited and does not lead toward reduction in the suitability of sage-grouse habitat.

TERR-SAGE-DC-02: Sagebrush ecosystems are resilient to fire and other disturbances including grazing, recreation, invasive species (including cheatgrass) and climate change.

WHAT is the problem or uncertainty?
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. Sagebrush and pinyon-juniper ecosystems invaded by cheatgrass have reduced ecological integrity and are prone to type conversion to non-native grasslands post-fire.

WHAT data will be collected?
Indicators and Units of Measure:

Indicator 1. Spatial Extent (acres) of area with annual grasses
Indicator 2. Percent cover of annual grasses (value assigned to 30m cell)

Method/Protocol:
Indicators 1, 2. R5 RSL produces an annual summary of annual grass cover (proxy for cheatgrass cover). Cover is derived from bi-weekly LandSat imagery with initial field data collection for calibration; the product is a raster dataset for the entire plan area with 30m cells assigned an annual grass % cover value for each year, during the growing season. The high temporal resolution of the imagery collection enables the detection of phenological change through the growing season. The variability of vegetation indices, such as NDVI, and their absolute values are input to the model to estimate annual grass cover. The model has been primarily calibrated for shrublands but may also be utilized in forested settings. Retrospective estimates of annual grass cover will be created for at least two years in the decade prior to the evaluation period, to serve as a point of comparison for trends.

Sampling Design:
Indicators 1, 2. Data will be collected for the indicators across the forest and will be summarized by vegetation type and for sage-grouse habitat and compared to previous years available as far back as

(2009). For field-based data collection the primary focus area has been in the Crowley Basin, which has high priority sage grouse habitat and where a very high density of monitoring plots exist. Plot data for shrub cover, all species compositions, and invasive grass.
Steps for incorporating field data with remote sensing to develop a model for the Sierra Nevada range:

1. Collect training data to determine what invasive grass looks like in a remote sensing signature at the 30 m scale., which so far, data has been a combination of field plots and desktop high-resolution imagery interpretation (on screen in some cases, we can actually evaluate % cover in 30 m pixels.).
2. Training data will be used to create a landscape/forest-wide raster map of invasive cover
3. A balance will be determined between field data collection and what can be achieved with image interpretation. Currently, model development is at this stage to determine what the minimum sample of field data is needed to develop the desktop image interpretation.

Data storage: Raster products to be obtained from R5 RSL.

WHEN will data be collected, evaluated, and reported?

Data collection schedule: Landsat images are collected bi-weekly and used to produce an annual raster GIS product. RSL will provide both annual datasets for each two-year monitoring period. Field data collection is described in sampling design above.

Sampling duration: Ongoing
Reporting schedule: Biennial

HOW will data be evaluated for each indicator?

Evaluation protocol:
Indicators 1, 2. The proportion of the Inyo NF with presence of cheatgrass as well as various cover classes of cheatgrass will be displayed as a map and compared to previous years, at the forest level and/or in veg types and habitat units of interest. Increasing rates of change (compared to baseline trend) in specific veg or habitat types or in areas with disturbance/management action would indicate a declining trend or departure from desired condition.
This question is also partially answered by question *TE03: What is the condition of sagebrush communities?*

Monitoring report: Map with higher values of cheatgrass displayed in red and lower values towards green, with areas lacking cheatgrass having no color. Indicators will also be summarized numerically in a figure/table summarizing average and range of percent cover by habitat type, or proportion of habitat type within various classes of cover.

Other monitoring data: Other possible sources of annual grass data that could be used in complement with the forest-wide remote-sensing product include:

1. R5 Ecology Plots- presence/absence and cover of cheatgrass in these plots (re-sampled sporadically) (R5 Ecology)
2. FIA data for understory vegetation (FS FIA)
3. AIM plots with presence/absence of cheatgrass (INF Veg/Fuels

4. Project-level quantitative or qualitative monitoring data on cheatgrass response to treatment (INF Botany)
5. NRIS Invasive Species Inventory data (acres, location) (INF Botany)
6. BAER post-fire Invasives EDRR survey findings (INF Botany)

HOW will results be applied to management?

Compare results for all indicators with desired targets: Because of the ecosystem and habitat values provided by healthy sagebrush and pinyon-juniper communities, and the challenges of restoration in these ecosystems, the forest should strive to not increase the extent or percent cover of annual grasses on the landscape. If resources and effective methods are available, there should be efforts to reduce the area dominated by annual grasses, including maintenance of native shrub and perennial grass components.

Success will be obtained if trends of annual grass extent and cover are stable or decreasing during the evaluation period as compared to 5-10 years prior to implementation of the plan.

Alerts: Annual grass cover values above ~10-20% in contiguous areas create sufficient continuity of flashy fuels to carry frequent fire and may suppress native vegetation, based on field observations from the Inyo NF. Because there is no established threshold for cheatgrass cover, this range of cover values will be used as a starting point during the first year of reporting and may be adjusted in the future. The raster dataset will be evaluated for areas of contiguous high % cover values within watersheds, fires, priority habitats, project areas, etc., to identify areas of potential concern.

Adaptive management: Annual grass cover values above ~10-20% in contiguous areas could trigger a need to conduct a more targeted assessment of grass cover using field evaluation to determine reliability of the mapping output and trend. In areas where non-native grass cover is increasing, specialists should identify the drivers of vegetation change (e.g. recent fire, fire suppression activities, recreational use, mortality due to drought, etc.) and discuss the feasibility and opportunity for lessening the impacts from the identified stressor. If the trend persists, then a change in management activities may be warranted. An example of potential actions is listed below:

Driver of increased extent and cover	Potential management action
Excessive fire	Aggressive fire suppression response, avoid/target prescribed burning to improve resilience, public education to reduce fire risk, limit use of recreation with high ignitions or where vegetation is recovering, reduce flashy fuels in fire prone corridors
Drought	Promote drought tolerant natives, forest health treatments, invasive plant removal to reduce competition
Other disturbances (OHV, Cattle Grazing)	Reduce recreational use, evaluate grazing regime

In instances where it is not possible to maintain or reverse the trend, a discussion of species-specific effects and actions to lessen these impacts will be important. For example, areas that are high priority

habitat for sage-grouse nesting and rearing could be prioritized for restoration with native grass and shrub species that contribute structure and are more tolerant of frequent disturbance.

WHO developed the monitoring guide, and who is responsible for collecting the data, evaluating and reporting the results?

Monitoring guide was prepared by: Botanist, Inyo NF (Blake Engelhardt)

Data collection, generation, processing:
Ecologist, R5 RSL(data collection, model creation and data generation)
Botanist, Inyo NF (data collection and product evaluation)
Evaluation/Reporting: Completed by INF specialists (Botanist, Wildlife Biologist) and/or Resource Officer with local knowledge of vegetation, disturbances, and habitat characteristics on the forest.

Visitor Use, Visitor Satisfaction, and Progress toward Meeting Recreation Objectives (v)

VU01: What are the trends in visitor use and satisfaction?

WHY is this question being evaluated?

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.

Desired condition:
REC-FW-DC-03 Recreation opportunities provide a high level of visitor satisfaction. The range of recreation activities contribute to social and economic sustainability of local communities.

WHAT is the problem or uncertainty?

It is unknown what type, quantity, and quality of recreation opportunities the Inyo NF will need to provide in response to future changes in recreation activity.

WHAT data will be collected?

Indicators and Units of Measure: Trends in visitor use and satisfaction
Multiple satisfaction metrics and participation rates for recreation activities as outlined in the USFS National Visitor Use Monitoring (NVUM) protocol.

Method/Protocol: Visitation estimates, visitor activities, and percent overall satisfaction are collected every five years via the National Visitor Use Monitoring (NVUM). Information about the visitor use monitoring program and forest results can be found at: https://apps.fs.usda.gov/nvum.

NVUM provides information that is valid and applicable at the national, regional and forest level, but it is not designed to be accurate at the district or site level.

The NVUM protocol has 14 metrics that are assessed in developed facilities, access, services, and safety. Metrics are based on a scale of categorical data from 1-5 (i.e., dissatisfied to very satisfied). The difference between what visitors feel is important to their satisfaction with an aggregated score of 20% or more, indicates a need for further investigation. The metrics are designed to show change over time in visitor satisfaction.

NVUM data will be collected by a contractor and processing and reporting are done by the WO.

Data storage:
https://www.fs.fed.us/recreation/programs/nvum/

WHEN will data be collected, evaluated, and reported?

Data collection schedule: Every five years. Next survey will occur in 2021.
Sampling duration: Ongoing
Reporting schedule: Data processing will be completed by the WO and included in the monitoring report occurring after the most recent NVUM survey. The earliest report would be calendar year 2021 or early 2022.

HOW will data be evaluated for each indicator?

Evaluation protocol: Evaluate potential trends by calculating percent change in indicators. Data are quantitatively collected and analyzed every 5 years.
Monitoring report: Tabular and graphic
Other monitoring data: None

HOW will results be applied to management?

Comparison is built into the NVUM data processing and reporting system to determine the level of visitor satisfaction.

Alerts: If the trends in visitor satisfaction continue to decrease over time.

Adaptive management:
Potential actions depend on the specific component of visitor satisfaction that indicates a need for action (e.g., parking availability, trail condition, restroom cleanliness).

WHO populated the template, and who is responsible for collecting the data, evaluating the results, and issuing the report?

Adam Barnett, Assistant Public Services Staff Officer

VU02: To what extent are trails providing access to the activities as intended?

WHY is this question being evaluated?

The Inyo trail system provides access to most areas of the forest. Motorized and non-motorized trails also provide for a variety of recreational activities such as hiking, horseback riding, backpacking, trail running, mountain biking, and off-highway vehicle driving. An open and useable trail system is necessary to continue to provide access and trail-based activities.

Desired condition:
REC-FW-DC-11: The Inyo National Forest provides a range of year-round developed and dispersed recreation settings that offer a variety of motorized and nonmotorized opportunities and recreation experiences.

REC-FW-OBJ-03: Within 10 years of plan approval, maintain to standard 75 percent of the Inyo's designated trail system.

WHAT is the problem or uncertainty?

Number of miles of trails built or maintained (to standard), or closed per year.

WHAT data will be collected?

Indicators and Units of Measure: Miles of motorized and nonmotorized trails maintained, built, or closed.

Method/Protocol: Data are collected and entered into the Infrastructure Administrative Sites, Recreation Facilities, and Roads (INFRA) database annually at end of the fiscal year. INFRA is a part of the Forest Service's Natural Resource Manager (NRM) system; information about these databases is available at http://fsweb.nrm.fs.fed.us/. Monitoring data would also be queried from the INFRA database for reporting.

Sampling Design: Verify miles of trails that were maintained, built, or closed each year

Data storage: USFS NRM Database/Business Areas/Recreation/Trails/Reports

WHEN will data be collected, evaluated, and reported?

Data collection schedule: Road maintenance inventory occurs from July-September during the field season.
Sampling duration: Ongoing
Reporting schedule: Biennial

HOW will data be evaluated for each indicator?

Evaluation protocol: Compare annual miles maintained, built, or closed at one-year intervals. Analyze trends by calculating percent change in miles maintained to standard.
Monitoring report: Tabular and graphic
Other monitoring data: NA

HOW will results be applied to management?

Evaluate the percent of trails maintained to the desired target of maintaining 75 percent of the Inyo's designated trail system to standard within 10 years of plan approval.

Alerts: After two reporting cycles, trends indicate that the forest is not on a trajectory to achieve targets to standard.

Adaptive management: The Inyo NF offers an extensive network of trails. If targets are unattainable, a plan of action may be needed to change the trajectory toward meeting targets within 10 years of plan approval. Possible solutions may include evaluating the forest's capacity to achieve goals with current staff or explore increasing partnerships or volunteer groups to assist with maintenance activities.

WHO populated the template, and who is responsible for collecting the data, evaluating the results, and issuing the report?

Template completed by Adam Barnett, Assistant Public Services Staff Officer

Trails data are entered into the Forest Service INFRA database annually. District recreation staffs are responsible for data entry. Forest recreation staff is responsible for evaluating and reporting results.

VU03: How effective have Forest communications with the public been in considering diverse backgrounds?

WHY is this question being evaluated?

The Inyo attracts visitors from around the country and the world. Effective communication is necessary to ensure that visitors can access the information they need to enjoy the forest responsibly.

Desired condition:
VIPS-FW-DC-04: The diverse backgrounds and needs of visitors are considered in the design of communication and interpretive messages.

WHAT is the problem or uncertainty?

It is unknown if forest communications are serving a diversity of visitors.

WHAT data will be collected?

Indicators and Units of Measure:
Indicator 1. Standard demographic data
Indicator 2. Public outreach activities identified by the Forest Public Affairs Officer

Method/Protocol:
Indicator 1. Forest visitor demographic data are collected on a five-year cycle during the NVUM process.
Indicator 2. Public outreach activities will be compiled biannually by the Forest Public Affairs Officer to coincide with the forest plan monitoring reporting schedule.

Sampling Design:
Demographic data are collected using a stratified random sample and in-person interviews. Public outreach activities are identified by the Forest Public Affairs Officer.

Data location:
https://www.fs.fed.us/recreation/programs/nvum/

WHEN are the data being collected, evaluated, and reported?

Data collection schedule:
Demographic data are collected on a five-year schedule. Public outreach activities will be compiled every two years coinciding with the forest plan monitoring schedule.
Sampling duration: Ongoing
Reporting schedule: Biennial

HOW will data be evaluated for each indicator?

Evaluation protocol:
Indicator 1. Compare demographic data in five-year intervals to identify possible trends
Indicator 2. Identify changes in demographics and the number of public outreach activities to inform forest outreach efforts to serve a diversity of visitors

Monitoring report: Tabular and graphic
Other monitoring data: None

HOW will results be applied to management?

Compare indicator results with desired targets: An increasing trend in demographic diversity of visitors is desired.

Alerts: A declining trend in the demographic diversity of visitors or a declining trend in public outreach activities would warrant further investigation.

Adaptive management: Potential actions could include increased investment in public outreach to diverse communities using forest staff, partners, or contracted services.

WHO populated the template, and who is responsible for collecting the data, evaluating the results, and issuing the report?

Template completed by Adam Barnett, Assistant Public Services Staff Officer

VU04: To what extent is designated wilderness being managed to preserve wilderness character?

WHY is this question being evaluated?

Federal law mandates the preservation of wilderness character. The Inyo includes about one million acres of congressionally designated wilderness in nine areas. Preserving wilderness character achieves the goal of the Wilderness Act and ensures outstanding opportunities for the visiting public.

Desired condition:
DA-WILD-DC-01: The wilderness character of each wilderness, including the qualities of untrammeled, natural, undeveloped, opportunities for solitude or primitive recreation, and other features of value (e.g., ecological, geological or other features of scientific, educational, scenic, cultural or historical value specific to each wilderness area) are preserved and, when possible, enhanced.

WHAT is the problem or uncertainty?

The trend in wilderness character is unknown.

WHAT data will be collected?

A suite of wilderness character monitoring data are collected by various Forest staff and partners. Data are entered by a combination of Forest staff and WO wilderness staff. WO staff are developing a Natural Resource Management (NRM) module to compile and report the results.

Indicators and Units of Measure: Forest Service Wilderness Character Monitoring Protocol (refer to pp 7-10 for summary) for complete list of indicators. Units of measure depend on the indicator and indicators selected vary by wilderness area.

Method/Protocol: USFS National Wilderness Character Monitoring Protocol (USFS Wilderness Character Monitoring Technical Guide, May 2019).

Sampling Design: Sampling design and methods vary by indicator. Forest Service Wilderness Character Monitoring Protocol (refer to pp. 7-10 for summary) for complete list of indicators. Relative indicators for each wilderness area are in the process of being selected.

Data storage: USFS NRM Wilderness Character Monitoring module

WHEN will data be collected, evaluated, and reported?

Data collection schedule: National funding is being used to develop the wilderness character baseline including the use of partners. The data collection schedule varies by indicator. A comprehensive assessment of all indicators is completed every five years starting with the year that the wilderness character baseline condition is established for each wilderness (refer to USFS National Wilderness Character Monitoring Protocol for frequency of data collected for each indicator).

Sampling duration: Ongoing

Reporting schedule: Reporting is completed every five years starting with the year that the wilderness character baseline condition is established for each wilderness. Inyo baselines are scheduled to be completed between 2020 and 2022 depending on the wilderness. Reporting for all nine wildernesses would be included in the next forest plan monitoring report after 2022.

HOW will data be evaluated for each indicator?

Evaluation protocol: All indicators are aggregated to get an overall trend in wilderness character for each of the 9 wilderness areas. Data analysis and reporting is automated in the NRM WCM module.
Monitoring report: Tabular and graphic
Other monitoring data: None

HOW will results be applied to management?

Compare indicator results with desired targets:

The baseline condition will be the year that the initial round of monitoring is completed using data from the year of designation or as close to that year as possible. The target is a stable or improving trend in wilderness character for each of the nine wildernesses managed by the Inyo NF.

Alerts: Overall declining trend in wilderness character for any of the nine wildernesses managed by the Inyo NF would trigger further investigation.

Adaptive management: Possible management actions vary widely depending on the indicators that are found to be drivers of declining wilderness character.

Literature Cited

Landres, Peter; Boutcher, Steve; Mejicano, Elizabeth, tech. eds. 2018. Wilderness character monitoring technical guide. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

WHO populated the template, and who is responsible for collecting the data, evaluating the results, and issuing the report?

Template completed by Adam Barnett, Assistant Public Services Staff Officer

Climate change and Other Stressors (vi)

CC01: How are high-elevation white pines responding to the effects of climate change and other stressors?

WHY is this question being evaluated?

Desired condition:

TERR-ALPN-DC-03 Subalpine woodlands are resilient to insects, diseases, fire, wind and climate change. High-elevation white pines (e.g., whitebark pine, Great Basin bristlecone pine, limber pine and foxtail pine) are healthy and vigorous, with a low incidence of white pine blister rust, and resilient to moisture stress and drought. White pine blister rust-resistant trees are regenerating and populations of high elevation white pines have the potential to expand above the tree line.

WHAT is the problem or uncertainty?

This question was designed to address the pattern and trend in high-elevation white pines, which are essential in many subalpine ecosystems. Changes in spatial extent, health, and regeneration of high-elevation white pine woodlands are essential indicators of subalpine ecosystem function and integrity. For example, some whitebark pine forest ecosystems on the Inyo National Forest have recently experienced elevated levels of tree mortality associated with warming regional temperature trends and associated mountain pine beetle outbreaks. 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. The identification of landscapes with elevated levels of high-elevation white pine mortality could be targeted for ecological restoration treatments (e.g., prescribed fire or managed wildfire) to improve ecosystem resilience to stressors or focused field-based monitoring to identify the impact of interactive stressors.

WHAT data will be collected?

Indicators and Units of Measure:

Indictor 1. Spatial extent of high-elevation white pine forests by forest type
Indicator 2. Tree mortality and incidence of insects, disease, and pathogens in high-elevation white pine stands
Indicator 3. Spatial extent of tree regeneration in high-elevation white pine stands

Method/Protocol:

Indicator 1: Spatial extent of high-elevation white pine forests by forest type can be obtained from the following sources:

1. R5 USFS EVEG
2. Distribution map of whitebark pine provided by R5 USFS Remote Sensing Lab
3. In both cases, spatial extent could be analyzed with the eDaRT tool to estimate potential loss of high-elevation white pine spatial extent in areas classified with a high magnitude of change

In both cases, spatial extent could be analyzed with the eDaRT tool to estimate potential loss of high-elevation white pine spatial extent in areas classified with a high magnitude of change.

Indicator 2. Tree mortality and forest health data for high-elevation white pines can be extracted from Forest Inventory and Analysis (FIA) data summaries, with supplemental information from USFS Forest Health and Protection aerial detection survey reports.

Indicator 3. Tree regeneration should be changed to a contingent indicator, dependent on whether there are notable changes in indicator 1 (spatial extent).

If notable changes are observed, the Inyo NF could inventory stands following stand-replacing events if within its capacity, especially in non-wilderness areas where management interventions are possible.

NOTE: 'spatial extent' should be changed to 'frequency of occurrence' or 'density' and should be summarized by forest type.

NOTE: whitebark pine regeneration can be monitored at the regional scale and part of the whitebark pine conservation strategy.

Sampling design: Data will be collected forest wide for all indicators.

Indicator 1. Spatial extent (in acres) of high-elevation white pines will be summarized by forest type (i.e., regional dominance [(EVEG type 1 or 2]):

1. Whitebark pine (*Pinus albicaulis*)
2. Great Basin bristlecone pine (*P. longaeva*)
3. Limber pine (P. flexilis)
4. Foxtail pine (*P. balfouriana subsp. austrina*)

Indicator 2. Tree mortality of high-elevation white pines will be presented as a density estimate (i.e., the number of dead tree stems that were previously coded as live stems per acre). The percentage of trees that exhibit evidence signs of insects or pathogens will be summarized based on the following categories:

1. Mountain pine beetle
2. White pine blister rust
3. other insects or pathogen

NOTE: FIA data are likely limited in sample size for all species except whitebark pine; therefore, alternative data sources such as Forest Health Protection aerial survey data and pest detection reports could be used where FIA data are unavailable.

Indicator 3. The frequency of occurrence (%) and density (number per acre) of high-elevation white pine tree regeneration will be summarized by forest type (see 1. above) in large patches of high white pine mortality only (see desired target and range section below).

NOTE: FIA data likely limited in sample size for all species except whitebark pine

Data location:

1. EVEG: FS R5 geospatial data
2. F3 data are currently available at R5 RSL
3. FIA: https://www.fia.fs.fed.us/tools-data/ and Aerial Detection Survey: ADS website

WHEN will data be collected, evaluated, and reported?

Data collection schedule:

1. EVEG data are updated every 10 to 15 years by USFS R5 Remote Sensing Lab. F3 data could be updated more regularly
2. FIA data are completely updated every 10 years (10% of plots are resampled annually in CA) by the USFS Forest Inventory and Analysis program
3. ADS data are updated annually, although there may be notable gaps in data coverage

Sampling duration: Ongoing

Reporting schedule: Data will be incorporated and updated into the Plan Monitoring Program every other biennial monitoring evaluation report, or more frequently if Inyo National Forest staff observe substantial increases in mortality of high-elevation white pine stands (based on incidental field surveys or aerial detection survey reports describe notable increases in mortality agents). These data will next be evaluated and reported in 2022, 2026, and onwards.

HOW will data be evaluated for each indicator?

Evaluation protocol:

Indicator 1. Spatial extent: Spatial extent of high-elevation white pine forests will be estimated by forest type (status) and compared to previous estimates (trend).

Indicator 2. Forest health: Percent tree mortality and insect and pathogen incidence will be displayed for whitebark pine only (see 3.a. above). ADS data may be available for all four tree species.

Indicator 3. Tree regeneration: The frequency of occurrence and density of whitebark pine regeneration will be displayed for the whitebark pine forest type. Other species will be displayed if sufficient sample size is available.

Monitoring report:

Indicator 1. Spatial extent of high-elevation white pines will be mapped by forest type and total areas will be displayed over time to graph trends.

Indicator 2. Forest health (% tree mortality, % incidence of insects or pathogens) data will be displayed in a tables or other data summary. Areas of elevated mortality, insect outbreaks, or white pine blister rust incidence (currently absent on the forest) could be displayed on a map.

Indicator 3. Tree regeneration data will be displayed in a table or other data summary.

Other monitoring data:

Indicator 1. Spatial extent – Also used in the Draft Region 5 Broader-scale Monitoring Strategy for whitebark pine only; additional whitebark pine mapping and F3 data (both currently in development by the R5 Remote Sensing Lab) could be used to map spatial extent more accurately than EVEG data.

Indicator 2. Forest health – Also used in the Draft Region 5 Broader-scale Monitoring Strategy for tree mortality; USFS R5 monitoring efforts (RSL, R5 Ecology Program) could provide supplementary information for whitebark pine.

Indicator 3. Tree regeneration – Also used in the Draft Region 5 Broader-scale Monitoring Strategy; USFS R5 monitoring efforts (RSL, R5 Ecology Program) could provide supplementary information for whitebark pine.

HOW will results be applied to management?

Compare indicator results with desired targets: Success will be observed if:

Indicator 1. Spatial extent – Desired target is small patches (consult Province Ecologist on current threshold value between 20 and 100 acres in size) of high tree mortality in high-elevation white pine stands, especially for whitebark pine forests (see Meyer et al. 2016 for example).

Indicator 2. Forest health – Desired targets include tree mortality rates (<1-2% per year) or insect of pathogen incidence within the natural range of variation (mortality rate: <1-2% per year; insect/pathogens: <2-5% per year or confined to patches <0.2 acre in size) (NRV; see Meyer and North 2019).

Indicator 3. Tree regeneration – Desired target is at least 150 to 200 stems per acre of white pine regeneration in areas of high white pine tree mortality as identified in spatial extent indicator.

Alerts: If the spatial extent, health, or regeneration of high-elevation white pine forests substantially declines (especially two or three indicators simultaneously), then this could trigger a need to conduct a more targeted evaluation using finer scale data (e.g., R5 ecology program and RSL whitebark pine monitoring plots). This could clarify the nature and extent of the trend and whether it is indicative of a loss in subalpine ecosystem health, resilience, and integrity. If substantial impacts are observed with more targeted evaluation, then this may require a change in management activities, such as increased use of wildland fire to increase forest landscape heterogeneity and white pine regeneration (Keane et al. 2012).

If an increase in the incidence of white pine blister rust (WPBR) is observed in high-elevation white pines (presumably from a more targeted evaluation with laboratory identification) this could initiate additional management actions, possibly including: (1) more targeted monitoring, (2) an investigation into the feasibility of planting WPBR-resistant seedlings in cooperation with the USFS Placerville nursery and other partners, and (3) seed collection efforts associated with WPBR resistance program in Region 5.

Adaptive management: In the above cases, it is unlikely that the desired condition (DC) would require a Forest Plan amendment. However, if persistent declining trends are observed in all indicators, then the Inyo National Forest will consider steps outlined in a white pine conservation/restoration strategy (e.g., whitebark pine strategy for R5) to address persistent declining trends.

Literature Cited

Keane, Robert E.; Tomback, D.F.; Aubry, C.A.; Bower, A.D.; Campbell, E.M.; Cripps, C.L.; Jenkins, M.B.; Mahalovich, M.F.; Manning, M.; McKinney, S.T.; Murray, M.P.; Perkins, D.L.; Reinhart, D.P.; Ryan, C.; Schoettle, A.W.; Smith, C.M. 2012. A range-wide restoration strategy for whitebark pine (Pinus albicaulis). Gen. Tech. Rep. RMRS-GTR-279. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 108 p.

Meyer, M.D., and M.P. North. 2019. Natural range of variation of red fir and subalpine forests in the Sierra Nevada bioregion. Gen Tech. Rep. PSW-GTR-263. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. 135 p.

WHO developed the monitoring guide, and who is responsible for collecting the data, evaluating and reporting the results?

Primary Contact: Province Ecologist, Marc Meyer, 760-873-2447, marc.meyer@usda.gov

Secondary Contact: RSLEcologist, Michèle Slaton, 760-873-2498, michele.slaton@usda.gov

CC02: What changes have occurred to the timing, amount, and duration of natural and managed runoff into the national forest's waterways?

WHY is this question being evaluated?

Desired condition:
WTR-FW-DC-01: Adequate quantity and timing of water flows support ecological structure and functions, including aquatic species diversity, and riparian vegetation. Watersheds are resilient to changes in air temperatures, snowpack, timing of runoff, and other effects of climate change.

WHAT is the Problem or Uncertainty?

The question was designed to address whether forest management or activities occurring on forest lands affect the timing, amount and duration of runoff from both managed and natural waterways.

WHAT data will be collected?

Indicators and Units of Measure:
Annual in-stream flow regime for selected waterways (excluding waterways regulated by the Federal Energy Regulatory Commission) measured in cubic feet per second (CFS) and annual runoff for a given year in acre-feet for watersheds throughout the forest.

Method/Protocol:
Summarized data will be downloaded from the Los Angeles Department of Water and Power (LADWP) website for the LADWP Annual Owens Valley Report. These data will provide the streamflow (cfs) for various sub-watersheds and can be used to determine a rough estimate of how many acre-feet of water came off the forest, and the general annual hydrograph for each of those sub-watersheds. Specific stream data must be requested from LADWP annually and will not be requested unless further detail is desired in the future.

Sampling Design: No data will be collected

Data storage:
The LADWP Annual Owens Valley Report: https://www.inyowater.org/documents/reports/ladwp-annual-owens-valley-report/

The LADWP will need to be contacted for stream-specific data if we determine that watershed-wide data is not sufficient to answer this question.

WHEN will data be collected, evaluated, and reported?

Data collection schedule: Annually
Sampling duration: Annual flow and hydrograph (timing and magnitude of flows) will be researched and recorded once per year.
Reporting schedule: Biennial

HOW will data be evaluated for each indicator?

Evaluation protocol:
Monitoring the annual acre-feet that the Owens River and Mono Lake watershed produces, will provide an estimate of how the timing, amount, and duration of runoff has changed over time. The Forest will summarize Owens River and Mono Lake watershed annual flow and its change over time, as well as

some of the sub-watersheds with the most active forest service management. Data on individual streams or sub-watersheds or more frequent flow information will not be obtained unless warranted by priorities or findings of watershed-wide monitoring.

Given that the forest will not likely have resources to collect water quantity data, the above methods are the most feasible way to collect and analyze information. These data will be of limited use in terms of evaluating how management activities on the forest are affecting the timing, amount and duration of runoff.

Monitoring report:
Data will be graphed to show annual runoff from the Owens River and Mono lake watersheds, over the past 20 years, and hydrographs over time when available. The graphs will be able to show the change in timing, amount and duration for watersheds over time. Land management activities will have to be large relative to the size of the watershed (e.g., large wildfire) to be meaningful in context of land management, otherwise differences in the amount, timing and duration of runoff would be negligible.

Other monitoring data:

HOW will results be applied to management?

Graphing the given indicators over time, will establish a trend showing the change in the timing, amount and duration of runoff coming off the forest.

WHO populated the template, and who is responsible for collecting the data, evaluating the results, and issuing the report?

Michael Wiese and Todd Ellsworth populated the template.
Primary contact: Todd Ellsworth, watershed program manager, todd.ellsworth@usda.gov
Secondary contact: Michael Wiese, Michael.wiese@usda.gov

CC03: How are fire regimes changing compared to the desired conditions and the natural range of variation?

WHY is this question being evaluated?

Desired condition:
FIRE-FW-DC-01: Wildland fires burn with a range of intensity, severity, and frequency that allows ecosystems to function in a healthy and sustainable manner. Wildland fire is a necessary process, integral to the sustainability of fire-adapted ecosystems.

WHAT is the problem or uncertainty?

This question was designed to address the pattern and trend in fire regimes, which is an essential ecological process in terrestrial and riparian ecosystems. Changes in fire regimes, including departure in fire frequency, severity, or extent, is an essential indicator of terrestrial ecosystem function and integrity. For example, currently 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. There is uncertainty regarding the degree and extent of negative impacts of changing fire regimes on terrestrial and aquatic ecosystems due to the interaction of additional stressors (e.g., climate change, invasive species, insect outbreaks) with fire. The identification of landscapes with increased fire regime departure from NRV could be targeted for ecological restoration treatments to improve ecosystem resilience to stressors or focused field-based monitoring to identify the impact of interactive stressors.

WHAT data will be collected?

Indicators and Units of Measure:
Indicator 1. Fire return interval departure (FRID)
Indicator 2. Number and acres of wildfire by ecosystem type
Indicator 3. Fire severity by ecosystem type

Method/Protocol:
Indicator 1. FRID – Data are obtained from the USFS R5 RSLand R5 Ecology Program provides FRID data using methods outlined in Safford and van de Water (2014).

Indicator 2. Number and acres of wildfire – Data are obtained from the CalFire California Fire and Resource Assessment Program (FRAP) Statewide Fire Perimeter Database.

Indicator 3. Fire severity – Data are obtained from the USFS R5 RSLVegetation Burn Severity (if available) or the Monitoring Trends in Burn Severity (MTBS) program.

Note: MTBS data are somewhat problematic in that fire severity thresholds are not field calibrated and subject to unintended bias and other inaccuracies.

Sampling Design: For all indicators, data will be collected for the entire Inyo National Forest spatial extent. The following specific metrics will be used:

Indicator 1. FRID – Fire return interval condition class (mean CC_FRI), which ranges from -3 (currently burning much less frequent than historical reference condition) to 3 (currently burning much more

frequently than historical reference), which are indicative of high departure. Values of 1 or -1 indicating current conditions that have low departure from this natural fire return interval.

Indicator 2. Total number and acres of wildfires – Wildfires (≥10 acres in size) will be categorized by fire management strategy (full suppression vs. other as recorded in FRAP database (objective field) and local forest specialist input) and totaled separately by ecological zone (arid shrublands & woodlands, montane, subalpine/alpine).

Indicator 3. Fire severity – Vegetation burn severity calibrated to the Composite Burn Index (CBI) will be used if available (otherwise MTBS fire severity data which are generally limited to fires >1000 acres in size) and evaluated by the 3 ecological zones.

NOTE: 'ecosystem type' should be changed to 'ecological zone'

Data location:

1. FRID – USFS R5 geospatial data - FRID
2. Number and acres of fire – FRAP GIS data
3. Fire severity – USFS R5 regional geospatial data

WHEN are the data being collected, evaluated, and reported?

Data collection schedule:
Indicator 1. FRID data are updated annually by USFS R5 Remote Sensing Lab.

Indicator 2. Fire perimeter data are updated annually by CalFire's Fire and Resource Assessment Program

Indicator 3. Vegetation burn severity data in R5 are updated annually by USFS R5 GIS (contingent on R5 capacity and resources). MTBS data are updated annually by the MTBS program, but with a time lag of a few years in data availability.

Sampling duration: Ongoing
Reporting schedule: Biennial commencing 2022

HOW will data be evaluated for each indicator?

Evaluation protocol:
Indicator 1. FRID: The proportions of the Inyo NF in each fire regime condition class (6 total) are estimated (status) and compared to previous estimates (trend). Increasing levels of fire return interval departure indicates a declining trend in fire regime integrity.

Indicator 2. Number and acres of wildfire: The total number and area (in acres) burned in wildfires will be displayed by fire management type to determine if there is an increasing trend in wildfires managed with full suppression objectives.

Note: Trends in wildfires categorized as 'other' management type will be evaluated in PC03 (Acres of fires managed for resource objectives).

Indicator 3. Fire severity: The proportion of each fire severity class (unchanged, low, moderate, high) will be estimated for each fire and summary statistics will be calculated by ecological zone (status). Trends

in high severity proportion could potentially be calculated for the forest but may be more appropriate at a provincial or regional scale.

Note: recommend dropping by ecological zone and concentrating on the montane forest zone only, since the other zones are not informative from a forest monitoring standpoint.

Additional note: See Meyer (2015) for example of comparing fire severity information to NRV, as well as additional metrics such as composite burn index.

Monitoring report:
Indicator 1. FRID – Displayed in both map and figure (or table) of fire regime condition classes, with higher values (2 or 3) displayed in warmer colors and lower values in cooler colors (-2 or -3)

Indicator 2. Number and acres of wildfires – tables or graphs

Indicator 3. Fire severity – Simple tabular or graphical display (for an example see Fig.1 in Meyer 2015; NRV values are optional)

Other monitoring data:
All three indicators of this PMP are incorporated into the Region 5 Broader-scale Monitoring Strategy.

HOW will results be applied to management?

Compare indicator results with desired targets: Success will be observed if:

Indicator 1: FRID – Desired target includes greater proportions of the Inyo NF in fire regime condition classes 1 and -1 (and to a lesser extent, CC 2) and lower proportions in condition classes 3, -2, and -3.

Indicator 2. Number and acres of wildfires – Desired target is fewer acres and less numbers of full suppression wildfires, especially in the arid shrublands and woodlands and montane zones.

Indicator 3. Fire severity – Desired target in the montane forest zone is a greater proportion of wildfires burning within NRV, which in general, amounts to lower proportions of high severity fire and greater proportions of other fire severity classes (i.e., unchanged, low, moderate).

Alerts:
If the proportion of FRID classes or fire occurrence patterns do not meet the desired targets, then this could trigger a need to conduct a more targeted evaluation using finer scale data (e.g., field validation, post-fire vegetation monitoring plots) to determine whether the trend is leading towards undesirable impacts to terrestrial ecosystems. If substantial impacts are observed with more targeted evaluation, then this may require a change in management activities, such as increased emphasis on restoration of montane forests with a consistent pattern of fire return interval departure in CC 3. If CC -2 or CC -3 becomes more common over time, additional steps (e.g., more emphasis on limiting human-caused ignitions, fuel break creation or maintenance, shrubland restoration) may be required to address arid shrubland and woodland landscapes that are currently burning too frequently compared to NRV.

If the proportion of high severity fire increases over time and exceeds NRV, then this could trigger a need to conduct a more targeted evaluation using finer scale data (e.g., field validation, post-fire vegetation monitoring plots) to determine whether the trend is leading towards undesirable impacts to terrestrial ecosystems. If substantial impacts are observed with more targeted evaluation, then this may

require a change in management activities, such as increased emphasis on restoration of montane forests and possibly reforestation activities in larger deforested high severity patches that exceed NRV.

Adaptive management: In all cases above, it is unlikely that the desired condition (DC) this question is addressing would require a Forest Plan amendment. However, if persistent declining trends are observed in all or most indicators, it is possible that changed to plan components may be required to improve the trend of natural fire regimes, such as an increase in the pace of restoration treatments in TERR-FW-OBJ 01 & 02.

WHO developed the monitoring guide, and who is responsible for collecting the data, evaluating and reporting the results?

Primary Contact: Province Ecologist, Marc Meyer, 760-873-2447, marc.meyer@usda.gov

Literature Cited

Meyer, M.D. 2015. Forest fire severity patterns of resource objective wildfires in the southern Sierra Nevada. Journal of Forestry 113(1):49-56.

Safford, H.D.; Van de Water, K.M. 2014. Using fire return interval departure (FRID) analysis to map spatial and temporal changes in fire frequency on national forest lands in California. Res. Pap. PSW-RP-266. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. 59 pp.

Toward Meeting the Desired Conditions, Objectives, or Other Plan Components (vii)

PC01: What are the economic conditions in local communities that could affect the impact of national forest contributions to local economies?

WHY is this question being evaluated?

Desired condition:
LOC-FW-DC-03 National forest uses such as recreation, forest products, mining, and grazing are provided in an ecologically sustainable way that also contributes to economic and social sustainability in local communities.

WHAT is the problem or uncertainty?

Understanding the conditions and trends of 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.

WHAT data will be collected?

Indicators and Unit of Measure:
Indicator 1. Economic health: unemployment rate, average earnings and per capita income
Indicator 2. Forest based economic sectors: total employment and percentage of total private employment in recreation and tourism-based services
Note: Economic diversity is recommended for removal because this indicator is difficult to measure.
The sector jobs indicators from PC02 was moved to this question because it can be a qualitative proxy for diversity – or at least dependence on forest-based sectors.
Note: Local fiscal conditions as a separate metric is also removed because indicators 1 and 2 get at this.

Method/Protocol:
Indicator 1. Data for economic health is available online from the Headwater Economics - Economic Profile System Summary Report.

1. Data will be downloaded from the summary report: unemployment rate, average earnings and per capita income (these values can all be found in the overview table under prosperity)

Indicator 2. Data for forest based economic sectors is available online from the Headwater Economics - Economic Profile System Tourism Report. Data from these should be collected every two years during biennial reporting in order to evaluate conditions and trends in these key economic characteristics.

1. Data will be downloaded from the tourism report: number of travel and tourism related employment (this value can be found in the travel and tourism sector table)

Sampling Design: Data should be examined for the counties that are directly affected socioeconomically: Inyo and Mono counties in California and Mineral and Esmeralda counties in Nevada. The counties should be examined individually as trends in one county may not be seen in the others.

Data location:
Economic Health
Headwaters Economics Economic Profile System – Summary Report (available annually)
https://headwaterseconomics.org/tools/economic-profile-system

Forest Based Economic Sectors – Tourism Report (available annually)
Headwaters Economics Economic Profile System
https://headwaterseconomics.org/tools/economic-profile-system

WHEN will data be collected, evaluated, and reported?

Data collection schedule: Data sources update data annually. Reports will be evaluated every 2 years during biennial evaluation reporting.
Sampling duration: Ongoing
Reporting schedule: Biennial

HOW will data be evaluated for each indicator?

Evaluation protocol: Data should be examined to determine if there are any recognizable changes in the values suggesting a change in economic health or dependence of county employment on recreational activities. Sustained downward trends in these values would suggest changes in local conditions that may be related to management changes. The best measure of community conditions and trends would be data collected at a community level; however, community level data are often difficult to obtain therefore more aggregated data may be the best available (e.g., county level data). Caution should be used in applying aggregated data, such as county data, to represent forest community conditions. For example, data from a county with a large urban area may not accurately reflect conditions in forest communities since social and economic activity in the urban area could overshadow trends occurring in smaller communities. This uncertainty related to using county level data should be noted in the reporting.

Monitoring report: Data should be displayed in a table or graph comparing changes in these four values over time: unemployment rate, average earnings, per capita income, and the number of tourism-based jobs in the local economy).

Other monitoring data: The broader scale monitoring strategy will be reporting on indicators associated with economic input-output analysis and economic statistics.

HOW will results be applied to management?

Compare indicator results with desired targets: Sustained downward trends in these values would suggest changes in local conditions that may be related to management changes. However, it is important to remember that economic data is driven by many different factors so in most cases changes in this data cannot be directly tied to changes in forest management. Instead this data should be used to look for long-term trends and establish a conversation with local communities and county governments to better understand what may be driving any changes. Contacting key local stakeholders to review these trends will help to build relationships to ensure a common understanding and interpretation of the results.

Alerts: While the monitoring data can highlight changes, it is the ensuing outreach that will be important to capturing important issues that may need to be examined in more detail as to their impacts on communities.

Adaptive management: Any outreach should discuss sustained downward trends and include input from key local stakeholders on what, if any, forest management actions may be leading to these changes.

WHO populated the template, and who is responsible for collecting the data, evaluating the results, and issuing the report?

Populated template: Mark Metcalfe, Economist, Pacific Northwest Region

Person responsible for collecting the data, evaluating the results, and reporting: Forest Planner. If downward trends are observed, then regional social science assistance would be utilized for interpretation and outreach.

PC02: What economic contributions are national forest-based recreation, forest products, mining and grazing making to local communities?

WHY is this question being evaluated?

Desired condition:

LOC-FW-DC-03 National forest uses such as recreation, forest products, mining, and grazing are provided in an ecologically sustainable way that also contributes to economic and social sustainability in local communities.

WHAT is the problem or uncertainty?

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. Recreation is a primary forest activity that contributes to the social and economic wellbeing in local communities around the Inyo National Forest and therefore should be a focus of this monitoring.

WHAT data will be collected?

Indicators and Units of Measure:

Indicator 1. Local fiscal conditions: percentage of local tax revenue attributed to forest visitation

Note: Local Fiscal conditions was added to this question as related to forest visitation specifically

Indicator 2. Forest contributions to employment: annual estimate of total jobs supported by forest activities

Note: Conditions in forest-based sectors was moved to PC01 because PC01 is more related to economic condition of communities, whereas PC02 is tied to economics of recreation.

Method/Protocol:

Data will be downloaded from applicable websites for data analysis and evaluation.

Indicator 1. Fiscal conditions data sources:

1. Dean Runyan Associates Annual California Travel Impacts by County Reports (for the county tourism specific data). Dean Runyan reports: Total and Visitor-Generated Taxable Sales table in the visitor column

2. California State Controller (for the total county tax revenues). The percentage of local tax revenue attributed to forest visitation can then be calculated. Data from these should be collected every two years in order to evaluate conditions and trends. California State Controller: total expenditures for the county (search by county in the revenue data section)

Example: (10.0 million for local tax revenue for tourism ÷ 76.02 million expenditures for Inyo)*100 (note make sure both data sources are for the same year, this example is for 2018 data) = 13.15% for local tax revenue attributed to forest visitation

Indicator 2. Forest contributions to employment: WO EMC Annual at a Glance Reports (updated annually)

Sampling protocol: None

Data location:
Forest Contributions
WO EMC Annual at a Glance Reports (updated annually)
https://usfs.maps.arcgis.com/apps/MapJournal/index.html?appid=325d69db77e44c0fbe99140439793b49#

Fiscal Conditions

- Dean Runyan Associates (updated annually): http://www.deanrunyan.com/#myModal (scroll down to California under state travel impacts for latest report); 2010: 2018 report http://www.deanrunyan.com/doc_library/CAImp.pdf
- California State Controller (updated annually: https://bythenumbers.sco.ca.gov - Total County Revenue data available in county revenue and expenditure data section

WHEN will data be collected, evaluated, and reported?

Data collection schedule: Data is updated annually at the sources. Reports will be evaluated every 2 years during biennial evaluation reporting.

Sampling duration: Ongoing
Reporting schedule: Biennial

HOW will data be evaluated for each indicator?

Evaluation protocol: Data should be examined to determine if there are recognizable changes (downward trends) in the values suggesting a potential change in forest contributions to communities. Given the immense importance of recreation to local economies around the Inyo National Forest, this would be done by looking at trends in the estimates of the jobs supported by forest activities as well as trends in the amount of local country tax revues generated by visitors. The best measure of community conditions and trends would be data collected at a community level; however, community level data are often difficult to obtain, therefore more aggregated data may be the best available (e.g., county level data). Caution should be used in applying aggregated data, such as county data, to represent forest community conditions and the uncertainty related to using county level data should be noted in the reporting.

Monitoring report: Data can be displayed in two tables and/or graphics comparing changes in values over time for jobs supported by forest activities and the percentage of local county tax revenue dependent on visitation.

Other monitoring data: The broader-scale monitoring strategy will be reporting on indicators associated with economic input-output analysis and economic statistics.

HOW will results be applied to management?

Compare indicator results with desired targets:

Alerts: While the monitoring data can highlight changes, it is the ensuing outreach that will be important to capturing important issues that may need to be examined in more detail as to their

impacts on communities. This outreach should discuss sustained downward trends and include input from key local stakeholders on what, if any, forest management actions may be leading to these changes.

Adaptive management: Sustained downward trends in these values would suggest changes in local conditions that may be related to management changes. However, it is important to remember that economic data is driven by many different factors so looking at changes in this data cannot be directly tied to forest management. Instead this data should be used to look for long-term trends and as a basis for conversations with local community stakeholders and county governments to better understand what may be driving any changes. Contacting key local stakeholders to review these trends will help to build relationships to ensure a common understanding and interpretation of the results.

WHO populated the template, and who is responsible for collecting the data, evaluating the results, and issuing the report?

Populated template: Mark Metcalfe, Economist, Pacific Northwest Region. Person responsible for collecting the data, evaluating the results, and reporting: Forest Planner. If downward trends are observed then regional social science assistance would be utilized for interpretation and outreach.

PC03: What management actions are contributing to the achievement of desired conditions relating to fire regimes?

WHY is this question being evaluated?

Desired condition:
One original plan component of the monitoring plan was related to this question:

Reduce fuel accumulations, help maintain and protect habitat for a variety of species, reduce smoke from larger fires, provide added protection for communities, and restore fire on the landscape. These actions are also an integral part of achieving sustainable recreation, particularly by maintaining scenic attractiveness, integrity, and character.

That goal, while relevant to the question, is very general and contains many different types of desired conditions making it difficult to meaningfully evaluate. Upon developing this guide, it was determined that additional plan components were more specific and easier to measure. The strategic fire management zone mapping considered all the desired conditions mentioned above, and the intention is to re-map those zones as conditions on the ground change.

Fire management zones will need to be evaluated and adjusted over time, and this monitoring question can be used to inform that process, while answering the question of whether our management activities are allowing the forest to have a more fire resilient landscape. The additional, more specific plan components that will be evaluated are:

MA-WRZ-GOAL 01: Create fire resilient landscapes that can be restored and maintained by managing wildfire to meet resource objectives, and prescribed fire and fuel reduction treatments.

MA-CWPZ-DC 02, MA-GWPZ-DC 02 and MA-WRZ-DC 03: Over time, risk is reduced sufficiently in the community wildfire protect, general wildfire protection, and wildfire restoration zones to allow some areas to be placed in a lower risk zone.

TERR-FW-OBJ 02: Restore low and moderate fire mosaics using prescribed fire on at least 20,000 acres within 10 to 15 years following plan approval.

WHAT is the problem or uncertainty?

The new Forest Plan is testing whether management actions will contribute to moving the landscape trend toward the natural range of variability (NRV) for fire regimes. Question CC03 was designed to address whether fire regimes were moving more toward NRV for specific ecosystems. This question addresses how the Forest's fuels treatment activities contribute to those changes in fire regimes. There is uncertainty whether our management actions, even with the changes in the forest plan, can contribute to fire regime desired conditions, and whether large portions of the Forest can be moved into lower fire risk zones.

WHAT data will be collected?

Indicators and Units of Measure:
Indicator 1. Acres of fire by objective within each fire management zone
Indicator 2 . Acres of prescribed fire – total and within each fire management zone
Note: Total acres was added to this indicator

Indicator 3. Acres of thinning (mechanical and hand treatment) – total and within each fire management zone.
NOTE: This indicator was broadened to include all thinning treatments. In the monitoring program in the 2019 forest plan, the indicator was "acres of mechanical treatment." It was meant to include all thinning other than prescribed fire, and inadvertently left out hand thinning.

** Note: Acres of fire managed for resource objectives by ecosystem type – was REMOVED from this indicator because it is already used in CC03 and does not specifically get at the goal of PC03.*

Method/Protocol:
Indicator 1. Acres of fire by objective within each fire management zone

1. Acres of wildfire – Data are obtained from the CalFire California Fire and Resource Assessment Program (FRAP) Statewide Fire Perimeter Database.

   May need to also use the forest's NIMS ICS-209 forms if objective is not clear in the FRAP database.

Indicators 2,3 . Acres of prescribed fire (total and by fire management zone) and Acres of mechanical and hand thinning (total and by fire management zone)

1. Tracked and recorded in FACTs – data entered annually by the vegetation team for all projects. Database can be queried and a summary can be extracted. *Note: Do NOT include pile burning.*

   In the future, individualized FACTS queries may be replaced when R5 develops a GI tool for similar indicators as part of the BSMS. Once developed, the GI tool will provide data to support this indicator.

NOTE: IT IS CRITICAL THAT FOREST STAFF ENTERS COMPLETION DATA INTO FACTS ANNUALLY

Sampling design: Data will be obtained annually from existing databases and summarized across the entire Inyo National Forest. All data will be totaled for the entire forest, and separately by strategic fire management zone.

Data location:
Indicator 1. Number and acres of wildfire – FRAP GIS data

1. Fire objective is in the FRAP database, and also may need some input from Forest staff, review of 209 forms, and/or review of the WFDSS data.
2. Fire management zones: In GIS data for Forest Plan Revision, currently stored at: T:\FS\NFS\Inyo\Project\ForestWide\PlanRevision\GIS\FinalOct2019_GIS_ForestPlan\StrategicFireManagementZones_INF_LMP2019.gdb

Indicator 2. Acres of prescribed burn/acres of thinning – FACTS database/GI tool

WHEN will data be collected, evaluated, and reported?

Data collection schedule: Annually report and map prescribed fire acreages, mechanical treatment acreages, total fire acreages, and map areas of wildfire meeting Forest Plan objectives.
Analysis and display for this question will be completed every reporting period (2 years), which will be in odd number years.

Sampling duration: Ongoing
Reporting schedule: Biennial

HOW will data be evaluated for each indicator?

Evaluation protocol:
Indicator 1: Acres of fire (wildfire) by objective

1. Total area (in acres) burned in wildfires will be displayed by fire management type to determine if there is an increasing trend in wildfires managed with objectives other than full suppression.
2. Wildfires will be also clipped to fire management zones
3. The proportion of fires with 'other' management (other than full suppression) versus overall fire acres, total for the Forest and in each fire management zone will be displayed
4. Results will be compared with previous results to determine trend

Indicators 2,3: Acres of prescribed fire/acres of thinning (hand and mechanical)

Acres of prescribed fire, hand and mechanical thinning will be calculated annually will be displayed for the Forest and clipped by strategic fire management zone.

Monitoring report:
Indicator 1. Acres of wildfire by objective: forestwide map with strategic fire management zones; table, bar chart or other graph displaying change over time since 2015

Indicators 2,3. Acres of prescribed fire/acres of thinning: forestwide Map with strategic fire management zones; table, bar chart or other graph, showing change over time since 2015

Other monitoring data: None

HOW will results be applied to management?

Compare indicator results with desired targets:

Indicator 1. Acres of fire by objective within each fire management zone. There is no numerical objective for this indicator. The Forest Plan has a goal of creating fire resilient landscapes that can allow for more fires to be managed to meet resource objectives. We will calculate the percentage of fire acres that are managed other than full suppression. If that acreage decreases over time, we will investigate the cause of that reduction, and determine whether there are conditions under the control of the Forest that could be adjusted. We would attempt to determine whether the decrease is due to natural conditions (such as climate), political constraints, fuels conditions (such as areas were not pre-thinned), budget, or other reasons. We could use those findings to try to improve those conditions to get more managed fire on the landscape.

Indicator 2. Acres of Prescribed Fire: In order to evaluate progress towards objective TERR-FW-OBJ 02, the total acres of prescribed fire will be summarized annually and compared to the goal of 20,000 acres of prescribed fire by 2029-2034.

Indicator 3. Acres of thinning: There is no numerical target for thinning, but there are general desired conditions of increasing pace and scale of restoration. The annual total number of acres thinned will be

used to determine whether the trend in acres treated is increasing over time to meet the general goals and desired conditions of the Forest Plan.

All indicators: The overlap with strategic fire management zones will be used to determine the trend in each zone. There is a desired condition of moving toward lower risk zones for the Community Wildfire Protection, General Wildfire Protection, and Wildfire Restoration Zones. Trend data will be analyzed in these zones to see if treatment is focused on these zones, and therefore whether our management actions may be helping to move areas toward a lower risk zone. More analysis is needed to determine whether the strategic fire management zones can be remapped, which will be discussed in the adaptive management section below.

Alerts:
If the trend in fires managed for resource benefit, or the acres of fire with actual resource benefits on the ground, or the acres of prescribed fire decreases over time (over 2 reporting periods), then the forest will attempt to determine the cause of those trends. It is unlikely that a desired condition or other plan component would need to be adjusted, because the plan calls for more wildfire managed for resource benefit, and more prescribed fire. It is more likely that the cause would be weather related (drought preventing prescribed fires), political constraints (lack of local or regional support for fires), regulatory (such as air or water board concerns), or insufficient budgets. The forest and regional fire and veg/fuels staff should be able to provide some insight into the causes, which will provide the basis for coming up with creative solutions to increase fire on the landscape.

Adaptive Management:
Finer-scale investigation may have the following outcomes:

If acres of wildfire are always being reported as managed for full suppression, it could mean that there is a reluctance to report accurately, or that full suppression is occurring. This scenario could lead toward improving reporting, working with the public to increase education and acceptance of managing wildfire instead of full suppression; or working with regulators on interpretation of regulations, and to improve accurate reporting.

FSIM data (landsat based fire simulation model) could be re-run and analyzed to evaluate if the fire management zones should be adjusted due to new conditions, which could occur approximately every 10 years or when a need is identified. This additional analysis could help to evaluate if there is a decrease in risk based on the number of acres in each fire management zone. The change in fire management zone will be compared to management actions to evaluate if any of the management actions may have contributed to a positive change in FSIM data (to lower fire risk), and toward achieving desired goals.

If the trend indicates that more acres are within a higher risk zone than before, treatments should be re-evaluated to determine if they were ineffective or contributing to this trend. If results indicate this scenario, treatments could be focused in higher risk zones or different kinds of treatment options should be explored to be more effective at reducing risk.

If there is no change in the fire risk zones, different prioritization strategies may need to be considered for thinning/prescribed burning, or lead to an investigation on whether the strategic fire management

zones are accurate on the ground, need to be altered, or whether the concept is helpful for making management decisions.

WHO populated the template, and who is responsible for collecting the data, evaluating the results, and issuing the report?

Erin Noesser, Heather Stone. and Alan Taylor populated the template.

Progress toward meeting the desired conditions, objectives, or other plan components (vii)

PC04: To what degree is the national forest using partnerships to provide additional capacity for visitor services?

WHY is this question being evaluated?

The forest plan identifies partners as a critical component of providing services to the public.

Desired condition:
VIPS-FW-DC-01: The Inyo has a network of dependable partners and volunteers who provide additional capacity to effectively and efficiently meet plan desired conditions and deliver services to the public.

WHAT is the problem or uncertainty?

The availability of partnerships to provide additional capacity for visitor services is unknown.

WHAT data are being collected?

Indicators and Units of Measure:
Indicator 1. Number of agreements with partners, by activity type, that are supporting visitor services.

Indicator 2. Number and type of projects completed with partners. Activity types are defined in VSReports.

Method/Protocol:
The forest reports volunteer and partner accomplishments annually via the Forest Service VSReports database. Individual volunteers, partners, and supervisors are responsible for tracking their work. As of 2019, the Inyo Volunteer and Partnership Coordinator collects this accomplishment information, enters data in VSReports, and communicates the results to the forest, the region, and the public.

The fiscal year partner accomplishment data is entered into VSReports in October. VSReports produces a summary of partner contributions and projects (i.e., number of agreements, number and type of projects) supporting visitor service.

Sampling Design: Forest wide census of all partners and projects supporting visitor services in a fiscal year.

Data location: FS VSReports database https://apps.fs.usda.gov/vsreports/welcome.do

WHEN will data be collected, evaluated, and reported?

Data collection schedule: Data can be collected year-round and are required to be entered into the VSReports database in October each year. Evaluation and reporting occur in November.
Sampling duration: Ongoing
Reporting schedule: Reporting is completed annually in November. These indicators can be included in each biennial forest plan monitoring report.

HOW will data be evaluated for each indicator?

Evaluation protocol:
An annual data summary is produced by VSReports. The Inyo Volunteer and Partnerships Coordinator will compare annual results to previous years.
Monitoring report: Tables and graphs
Other monitoring data: None

HOW will results be applied to management?

There is no quantitative target for this indicator. The Forest Plan encourages working with partners to develop additional capacity to provide public services. Thus, an increasing trend in partner accomplishments is desirable.

Alerts: A declining trend in the number of agreements with partners, activity type, and number of projects would require an assessment of likely contributing factors.

Adaptive management: Potential management actions could include dedicating additional staff time to partnership development and reporting tasks.

WHO populated the template, and who is responsible for collecting the data, evaluating the results, and issuing the report?

Template completed by Adam Barnett, Assistant Public Services Staff Officer

Productivity of the Land (viii)

PR01: How does soil disturbance differ from pre- and post-activity for timber management?

WHY is this question being evaluated?

Desired condition:

WTR-FW-DC-04: Soil and vegetation functions in upland and riparian areas are sustained and resilient. Healthy soils provide the base for resilient landscapes and nutritive forage for browsing and grazing animals, and support timber production. Healthy upland and riparian areas support healthy fish and wildlife populations, enhance recreation opportunities, and maintain water quality.

WHAT is the problem or uncertainty?

This question was designed to address to what extent does forest fuels, timber management, or activities occurring on the forest, affect soil quality and whether there is a trend over time for soil quality in the plan area (specifically where fuel and timber management take place – Jeffrey pine/lodgepole, mixed conifer and limited thinning of pinyon stands). Do management activities and systems substantially and permanently impair the productivity of the land?

WHAT data will be collected?

Indicators and Units of Measure:

Indicator 1. Soil Compaction (Soil Strength, soil structure and macroporosity)
Indicator 2. Displacement (Surface organic matter, soil organic matter)
Indicator 3. Erosion (soil stability)

Method/Protocol:

All indicators will be measured using the National Forest Soil Disturbance Monitoring Protocol. The protocols in NFSDMP: WO-GTR-82a and WO-GTR-82b, or subsequent versions, will be used as a guide for sampling. The NFSDMP Publication provides a framework for monitoring soil disturbances that is consistent, repeatable, and statistically valid (WO-GTR-82a).

The protocol is a qualitative rapid assessment tool to be used by soil scientists and watershed specialists when evaluating physical soil disturbance. The assessment tool monitors 6 different visual indicators which will be interpreted on a soil type and site-specific basis.

The NFSDMP consists of 6 visual indicators: 1) Forest floor impacted (indictor 3, 2 and 1); (2) Topsoil Displacement (indicator 2); (3) Rutting (indicator 2); (4) Burning (displacement – indicator 2) (5) Compaction (indicator 1); and (6) Platy Structure/massive/puddled (indicator 1)

Visual indicator 5 (compaction) and Visual Indicator 6 (macro-porosity) are evaluated using methods from the Field Book for Describing and Sampling Soils (Version 3.0, USDA-NRCS).https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052523.pdf

Sampling design: Assessments will be conducted on individual treatment units, within larger treatment areas. The area bounded by the assessment would be described or defined.

Highest priority areas are where soil conditions may have been adversely affected by past management, and where proposed activities have the greatest potential to cause adverse effects to soil functions. Examples of high priority areas include the following:

1. Areas where multiple ground-based management projects involving heavy equipment have occurred in the past
2. Areas where ground-based management activities involving heavy equipment are proposed
3. Areas where proposed activities could result in a large reduction in soil cover and increased soil erosion risk

Data storage: Data is stored in the 2500 Watershed folders in Pinyon.

WHEN will data be collected, evaluated, and reported?

Data collection schedule: One pre-activity unit and one post-activity unit within a mechanical treatment area per year is a minimum to understand timber management impacts on the monitoring question. The post-activity unit does not necessarily need to be the same one sampled pre – activity. Ideally, monitoring two pre and post-activity units within a treatment area would occur to provide a more complete understanding of impacts.

Sampling duration: Ongoing
Reporting schedule: Biennial

HOW will data be evaluated for each indicator?

Evaluation protocol:
After completing an assessment, each indicator (Indicators 1-3) will be rated one of the following condition classes: Good (Meets Desired Condition); Fair (Partially Meets Desired Condition); or Poor (Does Not Meet Desired Condition). A description of the 3 classes are provided below:

1. GOOD - Nearly all the area meets the desired condition for the indicator. Negligible changes have occurred.
2. FAIR - Changes in indicator condition both in degree and extent can no longer be considered negligible. Degree of indicator change may be slight in large parts of the area or great in minor portions of the area. As a general rule, the indicator desired condition may be unmet in 5 - 15% of the area. This percentage range is given to help describe a Fair condition but does not represent absolute limits or standards.
3. POOR - The degree and extent of indicator change is significant compared to the desired condition

The following information will be summarized in the biennial report:

1. Total number of units surveyed, what unit, and project name (and map)
2. Results of both pre- and post-management monitoring (when applicable)
3. Trend over time for pre- and post-management disturbance
4. Rating for soil characteristics: for soil compaction, displacement and erosion

Monitoring report: Report, table and map

Other monitoring data:

1. Accessory items that help identify soil disturbance classes as outlined in Forest Soil Disturbance Monitoring Protocol: Volume I: Rapid Assessment. USDA Forest Service, General Technical Report WO-GTR-82a, September 2009.
2. The Long-Term Soil Productivity plots (LTSP) are monitoring every five years. Although no plots exist on the Inyo, they provide valuable background information to help understand monitoring results and management effects on soil properties on the Inyo. The latest findings, after 20 years of monitoring, are located at: https://www.fs.fed.us/psw/publications/zhang/psw_2017_zhang003.pdf

HOW will results be applied to management?

Compare indicator results with desired target to determine if soil and vegetation functions in upland and riparian areas are sustained and resilient. Soil indicators (1-3) are in good condition.

Alerts: An indicator that is in "poor" condition may lead to a detrimental impact in soil productivity and indicate that a desired condition of the forest plan is not being met.

Adaptive management: Investigate why "fair" and "poor" indicator ratings are occurring and develop an action plan to address concerns. These rating would indicate that a future management action should be incorporated to mitigate the condition such as create subsoil skid trails landings to alleviate compaction, provide additional ground cover for nutrient cycling and erosion control or repair and stabilize actively eroding sites.

Literature cited

Forest Soil Disturbance Monitoring Protocol: Volume I: Rapid Assessment. USDA Forest Service, General Technical Report WO-GTR-82a, September 2009. This technical guide outlines a framework for monitoring soil disturbance from forest management pre-activity and post-activity. http://www.treesearch.fs.fed.us/pubs/34427

Forest Soil Disturbance Monitoring Protocol: Volume II: Supplementary methods, statistics, and data collection. USDA Forest Service, General Technical Report WO-GTR-82b, September 2009. This technical guide outlines a framework for monitoring soil disturbance from forest management pre-activity and post-activity. https://www.fs.usda.gov/treesearch/pubs/34426

Schoeneberger, P.J., D.A. Wysocki, E.C. Benham, and Soil Survey Staff. 2012. Field book for describing and sampling soils, Version 3.0. Natural Resources Conservation Service, National Soil Survey Center, Lincoln, NE. https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052523.pdf

WHO populated the template, and who is responsible for collecting the data, evaluating the results, and issuing the report?

Todd Ellsworth – Todd.ellsworth@usda.gov

Todd (Watershed Program Manager/Soil scientist) will be responsible for organizing and/or data collection, evaluating the results and issuing the report.

Inyo National Forest Monitoring Program of Work

Table 2 provides information that can be used for program of work planning. It includes information on when data collection occurs or when data are refreshed, the frequency of data reporting, and year reporting will start. It also includes an estimate on the number of days needed as well as key resource specialists. This table incorporates information for the basic monitoring and reporting needs.

Table 2. Inyo National Forest monitoring program schedule and associated personnel days needed by the Inyo National Forest staff for completing the Biennial evaluation and monitoring report (BMER)

Table 2a*. Inyo National Forest Staff estimated days for analysis and reporting on a biennial reporting cycle.*

Question	Existing POW? (Y/N) [1]	Data analysis and Reporting Cycle	Start year for reporting	Estimated total days[2]	Primary Specialist(s) Needed
WS01[3]	Y	Every 3rd BMER[4]	2021	4	Range, hydrology
WS02	Y	BMER[5]	2022	3	Watershed staff
TE03	Y	BMER	2021	6	Jointly by Region 5 Ecology Program, R5 Remote Sensing Lab, and Inyo National Forest Staff
AE01	Y	BMER	2021	4	Range Management Specialist, hydrologist, soil scientist
AE02	Y	BMER	2021	5	Range Management Specialist, hydrologist, soil scientist
AE03	Y	BMER	2021	3	Watershed staff
FS01	Y	BMER	2021	6	Botanist/Wildlife Biologist
FS02	N	BMER	2021	2	Hydrologist
AR01	Y	BMER	2021	12	Botanist/Wildlife Biologist
AR02	N	BMER	2021	6	Biologist/Fuels specialist
AR03	Y	BMER	2021	12	R5 Ecologist, Forest Botanist and Wildlife
VU01	Y	BMER	2021	1	Public Services SO
VU02	Y	BMER	2021	4	District Recreation Staff
VU03	N	BMER	2021	1	Assistant Public SO, Public Affairs SO

Question	Existing POW? (Y/N) [1]	Data analysis and Reporting Cycle	Start year for reporting	Estimated total days[2]	Primary Specialist(s) Needed
VU04	Y	BMER	2023	2	Assistant Public Affairs SO
CC02	N	BMER	2020	5	Hydrologist
PC01	N	BMER	2021	2	Forest Planner
PC02	N	BMER	2021	2	Forest Planner
PC03	Y	BMER	2021	5	Veg. Team Staff Member
PC04	Y	BMER	2021	2	Volunteer and Partnership Coordinator
PR01	N	BMER	2021	10	Hydrologist/ Soil scientist
All	N	BMER	2021	13	Forest Planner[6]
TOTAL DAYS FOR ONE BIENNIAL REPORTING CYCLE				**110**	

Table 2b. *Estimated reporting period frequency and days for Regional Office Ecology and Remote Sensing Lab Staff to complete analysis and reports for the Inyo National Forest monitoring reports.*

Question	POW? (Y/N) [1]	Data analysis and Reporting	Start year for reporting	Estimated total days	Primary Specialist(s) Needed
TE01	Y	Every 3rd BMER[4]	2022	3	Ecologist
TE02	Y	Every 3rd BMER[4]	2026	15	R5 ecology
TE03	Y	BMER	2021	6	Jointly by Region 5 Ecology Program, R5 Remote Sensing Lab, and Inyo National Forest Staff
AR03	Y	BMER	2021	12	R5 Ecologist, Forest Botanist and Wildlife
CC01	Y	Every 2nd BMER[7]	2022, 2026	3	Ecologist
CC03	Y	BMER	2022	3	Ecologist
TOTAL DAYS FOR REPORT COMPLETION				**42**	

[1] Work completed as part of the regular POW that partially fulfills the requirements of the PMP. Work may be conducted for a variety of reasons (e.g., program management, compliance with signed NEPA decisions, national road monitoring BMPS, OHV monitoring to fulfill grant requirements, regulatory requirements such as the California Waterboard).

[2] Estimated days for all personnel involved in evaluating 1 monitoring question beyond work that would regularly occur on the forest. Estimate is the number days needed for a biennial reporting cycle

[3] Question WS01 results reported every 5 years (WCATT)

[4] Results reported every 3rd reporting cycle

[5] BMER refers to the biennial monitoring evaluation report

[6] Days for Forest Planner to compile results into the BMER

[7] Results reported every 2nd reporting cycle

After the publication of each BMER, the monitoring plan will be re-evaluated and possibly adjusted as part of the adaptive management process.

Forest Planner's Role

The anticipated annual workload for the forest planner is 10 days on the biennial monitoring evaluation report on BMER years and 3 days on non-BMER years conducting the following tasks:

- Organize and bring forward the annual program of work needs based on the information contained in the guide, including data collection and reporting.
- Collate individual question reports into a BMER, ideally utilizing the WO template for BMER reporting.
- Elevate BMER reporting results to forest leadership where considerations for adaptive management (of either management activities and/or plan components) need to be considered.