

Draft Region 5 Broader-scale Monitoring Strategy

Objectives

The broader-scale monitoring strategy (Strategy) and the forest-level plan monitoring programs (PMP) together comprise the monitoring requirements of the 2012 Planning Rule (36 CFR 219.12). A PMP is part of a forest unit's Land Management Plan (forest plan) and its monitoring questions address specific plan components. While a PMP is particular to the management direction of that individual forest unit, this Strategy encompasses all of the forest units located within Region 5.

The primary objective of this Strategy is to provide the Regional Forester and forest stakeholders a broad geographic perspective on the status and trends of conditions relevant to the forests in the region. Similar to a PMP, monitoring questions and associated indicators are used in this Strategy to identify which aspects of the social, economic, and ecological environment will be monitored. A secondary objective of this Strategy is to help inform the individual PMP biennial monitoring evaluation reports (219.12(d)) in the region by gathering additional monitoring information from multiple sources across multiple forest units into a single source. These biennial evaluation reports are used by the Forest Supervisor to determine if a change to plan components or other plan content may be needed for the forest Plan. Together, this Strategy and each PMP will serve as a key step in the U.S. Forest Service's adaptive management framework (FSH 1909.12 Chapter 06) by addressing environmental uncertainty and responses to management actions at multiple scales.

The 2012 Planning Rule (36 CFR 219.12 (b)) requires that the Strategy have the following three characteristics:

- Monitoring questions that can best be answered at a geographic scale broader than one plan area;
- Coordinated with the relevant responsible officials, State and Private Forestry, Research and Development, partners, and the public; and,
- Is within the financial and technical capabilities of the region and complements other ongoing monitoring efforts.

This Strategy is envisioned to be a living document that will change over time as monitoring questions and associated indicators are revised, added, or removed as conditions change. It will also potentially be modified with changes to national, regional, or forest-level monitoring programs. In addition, changes to the financial and technical capabilities of Region 5 will need to be addressed at least every five years. Monitoring should always be adaptive to changing conditions, and ecological and institutional changes (Lindenmayer and Likens 2009).

Recent History of Region 5 Regional Monitoring

Since the mid-1990s, Region 5 has implemented a plan revision strategy that is based on collaborative bio-regional planning of the four geographic sub-regions in California: southern California, the Sierra Nevada Range, the Pacific Northwest, and northeastern California Plateaus.

In 1994 the Northwest Forest Plan Amendment (NWFP) was developed for part of Region 5 and Region 6 to take a landscape approach to federal land management. It was designed to specifically address threatened and endangered species, and social and economic sustainability, while creating a regional monitoring program. This interagency regional monitoring program provided information on the status and trends of: late-successional and old-growth forests; northern spotted owl habitats and populations; marbled murrelet habitats and populations; watershed conditions; socio-economic conditions; and Tribal-Federal relationships. Results from this monitoring program were incorporated into the recently published science synthesis (PNW-GTR-966) to inform land management within the NWFP area.

In 2001 and 2004, the Forest Plans for the national forests of the Sierra Nevada and the Lake Tahoe Basin Management Unit were amended by the Sierra Nevada Forest Plan Amendment (Framework), and specific monitoring was initiated for geographic areas larger than a single forest. Subsequently, the 2007 Sierra Nevada Management Indicator Species Amendment identified management indicator species (MIS) in common for the same units, which are monitored on a bio-regional scale. In 2014, a science synthesis (PSW-GTR-247) was published to support socioecological resilience and future forest plan revision in the bio-region.

The forest plans for the four forests in southern California (Angeles, Cleveland, Los Padres, and San Bernardino) were revised between 2005 and 2006, and a common monitoring program was instituted for all four forests in the bioregion. Subsequently, these four forest plans were amended in 2014, including minor changes to the monitoring program.

In 2016, a science synthesis was initiated for the northeastern California Plateaus, which includes the Modoc and Lassen National Forests. The synthesis is combining new scientific findings into a single comprehensive overview for forest stakeholders and managers for the purpose of informing future land management planning. Historically, this region was included in either the NWFP, Framework, or both, but it has a distinctive system with dry pine and juniper forestland, as well as sagebrush and shrub lands.

Broader-scale Monitoring Strategy Approach

The approach taken in developing this Strategy has been to find efficiencies in monitoring many different forest resources and uses at multiple scales in Region 5. It has included working with USFS staff, other resource agencies, and stakeholders. This Strategy draws from the preamble to the 2012 Planning Rule, the Forest Service Handbook, strategies produced by other USFS regions, and related reports (e.g., the Sierra Cascades Dialog Sessions No. 14: Monitoring, the Southwestern Ecological Restoration Institutes' technical report titled "Developing a Framework for the U.S. Forest Service Broader-Scale Monitoring Strategy: Processes and Outcomes").

Identifying efficiencies in a region as large as Region 5 is imperative. Region 5 includes 18 different forest units, covering approximately 20 million acres, and stretches from the arid Southwest to the temperate rain forests of the Pacific Northwest. Similarly, there are a wide variety of forest uses, from timber production, to recreation, to traditional collection of forest products, to people looking for solitude in a wilderness area.

While this Strategy is intended to address certain PMP monitoring questions on a region-wide scale that were developed at a forest-scale (219.12(b)(1)), it will also address monitoring questions that are not contained in a PMP. These non-PMP monitoring questions are critical to informing the status and trends of key resources even if they are not listed in a forest plan. For instance, understanding regional trends in air

quality can potentially be more valuable on a larger scale than at a smaller scale, which can be highly variable due to localized effects.

One of the efficiencies will include enhanced sharing of existing information with federal, state, and non-governmental organization partners. On a regional scale, this would specifically include using information collected and analyzed by partners both on the national forests and neighboring lands. These partners may include the National Park Service, Bureau of Land Management, State of California, commercial timber land companies, and private citizens. Another efficiency will include accessing national datasets that address monitoring questions or use associated indicators useful at a regional scale. This could include climate information from NOAA and water resources data from USGS.

The results from this Strategy will be summarized and reported every five years in accordance with USFS Handbook directives (FSH 1909.12 sec. 33.2(2)(c)). In addition, the results need to be made available annually, as applicable, for forest units that are preparing their biennial monitoring evaluation reports in any particular year. Therefore, this Strategy is designed to direct users to the source of the information through hyperlinks, where available, so that the information can be accessed as needed.

While the current approach for the Strategy is region-wide, certain components of this Strategy will only apply to particular sub-regions or provinces. For instance, a plant or animal species that is restricted to southern California may warrant inclusion in the Strategy because it applies to more than one unit, but the utility of the information may be negligible to a forest on the Modoc Plateau.

Relationship with Plan-level Monitoring Programs

As described in the preamble to the final 2012 Planning Rule (77 FR 21174):

Modified Alternative A [-- the selected alternative --] requires that future plans be based on a complementary ecosystem and species-specific approach to provide for the diversity of plant and animal communities in the plan area and the long-term persistence of native species in the plan area. This approach is often referred to as the coarse-filter/fine-filter approach.

The ecosystem integrity and diversity requirements in Modified Alternative A are meant to provide a coarse-filter designed to maintain biological diversity. By working toward diverse, connected ecosystems with ecological integrity, the Agency expects that over time, management will create ecological conditions which support the abundance, distribution, and long-term persistence of most native species within a plan area, as well as provide for diversity of plant and animal communities. The fine-filter provisions are intended to provide a safety net for those species whose specific habitat needs or other influences on their life requirements may not be fully met under the coarse-filter provisions.

In general, the PMP is designed around the coarse-filter approach, while this Strategy includes both the coarse- and fine-filter approaches. Specifically, the PMP focuses the ecosystem conditions or characteristics that are necessary to support key ecological functions and services in the forest. While it does not require species population monitoring – beyond the status of focal species – it doesn't prohibit it either. The PMP includes monitoring questions and associated indicators that are based on one or more desired conditions, objectives, or other plan components in the Forest Plan. This select set of monitoring questions is built around eight requirements in the 2012 Planning Rule (§ 219.12(a)(5)):

- (i) The status of select watershed conditions.
- (ii) The status of select ecological conditions including key characteristics of terrestrial and aquatic ecosystems.
- (iii) The status of focal species to assess the ecological conditions required under § 219.9.

- (iv) The status of a select set of the ecological conditions required under § 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.
- (v) The status of visitor use, visitor satisfaction, and progress toward meeting recreation objectives.
- (vi) Measurable changes on the plan area related to climate change and other stressors that may be affecting the plan area.
- (vii) Progress toward meeting the desired conditions and objectives in the plan, including for providing multiple use opportunities.
- (viii) The effects of each management system to determine that they do not substantially and permanently impair the productivity of the land (16 U.S.C. 1604(g)(3)(c)).

While each PMP is driven by the monitoring questions that are tied to specific plan components in that particular forest plan, this Strategy is not. However, many plan components are similar across forest units and they have been used to help formulate this Strategy. In some instances, the same PMP data from a province may be aggregated and compared to the status and trend of those data outside the forests in that province. For example, the collection of benthic macroinvertebrate data can be aggregated across multiple forest units in a province and compared to similar data collected by others downstream of the forest boundaries to monitoring differences in water quality based on different land uses.

One of the complementary aspects of this Strategy relates to the collection of large-scale surveillance-type monitoring data. These surveillance results (e.g., changes in regional evapotranspiration, regional trends in fire severity) may help facilitate the evaluation of other more localized PMP results by providing additional context. In general, the PMP is considered an effectiveness-type monitoring program, with the intent of assessing progress towards achieving the desired conditions, goals, and objectives set out in the forest plan. However, the PMP isn't exclusively an effectiveness-type monitoring program, and its specific direction will depend upon the needs and conditions of the particular forest unit. Often the data collected to assess the effectiveness of the forest plan are implementation-type data. Implementation data are usually derived from the implementation, or carrying out, of a project on the forest under the forest plan and may be linked to other plan components, such as standards or guidelines. For example, the data collected during implementation of a restoration project would contribute to the overall forest objective of total acres restored of a particular forest type, or desired conditions for a particular species, or a standard related to cutting of trees of a certain size. The PMP could also include: validation-type monitoring to test assumptions in the forest plan (e.g., action X will result in effect Y); or site-specific surveillance monitoring to collect data on particular environmental variables (e.g., stream flow downstream of a diversion).

Another complementary aspect of this Strategy relates to the fine-filter approach. This fine-filter approach will focus on those particular wide-ranging species where the forest-level coarse-filter approach is insufficient. For instance, many bird species occur on multiple neighboring forests and require certain habitat conditions to persist. Using the coarse-filter approach a forest unit can evaluate if the proper habitat conditions (e.g., percent cover of a particular vegetation type, number of snags per acre) as identified in the forest plan are present on that forest. This is critical to managing for ecosystem integrity. However, for key bird species found in the region it is also important to know where those species occur across the region over time. Furthermore, by monitoring a particular species across multiple units, certain efficiencies are gained through a standard data collection protocol and centralized data management.

“Key” – in the context of this Strategy – is not defined in the statute or regulations. However, key plant and animal species are identified below by the Regional Forester for this Strategy based on a range of factors.

These factors include, but are not limited to: inclusion in existing monitoring programs, specific plan components, Endangered Species Act status, species of conservation concern (SCC) status, role as an ecosystem indicator, technical limitations, and funding. While including more key plant and animal species could provide additional insights, there are financial and technical limitations to the number of species that can be included herein.

Broader-scale Monitoring Questions, Associated Indicators, and Datasets

The Strategy monitoring questions and associated indicators (e.g., datasets) are presented below in the following layout:

[#. Monitoring Question]

- [Associated indicator(s)]
 - [Name, or source, of dataset(s)]
 - [Scale of dataset]
 - [Frequency of data collection]

1. What is the occurrence and distribution of key plant and animal species known to occur in Region 5?

- California spotted owl
 - USFS Region 5
 - Sierra Nevada Range and Southern California Sub-region
 - Annual
- Pacific fisher
 - USFS Region 5
 - Sierra Nevada Range Sub-region
 - Annual
- Northern spotted owl
 - USFS [Regional Ecosystem Office](#)
 - Northwest Forest Plan Sub-region
 - Annual
- Key land bird species
 - USFS Region 5 with Point Blue [Sierra Nevada Avian Monitoring Info Network](#)
 - Sierra Nevada Range Sub-region
 - Biennial
- Yosemite toad, Sierra Nevada yellow-legged frog, and Northern Distinct Population Segment of the mountain yellow-legged frog
 - USFS Region 5
 - Sierra Nevada Range Sub-region
 - Annual
- Black-backed woodpecker
 - USFS Region 5 with [Institute for Bird Populations](#)
 - Region-wide
 - Annual or biennial
- Whitebark pine
 - USFS Region 5
 - Sierra Nevada Range and Northwest Forest Plan Sub-regions
 - Annual

2. What is the status and trend of vegetation cover and types in Region 5 over time?

- Forest extent and carbon stock
 - USFS [Forest Inventory and Analysis](#) (FIA)
 - Region-wide
 - Five years
- Existing vegetation
 - USFS Remote Sensing Lab [Existing Vegetation](#) (EVEG)
 - Region-wide
 - Five years
- Forest structure
 - Oregon State University [Landscape Ecology, Modeling, Mapping & Analysis](#) (LEMMA)
 - Northwest Forest Plan Sub-region
 - Annual

3. What are the status and trend of air quality across Region 5?

- IMPROVE air quality monitoring in Class I Wildernesses
 - USFS Air Program [Federal Land Manager Environmental Database](#)
 - Region-wide
 - Annual
- Criteria pollutants and GHG
 - California Air Resources Board [Air Quality and Emissions](#) and EPA [Air Data](#)
 - Region-wide
 - Annual

4. How have climatic conditions varied across Region 5 over time?

- Precipitation and Temperature
 - NOAA [National Centers for Environmental Information](#) and [Western Regional Climate Center](#)
 - Region-wide
 - Annual
- Snowpack
 - California Department of Water Resources [California Data Exchange Center](#)
 - Region-wide
 - Annual
- Evapotranspiration
 - USGS [Early Warning and Environmental Monitoring Program](#)
 - Region-wide
 - Annual
- Water temperature
 - Rocky Mountain Research Station [NorWEST](#)
 - Region-wide
 - Annual

5. How has fire frequency, size, and severity varied over time across Region 5?

- Fire frequency and size
 - CalFire [California Fire Perimeter Database](#)
 - Region-wide
 - Annual
- Fire severity
 - USFS R5 Remote Sensing Lab [Vegetation Burn Severity](#) and Wildland Fire Research Council [Monitoring Trends in Burn Severity](#) (MTBS)
 - Region-wide
 - Annual
- Fire return interval departure
 - USFS R5 Remote Sensing and R5 Ecology Program [Lab Fire Return Interval Departure](#) (FRID)
 - Region-wide
 - Annual

6. Where are major incidences of insect, disease, and invasive species affecting Region 5?

- Tree mortality
 - USFS R5 State and Private Forestry [Aerial Detection Monitoring](#)
 - Region-wide
 - Annual
- Sudden oak death
 - USFS R5 State and Private Forestry [Sudden Oak Death Monitoring](#) and UC Berkeley [SOD Heat Map](#)
 - Region-wide
 - Annual
- Non-native invasive plants
 - California Invasive Plant Council [Cal WeedMapper](#)
 - Region-wide
 - Annual

7. What are the ecosystem services and economic contributions from national forests, as well as the economic conditions in communities located near national forests, in Region 5?

- Economic input-output analysis
 - [IMPLAN](#)
 - Region-wide
 - Annual
- Economic statistics
 - [Headwaters Economics](#)
 - Region-wide
 - Annual
- Forest carbon stocks and trend
 - California Air Resources Board [Land Carbon Stocks and Stock-change](#)
 - Region-wide
 - Five year

- Timber and non-wood forest products
 - USFS FIA [Timber Product Output](#) (TPO)
 - Region-wide
 - Annual

8. What is the status of ecological restoration goals in the identified in the [2015 Leadership Intent](#) in Region 5?

- By approximately 2035, increase forest resilience through treatments (including prescribed fire and thinning) and wildfire, resulting in resource benefits to approximately 9 million acres on national forest system lands.
 - USFS [FSGeodata Clearinghouse](#)
 - Region-wide
 - Five years
- By approximately 2035, increase forest meadow habitat function through restoration activities, resulting in an enhanced ability to hold water longer into the summer and deliver clean water when most needed.
 - USFS [FSGeodata Clearinghouse](#)
 - Region-wide
 - Five years

9. How have the quality, quantity, and distribution of aquatic resources found in Region 5 forests changed over time?

- Watershed condition
 - USFS [Watershed Condition Framework](#)
 - Region-wide
 - Annual
- Aquatic and riparian condition
 - USFS [Aquatic and Riparian Effectiveness Monitoring Program](#) (AREMP)
 - Norwest Forest Plan Sub-region
 - Five years
- Benthic macroinvertebrates
 - State of California [Surface Water Assessment and Monitoring Program](#) (SWAMP)
 - Region-wide
 - Annual
- Impaired waterways
 - EPA [Office of Wetlands, Oceans, and Watersheds: 303\(d\) list](#) and [Water Quality Data](#)
 - Region-wide
 - Annual
- Water supply
 - California Department of Water Resources [Storage in Major Reservoirs](#)
 - Region-wide
 - Five year
- Extent of surface and shallow sub-surface water in mapped meadows of the Sierra Nevada
 - USFS Region 5 (Proposed remote sensing product in early development)
 - Sierra Nevada Range Sub-region
 - Five years

10. How has the level of satisfaction expressed by forest visitors and users in Region 5 changed over time?

- Visitor use and satisfaction
 - USFS [National Visitor Use Monitoring](#) (NVUM)
 - Region-wide
 - Five years
- Recreation value derived from visitors
 - S&PF Ecosystem Services (in development)
 - Region-wide
 - Five years

Potential Citizen Science and Other Volunteer Data Collection Opportunities

The USFS recognizes the value of [citizen science](#) in engaging stakeholders and augmenting existing data collection programs. During the *Sierra Cascades Dialog Session on Monitoring* ([Session No. 14, January 22, 2015](#)), many different potential opportunities for volunteer or user group data collection were identified. These ranged from indicators associated with trail use to bird diversity.

We want to take this opportunity to invite the public as well as Native American Tribes and Tribal Communities to identify specific opportunities for citizen science and the integration of Traditional Ecological Knowledge (TEK) that may serve the purposes of this Strategy. While many different types of volunteer data collection would be valuable citizen science projects in national forests, only a subset of all these projects would be within the context of this Strategy. For instance, a small-scale monitoring project may best be coordinated through the plan monitoring program of a particular national forest unit rather than this broader-scale monitoring strategy.

An ideal citizen science collaboration for this Strategy would help answer a plan monitoring question across multiple forest units using a peer-reviewed, statistically robust, long-term dataset. We recognize that not every citizen science collaboration will have all of these characteristics. For example, a new collaboration won't necessarily have a long-term dataset, but could be critically important if it addresses an emerging issue that the USFS isn't currently monitoring. Citizen science opportunities in the context of this Strategy could potentially include:

1. Non-native invasive plant occurrence and distribution using a geospatial smart phone app
2. Identification and reporting of proper signage for conservation and recovery plans in remote areas
3. Lichen biodiversity and air quality (Jovan 2008)

References

- Jovan, S., 2008. Lichen bioindication of biodiversity, air quality, and climate: baseline results from monitoring in Washington, Oregon, and California (Vol. 737). Portland, OR: US Department of Agriculture, Forest Service, Pacific Northwest Research Station.
- Lindenmayer, D.B. and Likens, G.E., 2009. Adaptive monitoring: a new paradigm for long-term research and monitoring. *Trends in Ecology & Evolution*, 24(9), pp.482-486.