# Introduction and Framework for Region 4's Pollinator Survey Protocol

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This effort is the brainchild of John Proctor, Regional Botanist and Invasive Species Program Manager, and the purpose was to develop a standardized protocol for surveying pollinators in Region 4 with the hopes of avoiding different protocols being carried out on different districts and forests. Region 4 has identified a "focus on determining the status of pollinators…" (Warziniack et al. 2018)

Two tasks have been completed to date in the effort to develop standardized pollinator survey protocols for Region 4: a Region 4 pollinator survey protocols framework (this report) and a survey protocol for bees and butterflies (separate report). The framework is described below and illustrated in Figures 1 and 2.

## NEED FOR SURVEYING POLLINATORS

Pollinators have declined regionally, nationally, and globally, with some species of bees and butterflies having declined precipitously (Rhodes 2019, Sanchez-Bayo et al. 2019, Graves et al. 2020), and pollinators play a crucial role in maintaining ecosystem health and restoring damaged plant communities by pollinating flowering plants, thereby providing for plant reproduction and sustainability (Hatfield et al. 2012, Pollinator Health Task Force 2015, Warziniack et al. 2018).

Despite the crucial ecosystem services they perform, there is very little baseline information on pollinator species' occupancy, distribution, and abundance on National Forest System (NFS) lands in Region 4, and even less population trend information. Without this data, it may be difficult to adjust management of NFS lands and decisions on whether to permit apiaries will be difficult (non-native honey bees can impact native bees). The federal government recognizes the high importance of baseline pollinator data (Pollinator Health Task Force 2015), and Region 4 has identified a "focus on determining the status of pollinators…" (Warziniack et al. 2018).

## PURPOSE OF SURVEYING POLLINATORS

Based on an email-survey of working-group members early in the process, the following goal statement was developed:

> An overriding goal of pollinator surveys in Region 4 will be to inventory and monitor pollinator species richness and relative abundance, especially bees and butterflies, in ways that facilitate scaling-up to the Intermountain Region scale, while also collecting data on habitat and floral associations as resources allow.

This goal provided the direction and sideboards for developing the "framework" and for developing the protocol for surveying bee and butterfly taxa (C.1 and C.2 in Figure 1). Seven questions were asked in the email-survey sent to working-group members, and six of these questions had multiple-choice answers. Answers to five are summarized in Table 1.

Table 1. Summary of results of an email survey of participants in the R4 Pollinator Survey Protocol. Questions of the email survey are paraphrased and in **bold lettering**, and the highest ranked answers are shown in *blue italics*. X's show the tally of 'votes' for questions involving only one answer, and 1's indicate participant's first choice and 2's show their second choice for those that identified a second choice. (DeLong 2020)

| **Which Pollinator Taxa should be Addressed?** | Votes | **What Aspect of Diversity should be Addressed?** | Votes |
|---|---|---|---|
| Bumble bees | X | Presence/absence of one or two species | 2 |
| Bees | X | Presence/absence of Xerces Soc. Red List Species | 12 |
| *Bees and butterflies* | XXXXX | *Species Richness* | 1112111 |
| Bees and flies | | Abundance estimates of one or two species | |
| All insect pollinators | X | Relative abundance | 221122 |
| Other (butterflies) | X | Abundance estimates by species | 12122 |

| **What Geographic Scale?** | Votes | **Inventory or Monitoring?** | Votes | **Habitat & Floral Associations** | Votes |
|---|---|---|---|---|---|
| District or Forest | 21 | Inventory | X | *Habitat Associations* | 211211 |
| *NFs across Region 4* | 12111 | Monitoring | XX | Floral Associations | 1212 |
| All lands across Region 4 | 121 | *Inventory and Monitoring* | XXXXXXXX | | |
| NFs across the U.S. | 22 | | | | |
| All lands across U.S. | 1 | | | | |
| Other | 11 | | | | |

Beyond the questions paraphrased in Table 1, a question was asked about representativeness, with two possible choices: (1) concept of building species list over time, with no major intent for the data to represent the status on the unit, and (2) data to represent status of populations of the vegetation type (within a Forest), Forest, Region, or other unit; six participants selected the second and four selected the first. The seventh question dealt with causation but results were inconclusive.

## RELATIONSHIP TO 2012 PLANNING RULE

Forest Plans direct and guide management of each national forest (each national forest has their own forest plan), and the process of revising existing forest plans is directed and guided by planning rules. Planning rules have a heavy influence on how land-management requirements in law and regulation are translated into on-the-ground actions, and they identify requirements for inventorying and monitoring animals and plants. The most recent planning rule is the 2012 Planning Rule.

The 2012 Planning Rule does not require inventorying or monitoring of pollinators and does not provide any mechanisms for their monitoring over the long term. An exception is if one or more pollinator species are identified as Species of Conservation Concern (SCC) on a particular national forest. This means that, unless a pollinator species is identified as SCC, the Forest Service probably may not fund pollinator inventories and monitoring in most situations. (Attachment A outlines information on ecological monitoring under the 2012 Planning Rule.)

That said, however, there is a considerable and growing concern about pollinators in the western U.S., across the United States, and globally (Rhodes 2019, Sanchez-Bayo et al. 2019, Graves et al. 2020). While there is sufficient information to have determined declining population trends or declining distribution of western bumble bees and Suckley's bumble bees (Strange and Tripodi 2019, Graves et al. 2020), Spring Mountains dark blue butterflies and Morand's checkerspot butterfly (USFWS 2012), and a small number of other bee and butterfly species, there is very limited or no population trend or distribution data to ascertain whether numerous species warrant consideration as SCC. To be able to assess population trends for the purposes of determining whether species are of concern, pollinator population data collected on individual districts and national forests needs to be collected in ways that facilitate assessments at large geographic scales.

Also, while pollinators are not specifically mentioned in the 2012 Planning Rule, pollination is identified in the Forest Service Handbook as an ecological process (driver) to consider in forest plan revision (Exhibit 12.13 of 1909.12) and is identified as a supporting ecosystem service in section 13.12 of 1909.12, both of which fall under section 219.8, 219.9, and 219.10 of the 2012 Planning Rule.

Therefore, while it is recognized that outside funding will be needed in most cases to inventory and monitor pollinators, a standardized approach will facilitate future analysis of population-level trends and possible distribution changes.

## KEY PARTS OF THE FRAMEWORK

The following key factors were decided upon, based on the email-survey sent to working-group members, the goal statement, and discussion.

### Three Broad Categories of Surveys

Three broad categories of pollinator surveys were identified from the questionnaire and discussion:

A. ***Single species or narrow taxa (e.g., bumblebees, Spring Mountains dark blue butterfly)***
   1. Baseline inventory
   2. Long-term monitoring

B. ***Butterfly taxa or bumble bee taxa***, by volunteers (assumed to be long-term monitoring)

C. ***Pollinators as a group (bees, butterflies, and possibly flies)***
   1. Baseline inventory
   2. Long-term monitoring

These survey categories are shown in the middle of Figure 1. More than one pollinator-survey protocol is needed because not all survey needs can be accommodated with one protocol. One reason for this is that a general pollinator survey protocol (for 'C' above) includes survey methods that may not make sense where an individual pollinator species or narrow taxa are being surveyed (i.e., 'A' and 'B' above).

*Category A* — It is hoped that the Regional Office would create a place (e.g., on the RO website) for survey protocol for individual species like threatened Spring Mountains dark blue butterfly, the endangered Mount Charleston blue butterfly, and endangered Acastus checkerspot butterfly. This could facilitate future efforts to develop survey protocol for individual species or genera.

*Category B* — Forest Service protocols will not be needed for 'B', above, because these have been and will be developed by other agencies or organizations. However, attempts will be made to compile and make-available protocols for efforts that take place on National Forest System lands in Region 4. Two examples are:

- Bumble Bee Watch (https://www.bumblebeewatch.org/).
- Bumble Bee Atlas (e.g., https://www.pnwbumblebeeatlas.org/).
- Butterfly monitoring programs (see https://thebutterflynetwork.org/monitor-tracker).
- Other citizen science efforts (links provided at https://xerces.org/community-science).

*Category C* — A protocol for Category C ("Forest Service Region 4 Pollinator Survey Protocol for Bees and Butterflies") was prepared by the working group; see Tronstad et al. (2020). While in draft form, it was applied to a baseline inventory of the Greys River Ranger District, Bridger-Teton National Forest as a pilot project, and a small number of adjustments were made to the protocol based on preliminary results of this pilot project.

## Geographic Scale Considerations

Protocol for the above three categories of surveys are designed to be able to answer questions at the Forest level, primarily, but also with an eye toward scaling the data upward to state and regional levels. Having standardized protocols across the region will be instrumental for doing this.

## Sampling Methodology

The main sampling methods are as follows.

1. Blue vane traps and pan (cup) traps for bees — Where bees are to be surveyed as a taxa, a minimum of 3 vane traps and 9 cup traps (3 blue, 3 yellow, and 3 white) should be used at each site. The number of traps is based on a power analysis conducted by Tronstad (2020). However, note that pan traps do not work very well in windy, dry areas due to higher rates of evaporation and they are more likely to blow away.
2. Netting along transects for butterflies and bees — Transects for surveying butterflies as a taxa should be at least 1 km in length, based on the 'Pollard walk' (Taron and Ries 2015), to be able to use the data at larger scales (e.g., North American Butterfly Monitoring Network). A meandering transect may be needed to be able to fit the transect within one type of habitat.

As noted by Droege et al. (2016:11), "no single method has the capability of capturing representatives of all bee genera and/or species within the area of interest." Each individual method has pros and cons. Recent studies of bees have demonstrated that a combination of blue vane traps, bee cups, and netting of individual bees (or sweep netting) along transects will result in wide range of taxa being captured (Joshi et al. 2015, Droege et al. 2016, Rhoades et al. 2017, Bell 2019), although other authors have critiqued this type of 'all of the above' approach (Portman et al. 2020) and pan traps "…are considered the mainstay of many I&M programs" (Droege et al. 2016:11). Some studies have found that vane traps tend to capture larger bees (e.g., bumble bees, carpenter bees), pan traps more efficiently capture small bees (e.g., sweat bees, mason bees), and netting of individual bees along transects will allow bee species not captured in vane and pan traps to be sampled (Joshi et al. 2015, Droege et al. 2016, Rhoades et al. 2017), while another studies found vane traps to capture a large range of sizes, overlapping with pan traps (Bell 2019). A combination of netting along transects, blue vane traps, and pan traps or bee cups appears to be increasingly used to survey pollinators (personal comm. 2020, Jim Rivers, Oregon State University).

Many pollinator fly species do not respond to color (they are volatile sensitive), so color traps do not attract them, although some fly species are captured in vane and pan traps. However, although malaise traps are good for sampling pollinating flies, they also capture a wide range of non-pollinating insects ("they catch everything") and will add considerably to workload. It was decided that they can be used as a supplement where specific questions and sufficient funding warrants this.

Visual/photography based sampling is not realistic. Even for bumble bees, which some members of the working group feel are the easiest bees to identify, experts found that only half of photos are sufficient to identify bumble bees to species with certainty. It is better for butterflies, but both the topside and underside of wings are needed for identifying many butterfly species. Photos can be a good addition (supplementary) to other methods.

Acoustic methods 'are not there yet'.

## Habitat and Flower Associations

Habitat and flower associations of individual pollinator species should be documented to the degree possible. The vegetation classification system (whether it is plant community type, habitat type, vegetation type, or other classification system) needs to be decided upon, in order to scale upward in data

analysis. Wherever possible, species of flower (or genus at a minimum) should be documented when pollinators are captured on a flower or captured pollinators had just been observed on a particular flower.

Recording habitat and flower associations will add to the information base of habitat and flower associations of each pollinator species, and will contribute to our understanding of ecological conditions (Attachment A) in the context of pollinators. While considerable information exists for a small number of pollinator species, these associations are not well understood for most species, and this information provides a connection between pollinator population data and on-the-ground management.

## USING THE FRAMEWORK IN FIGURES 1 AND 2

The intent of the framework outlined in Figures 1 and 2 is two-fold: (1) guide the development of standardized pollinator protocols for Region 4, and (2) provide assistance to botanists, biologists, and others on individual districts and forests in the process of deciding the scope of pollinator surveys to initiate.

The answers to two main questions narrow the scope of possible survey categories considerably (at the top of Figure 1), and subsequent questions in Figure 1 serve to help ascertain what category of survey makes most sense in particular situations.

The shaded boxes of Figure 1 (broad category of survey) are repeated along the left side of Figure 2, and the questions begin in the middle-left of the figure (indicated with "Start Here") to ascertain:

- Diversity elements to address: species richness and abundance, species richness and relative abundance, or species richness only.
- Habitat and floral elements to address.

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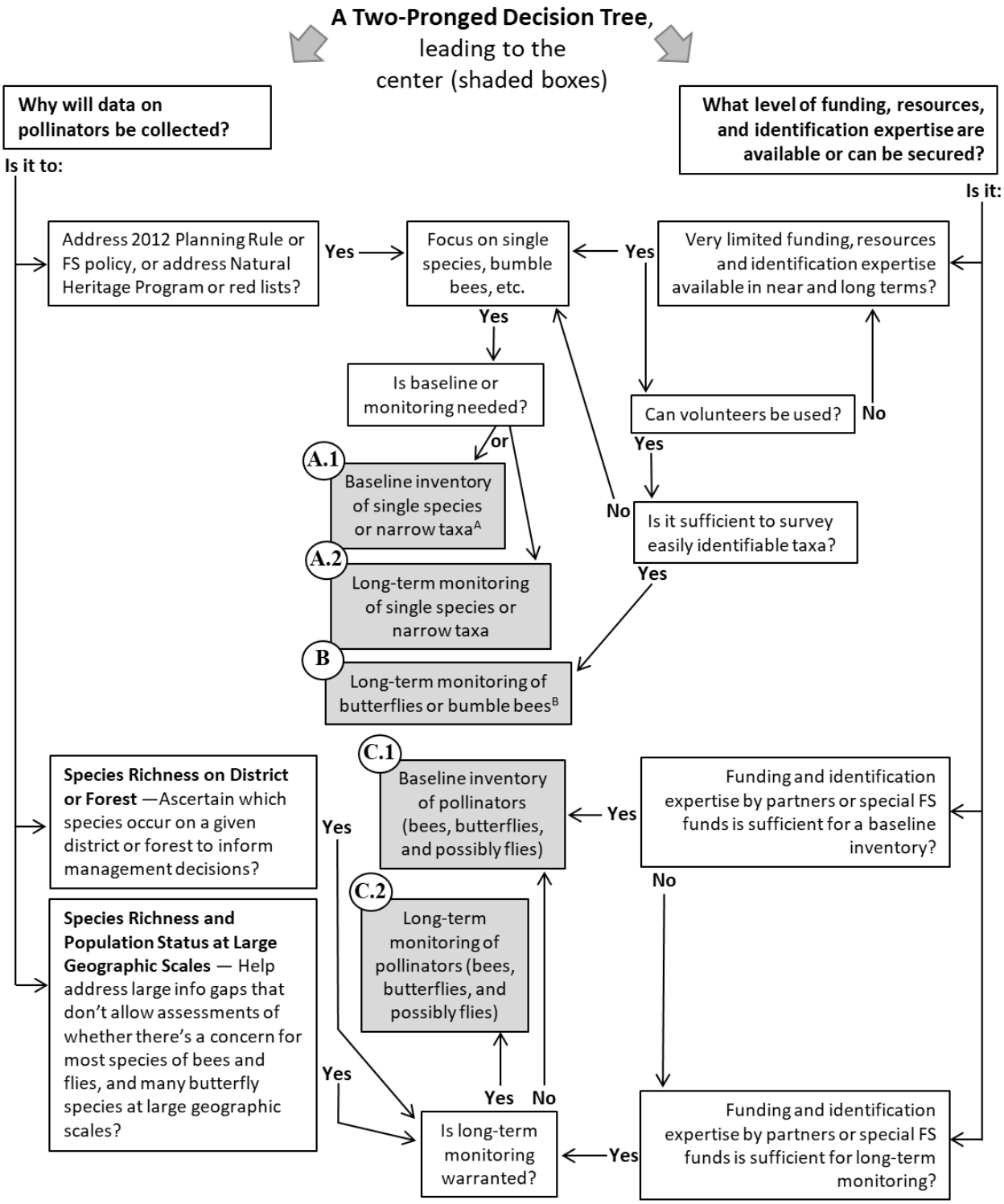


Figure 1. **Region 4 Pollinator Survey Protocols Framework**. A decision tree for assessing the level of pollinator survey to carry out, based on pollinator survey needs and the level of funding, resources, and identification expertise that are available or that can be obtained. Shaded boxes generally depict whether an inventory or monitoring is warranted, and the taxa of pollinators to be surveyed.

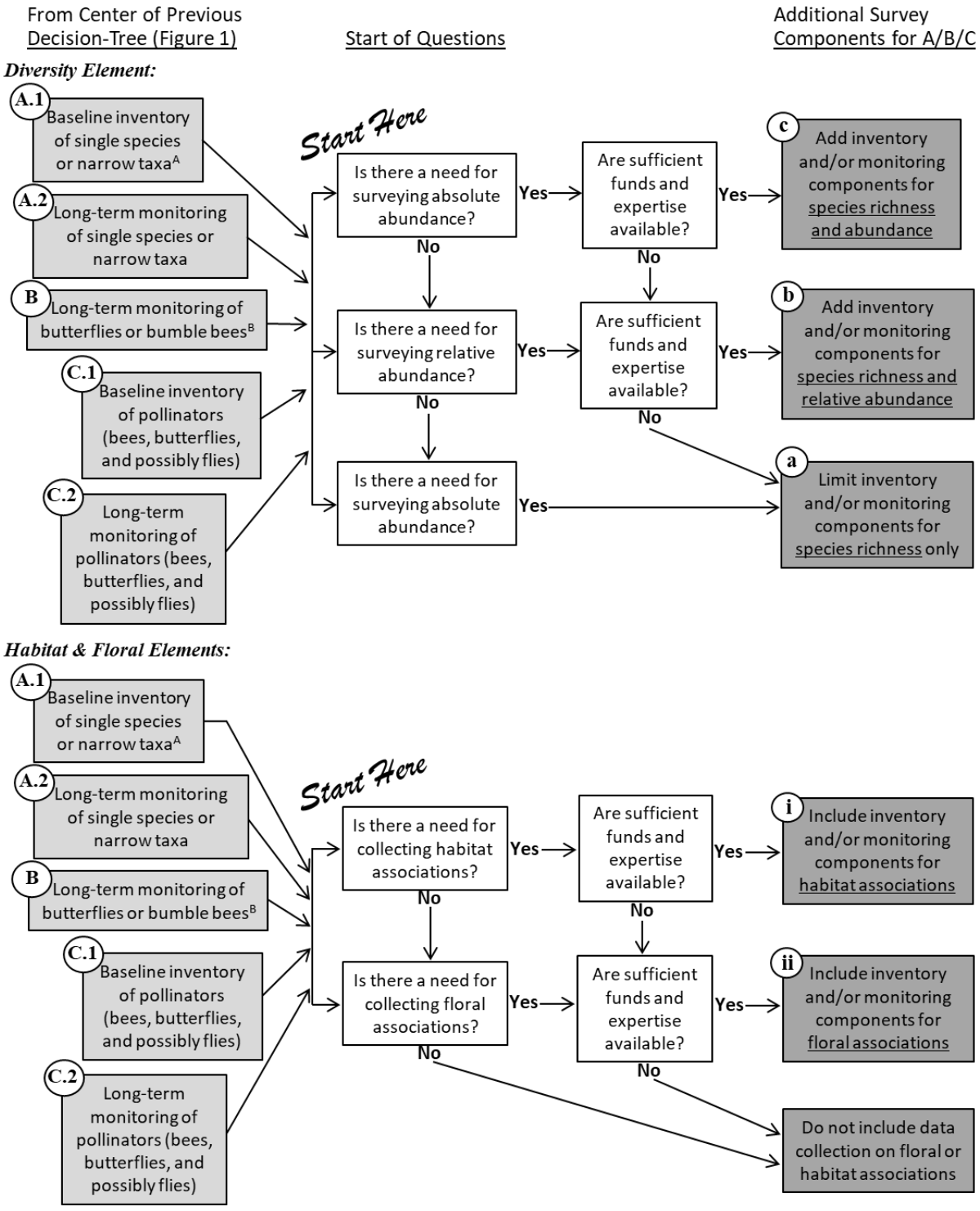


Figure 2. **Region 4 Pollinator Survey Protocols Framework** (cont'd). The second part of decision tree for assessing the level of pollinator survey to carry out in terms of diversity elements to survey and secondary data collection (habitat and floral resources). Dark-shaded boxes on the right side of decision tree identify additional components to add to inventory and monitoring protocols.

**Attachment A**

**Regional Ecological Monitoring According to 2012 Rule—Salient Summary (219.12)**

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Monitoring is continuous and provides feedback for the planning cycle by testing relevant assumptions, tracking relevant conditions over time, and measuring management effectiveness. The monitoring program includes plan-level and broader-scale monitoring. The plan-level monitoring program is informed by the assessment phase; developed during plan development, plan amendment, or plan revision; and implemented after plan decision. The regional forester develops broader-scale monitoring strategies. Biennial monitoring evaluation reports document whether a change to the plan or change to the monitoring program is warranted based on new information, whether a new assessment may be needed, or whether there is no need for change at that time.—From 219.5

These monitoring activities do not apply to and are not a prerequisite for project level decisions.

Process:

- Regional forester develops broader-scale monitoring strategy for questions best answered across more than one plan area.
- Should have been developed by 2016, or during plan revision, or as soon as practicable.

Purpose and Form:

- To be able to help determine if a change in plan content is needed.
- Formed in coordination with the regional forester, State and Private, R&D and public.
- Questions and indicators are designed to track relevant changes on plan areas.
- Measures management effectiveness toward achieving desired conditions and objectives.
- Is coordinated at local and broader scales.
- It may be limited due to financial and technical capabilities of the FS.

Must Include One or More Of:

- Status of select watershed conditions.
- Status of select ecological conditions and characteristics of terrestrial and aquatic ecosystems.
- Status of focal species to assess ecological conditions.
- Status of ecological conditions (219.9) contributing to recovery for TES, candidates, and SCC viability.

Must take into account:

- Existing national and regional inventory, monitoring, and research programs of FS and others.
- Opportunities for multi-party monitoring among FS units and other entities, including Tribes.

Required Evaluation and Reporting:

- Biennial evaluation of the monitoring information issued in a written report available to public.
- First monitoring report due within 2 years from plan revision or as soon as practicable.
- The monitoring report can be postponed for 1 year, but notice of postponement must be announced.
- Must indicate if changes to plan, activities, or monitoring may be warranted and must inform adaptive management.