Burney-Hat Creek Basins Project

Collaborative Forest Landscape Restoration Program (CFLRP)

Multiparty Monitoring Plan for Ecological Resources

Lassen National Forest, Region 5, USDA Forest Service
Burney-Hat Creek Community Forest and Watershed Group

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Version 2.0

Table of Contents

1.0 Introduction 1
2.0 CFLRP monitoring guidelines 1
3.0 Background 2
4.0 Monitoring Questions 3
4.1 Guide to Monitoring Questions 12
4.1.1 Question vs. Sub-question 12
4.1.2 Priority 12
4.1.3 Scale 12
4.1.4 Type 13
4.1.5 Potential Indicators 13
4.1.6 Methodology 13
4.1.7 Responsibility 13
5.0 Prioritization Results 13
6.0 Individual monitoring plans 14
7.0 Communication and Reporting Results 14
Burney Hat Creek CFLR Monitoring Project Proposal 15

Tables

Table 1. Monitoring questions related to **Fire and Fuels and Reforestation** 4
Table 2. Monitoring questions related to **Forest Structure and Spatial Heterogeneity** 5
Table 3. Monitoring questions related to **Hydrology** 6
Table 4. Monitoring questions related to **Wildlife** 7
Table 5. Monitoring questions related to **Forest Understories and Non-Forested Ecosystems** 8
Table 6. Monitoring questions related to **Botanical Resources** 9
Table 7. Monitoring questions related to **Aquatic Resources** 10
Table 8. Monitoring questions related to **Soil Resources and Project Implementation** 11

Recommended by: Burney Hat Creek Community Forest and Watershed Group 7/26/18
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MONITORING STRATEGY OBJECTIVES

- Develop questions with **measureable** indicators and **meaningful** outcomes
- Build a **feasible** monitoring program that can be implemented
- Incorporate **flexibility** to adapt to new opportunities (unforeseen questions) and altered conditions (e.g. fires, drought, tree mortality)
- Focus on questions that are important **learning** opportunities, don't monitor just to monitor
- **Reduce redundancy**; don't waste time doing something that we already know the answer to or another group is monitoring

1.0 Introduction

Monitoring is integral to the success of the Burney-Hat Creek Basins Collaborative Forest Landscape Restoration Program (CFLRP) Project. Forest Service managers and stakeholders use monitoring to measure progress toward restoration goals, objectives, and desired conditions; identify ways to improve project design and implementation; and assess the ecological impacts on resources of concern. Monitoring is also an essential tool for demonstrating and communicating successes, as well as areas in need of improvement, to stakeholders involved in the collaborative process.

Monitoring has been ongoing within the Burney-Hat Creek Basins CFLRP since the project's inception in 2012; descriptions of these monitoring activities have been provided in both the Annual Reports and Ecological Indicator Reports (available online at https://www.fs.fed.us/restoration/CFLRP/results.shtml). The purpose of this document, is to build upon these efforts by providing a more cohesive, overarching monitoring framework. This framework, which is presented in the form of detailed monitoring questions, was developed by the Burney-Hat Creek multiparty monitoring working group (MMWG) over a three year period. The intent of this strategy is to provide questions that are focused, practical, and feasible to implement, and will also produce meaningful outcomes. The questions outlined in this strategy are not meant to be static; rather they will be updated and refined by the MMWG on an annual basis, as new information is gathered, projects are designed, and opportunities for partnerships arise. It is our overarching goal that this strategy will be a springboard for development of collaborative monitoring partnerships, where resource specialists and stakeholders have strong ownership in the monitoring process.

2.0 CFLRP monitoring guidelines

The Omnibus Public Land Management Act of 2009, as well as the 2011 Burney Hat Creek Basins CFLRP Project Proposal, provides some guidelines for multiparty monitoring within the CFLRP, including the following:

- A multiparty monitoring, evaluation, and accountability process will be used to assess the positive or negative ecological, social, and economic effects of implementing CFLRP projects (Omnibus Public Land Management Act of 2009);
- Monitoring will occur throughout the life of the project, and then for an additional five years; for Burney Hat Creek CFLRP this time period extends from 2012 to 2027 (Omnibus Public Land Management Act of 2009)

- The Collaborative Forest Landscape Restoration Fund can be used to pay up to 50 percent of the cost of carrying out and monitoring ecological restoration treatments on National Forest System lands (Omnibus Public Land Management Act of 2009)
- Over eight percent of the Burney Hat Creek Basins CFLRP project budget will be dedicated to monitoring; this includes project and landscape-scale baseline monitoring (Burney Hat Creek Basins CFLRP Project Proposal 2011)

These documents, as well as other local management plans and assessments (e.g. Fall River RCD Watershed Assessment and Watershed Management Plans, 10-year Comprehensive Strategy Implementation Plan, etc.) also contain a number of ecological restoration goals that are relevant to project design, implementation, and monitoring in the Burney Hat Creek Basins CFLRP project.

3.0 Background

This monitoring strategy was developed by the Burney-Hat Creek Basins MMWG. This group, which was officially formed in 2014, has diverse membership, including representation from the U.S. Forest Service, Lassen Forest Preservation Group, Resource Conservation Districts, Sierra Pacific Industries, Fire Safe Councils, Lassen National Park, Pit River Tribe (environmental coordinator), and local land owners (see list of contributors on page 3). Prior to drafting a list of monitoring questions, the MMWG identified criteria for question refinement and prioritization (see box). Over the fall and summer of 2014, a list of about 27 ecological monitoring questions were drafted. These questions were revised and refined between 2015 and 2016 by the MMWG and a series of small focus groups. From these efforts, 14 broad ecological monitoring questions and 34 associated sub-questions were identified. The MMWG then prioritized the list of questions based on the prioritization criteria described in the box to the right (see section 5.0 for overview of results).

PRIORITIZATION CRITERIA USED IN DEVELOPMENT OF MONITORING QUESTIONS

Informs adaptive management

Provides data to inform future management decisions

Builds on scientific knowledge or addresses uncertainty about treatments, systems, etc.

Has not been answered through previous monitoring efforts

Meets national requirements and project goals

Addresses goals of the CFLRP and the requirements to monitor social, economic, and ecological values

Focuses on one of the four ecological indicators (fire regime restoration, fish and wildlife habitat, watershed conditions, invasive species) that must be reported on

Assesses the effectiveness of a treatment

Is measurable using feasible and defensible methods

Is cost-effective and practical to implement

Is measureable. The question is focused and outcome based.

It will provide the quality of evidence needed to answer the question at hand.

Is important to stakeholders

Stakeholders have ownership in the question and the outcomes

4.0 Monitoring Questions

The tables below are the foundation of this monitoring strategy. They list the ecological monitoring questions, as well as the prioritization score, project scale, type of monitoring, potential indicator metrics, and responsible parties. Descriptions and definitions for each of these fields are provided following the tables in Section 4.1. Questions are grouped into the categories listed below and are presented in order of priority (based on the average group score); the National CFLR Ecological Indicator that each group of questions addresses is also provided.

- Fire and Fuels (Table 1) – Fire Regime Restoration
- Reforestation (Table 1) – Fire Regime Restoration
- Forest Structure and Spatial Heterogeneity (Table 2) – Fire Regime Restoration
- Hydrology (Table 3) – Watershed Condition
- Wildlife (Table 4) – Fish and Wildlife Habitat Condition
- Forest understories and non-forested ecosystems (Table 5) - Fish and Wildlife Habitat and Watershed Condition
- Botanical Resources (Table 6) – Invasive Species
- Aquatic Resources (Table 7) – Fish and Wildlife Habitat
- Soil Resources (Table 8) – Watershed Condition
- Project Implementation (Table 8) – All categories

List of contributors to strategy

MMWG co-leads

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Table 1. Monitoring questions related to **Fire and Fuels and Reforestation**

Question	Sub-question	Priority	Scale	Type	Potential Indicators	Methodology	Responsibility
FIRE.1. Are treatments effective at maintaining, promoting, or reestablishing natural fire regimes?	FIRE.1.1. In areas where the goal is to reduce high severity patch size and fire-related tree mortality, are treatments effective?	2.6	Landscape	Effectiveness (3)	Wildfires: total acres burned at high severity (that would "naturally" be low to moderate severity) in treated (pre-fire) and untreated areas; Fire models: total acres projected to burn at high severity pre and post-treatment	FARSITE models - run now and at the end of the CFLR project	LNF Fire and Fuels
	FIRE.1.2. Are prescribed fire treatments and/or managed wildfires effective at maintaining, promoting, or reestablishing natural fire regimes?	2.6	Landscape	Effectiveness (3)	Treated (including wildfire) vs. untreated; proportion of landscape within the appropriate fire return interval (FRID) and natural fire regime	GIS analysis	LNF Fire and Fuels/GIS/SCP Ecology
RF.1. What are the effects of different salvage and reforestation strategies on post-fire fuel loads, understory species, and the survival and growth of planted trees?	RF.1.0. What are the effects of different salvage and reforestation strategies on post-fire fuel loads, understory species, and the survival and growth of planted trees?	2.7	Project (Eiler Fire) Landscape	Effectiveness (3)	Current and future stand structure; competing vegetation (understory cover, height and species); fuel loads; moisture availability, moisture stress	Long-term permanent planted plots in treated and untreated areas	PSW, LNF Ecology

Table 2. Monitoring questions related to **Forest Structure and Spatial Heterogeneity**

Question	Sub-question	Priority	Scale	Type	Potential Indicators	Methodology	Responsibility
FOR.1. Do thinning (e.g. variable density, ICO, etc.) and prescribed fire treatments increase heterogeneity within forest stands?	FOR.1.1. Do thinning and prescribed fire treatments maintain or create desired levels of down woody debris (over 15" diameter) and standing snags?	2.2	Project (N49, Plum)	Effectiveness (3)	Pre and post-treatment snag size, density, and decay class; Pre and post-treatment coarse woody debris (> 15" diameter)	Pre and post-treatment stand exams (modified to capture key indicators)	LNF Wildlife/Veg
	FOR.1.2. How do large (>25" dbh) pines respond to radial and area (stand-level) thinning treatments?	2.5	Project (N49)	Effectiveness (3)	5-10 years post-treatment: tree species, dbh, height, crown height, basal area, vigor (using Keen Class System), mistletoe rating, and beetle presence	Forest Health Protection (FHP) protocol	LNF Ecology; FHP
	FOR.1.3. What are the effects of thinning and prescribed fire treatments on tree survival, mortality, and regeneration?	2.5	Project (N49, Plum)	Effectiveness (3)	Stand level: pre and post-treatment distribution of individuals, clumps, and openings (ICO)	Pre and post-treatment stand exams (modified to capture key indicators); ICO protocol; Aspen treatment effectiveness; LiDAR data analysis	USFS Veg / SCP Ecology
	FOR.1.4. Do thinning treatments increase spatial heterogeneity within forest stands?	2.1	Project (N49, Plum); Landscape	Effectiveness (3)	Individuals, clumps, and openings (ICO)	Pre and post-treatment stand exams (modified to capture key indicators);LiDAR data analysis	USFS Veg / SCP Ecology
FOR.2. Are restoration treatments (e.g. thinning and/or prescribed fire) effective at enhancing resistance and resilience of forested stands to insect outbreaks and moisture stress?	FOR.2.0 Are restoration treatments (e.g. thinning and/or prescribed fire) effective at enhancing resistance and resilience of forested stands to insect outbreaks and moisture stress?	2.8	Project (CrossRds, Ventura Fire); Landscape	Effectiveness (3)	TBD	R5 Ecology protocol: Forest treatment effectiveness for reducing tree mortality	TBD

Table 3. Monitoring questions related to **Hydrology**

Question	Sub-question	Priority	Scale	Type	Potential Indicators	Methodology	Responsibility
HYD.1. What are the effects of thinning treatments on snow melt dynamics and soil moisture availability?	HYD.1.1. What are the effects of different silvicultural treatments (e.g. radial thinning, group selection, diversity thinning, and no treatment) on snow melt dynamics?	2.6	Project (N49)	Effectiveness (3)	snow accumulation, sublimation; transpiration; soil moisture and temperature; weather variables; stand structure and composition; understory plant cover and composition; ground cover; ground fuels;	Fiber-optic lines w/ thermocouples; weather towers; buried soil moisture and temperature probes; permanent vegetation plots; LiDAR coverage.	LNF Hydrology, UNR, PNW, and SCP Ecology
	HYD.1.2. How do management activities, such as thinning and hydrologic restoration, influence soil moisture?	2.6	Project (N49, Big Lake)	Effectiveness (3)	soil water content; tree water uptake; tree density; transpiration; sap flux	sap flow sensors; rain buckets, weather towers; buried soil moisture and temperature probes	LNF Hydrology, UNR, PNW
HYD.2.How are CFLR-related activities (e.g. upland and riparian restoration actions, grazing, and recreation) impacting condition and water quality in perennial streams and springs?	HYD.2.1. Do livestock use patterns negatively impact the condition and quality of natural waters?	2.3	Landscape	Baseline (1)	Water quality (total dissolved solids, dissolved oxygen, salinity, nitrates, ammonium), pH; grazing utilization	multi-year pre and post-season water sampling	LNF Hydrology, LNF Range
	HYD.2.2. What is current stream condition and water quality in Hat Creek and Lost Creeks?	2.5	Hat and Lost Creeks	Baseline (1)	Water quality (temperature, nutrients, turbidity, suspended sediment, total dissolved solids, oxidation/reduction potential, dissolved oxygen); sedimentation (stream bank stability), deposition in spawning gravels and other places); macro-invertebrates; vegetation (extent, sp. composition, forage utilization); groundwater (major ion characterization);	Modified streamscape protocol surveys, temperature loggers in rivers, fine-scale temperature work in streams, flow gauge, major ion analyses.	LNF Hydrology, Pit River tribe, USGS

Table 4. Monitoring questions related to **Wildlife**

Question	Sub-question	Priority	Scale	Type	Potential Indicators	Methodology	Responsibility
WL.1. Do restoration treatments maintain or enhance key habitat features for forest-dependent wildlife species of concern?	WL.1.1. Do thinning and prescribed fire treatments within spotted owl home range core areas (HRCAs) and northern goshawk protected activity centers (PACs) create, retain, or enhance key habitat features?	2.6	Project (Plum, N49) Landscape	Effectiveness (3)	Snag density and decay class; overstory canopy cover; down logs (coarse woody debris); tree density by size class; height strata (multilayer canopy)	Pre and post-treatment stand exams (modified to capture key indicators)	LNF Wildlife: External or internal (USFS) monitoring crew
	WL.1.2.Do restoration treatments maintain landscape-scale habitat connectivity for marten?	2.0	(N49, Whitt, Eiler) Landscape	Effectiveness (3)	LiDAR-derived metrics (e.g. canopy cover, tree height); shrub and understory vegetation; tree basal area; habitat connectedness; coarse woody debris; canopy closure, snag density	Spatial analysis of LiDAR data collected pre and post-treatment implementation	LNF Wildlife/GIS
WL.2.How do restoration treatments affect habitat use patterns for forest-dependent wildlife species of concern?	WL.2.1. Did spotted owl and northern goshawk occupancy within Protected Activity Centers (PACs) change after thinning and prescribed fire treatments?	2.2	Project (Plum, N49)	Effectiveness (3)	Nest site occupancy	Pre and post-treatment surveys	LNF Wildlife (pre and post-surveys)
	WL.2.2. Do individuals use areas within restoration treatments that were designed to maintain habitat features for marten?	2.2	Project (N49)	Effectiveness (3)	martin presence/absence	Motion-sensor cameras in treated and untreated areas (i.e. leave islands)	LNF Wildlife

Table 5. Monitoring questions related to **Forest Understories and Non-Forested Ecosystems**

Question	Sub-question	Priority	Scale	Type	Potential Indicators	Methodology	Responsibility
EC.1. What are the effects of management activities (e.g. thinning and prescribed fire) on species composition in forest understories and non-forested ecosystems?	EC1.1.How does thinning and underburning affect understory forage in forested ecosystems and how does this response influence livestock use patterns?	2.1	Project (Plum?)	Effectiveness (3)	Understory species composition; biomass; livestock utilization, seasonality; forage quality; bitterbrush density and cover by age class	LNF bitterbrush protocol; UC extension protocol	LNF Ecology, External Partners (UC Extension)
	EC1.2.How does juniper removal in sage brush steppe habitats affect plant community composition?	2.1	Project (Plum)	Effectiveness (3)	Species richness and abundance; soil moisture; treatment effects (e.g. basal area reduction, etc.); presence/ abundance of invasive species (e.g. cheat grass)	Pre- and post-treatment permanent vegetation plots (modified Whitaker plots)	LNF Ecology
	EC1.3.Does hydrologic restoration increase water availability within the system and alter plant community composition in meadow habitats?	2.6	Project (Big Lake, Coyote Spring, Twin Ponds)	Effectiveness (3)	Plant species cover and diversity; soil moisture; water table level	Pre- and post-treatment permanent vegetation plots surrounding piezometers and soil moisture meters	USFS Botany/ Ecology/ Hydrology
	EC1.4.Does thinning (lodgepole) and underburning maintain or increase native perennial bunchgrass species richness or cover in grassland and chaparral plots?	2.0	Project (Burney Springs Meadow Complex/ Eiler Fire)	Effectiveness (3)	Species richness and cover; distance to nearest cone-bearing lodgepole; duff/litter depth; lodgepole pine density by size class	Pre and post-treatment plots (vegetation and lodgepole pine) stratified by treatment	USFS Botany

Table 6. Monitoring questions related to **Botanical Resources**

Question	Sub-question	Priority	Scale	Type	Potential Indicators	Methodology	Responsibility
BOT.1. Do restoration activities (e.g. thinning, burning, post-fire management, livestock exclusion) increase the abundance, distribution, or persistence of Sensitive and Special Interest plant species?	BOT.1.1. What are the effects of overstory removal and grazing exclusion on the frequency of vanilla grass (*Anthoxanthum nitens*)?	2.0	Project (N49)	Effectiveness (3)	Vanilla grass frequency and reproduction; treatment variables (e.g. changes in overstory canopy cover, ground disturbance)	Pre and post-treatment vegetation plots (control, fenced, thinned, fenced & thinned)	LNF Botany
	BOT.1.2. How does wildfire severity affect Baker cypress regeneration and survival?	2.1	Project (Eiler Fire)	Baseline (1)	Baker cypress seedling density, tree health, incremental growth	Permanent plots established post-fire to assess stand structure, fire severity, cypress indicators, and vegetative cover	SCP Ecology, LNF Botany
	BOT.1.3. Can management activities such as thinning and prescribed fire be used to promote cypress reproduction and vigor?	2.3	Project (Whitt)	Effectiveness (3)	Cypress vigor, canopy cone storage, incremental growth, seedling densities.	Pre- and post-treatment plots centered on isolated cypress trees	SCP Ecology, LNF Botany
	BOT.1.4. What factors contribute to germination, persistence, and flowering of Baker's globe-mallow (*Iliamna bakeri*) following a fire event?	1.9	Project (Eiler Fire)	Baseline (1)	Densities of flowering and vegetative plants over time; fire severity	Permanent plots established post-fire	LNF Botany
NOX.1. Are restoration projects effective at containing or reducing the spread of noxious weeds?	NOX.1.1. How effective are targeted treatments on small infestations of high priority invasive species? Where necessary, did collaboration with adjacent landowners occur and was it successful?	2.0	Project (multiple, Brush Mountain)	Effectiveness (3)	Pre- and post-treatment density and cover	Pre and post-treatment monitoring of targeted weed treatments (permanent plots)	LNF Botany

Table 7. Monitoring questions related to **Aquatic Resources**

Question	Sub-question	Priority	Scale	Type	Potential Indicators	Methodology	Responsibility
AQ.1. To evaluate consistency with Forest Plan direction, how do restoration treatments in lentic and/or upland terrestrial ecosystems contribute to the maintenance and/or restoration of aquatic-riparian dependent species?	AQ.1.1. Does upslope thinning and post-thin burning affect the distribution of post-metamorphic long-toed salamanders and western toads that use these habitats during non-breeding seasons?	1.9	Project (Big Lake; Plum)	Baseline (1) and Effectiveness (3)	Presence and abundance of salamanders and toads in thinned and unthinned forests around the breeding lakes	Drift fence and time-constrained surveys before and after thinning compared to control sites	LNF Aquatics, PSW, University
	AQ.1.2. Do forest treatments influence the relative abundance and community structure of soil-surface macroinvertebrates, which are the primary food source of target amphibians (and can be beneficial or detrimental to forest productivity)?	2.0	Project (Big Lake)	Effectiveness (3)	Abundance and biomass by insect guild (e.g., root borers, dead-wood feeders, detritivores)	Funnel traps adjacent to amphibian sampling locations	PSW, University
	AQ.1.3. Does in-lake wood augmentation increase amphibian and aquatic macroinvertebrate densities or change the community structure of the aquatic fauna?	2.0	Project (Big Lake)	Baseline (1) and Effectiveness (3)	Distribution and community structure of amphibians and aquatic insects	*Amphibians*: Systematic visual encounter surveys *Aquatic insects*: Similar systematic surveys using benthic sweeps and emergence traps	LNF Aquatics, PSW, University
	AQ.1.4. Do restoration actions (e.g. wood augmentation) influence the prevalence and/or persistence of diseases in amphibians?	1.9	Project (Big Lake, Red Lake)	Effectiveness (3)	Larval mortality and prevalence of individuals infected with ranavirus, chytrid and/or chytrid Bsal in relation to lake-level and within lake treatments.	Visual encounter surveys; collection of moribund animals for lab testing; Swab a proportion of living animals for qPCR testing of disease status.	LNF Aquatics, PSW, University

Table 8. Monitoring questions related to **Soil Resources and Project Implementation**

Question	Sub-question	Priority	Scale	Type	Potential Indicators	Methodology	Responsibility
SOIL.1.How do restoration treatments (including post-fire management activities) impact soil productivity and associated plant growth?	SOIL.1.1. How does spreading windrowed topsoil increase soil productivity of the site and impact tree growth?	1.5	Project (Whitt)	Effectiveness (3)	Understory species, soil nutrients, tree productivity		LNF Soil Scientist
	SOIL.1.2.What methods are most effective for windrow restoration (i.e. to achieve even soil spreading)?	1.5	Project (Whitt)	Effectiveness (3)	Soil depth, soil nutrients, tree productivity		LNF Soil Scientist
	SOIL.1.3.What are the effects of salvage logging on soil recovery?	2.4	Project (Eiler Fire)	Effectiveness (3)	Total soil cover, woody debris cover, vegetative cover	Soil and vegetation transects within salvaged and un-salvaged retention islands; Digital photographs and cover analysis	LNF Soil Scientist; RSAC
IMP.1.Were the project-specific objectives, design features, and mitigation measures identified during the planning process implemented?	IMP.1.0. Were the project-specific objectives, design features, and mitigation measures identified during the planning process implemented?	2.3	Project (N49, Plum, CrossRds)	Implement (2)	Number of control areas protected; BMPs; project-specific standards and guidelines	Post-implementation project evaluation; BMP monitoring; GIS analysis	LNF (multiple resource areas); External Partners

4.1 Guide to Monitoring Questions

4.1.1 Question vs. Sub-question

a) *Question:* a broad monitoring question that is flexible enough to encompass current and future monitoring opportunities; can include multiple sub-questions.
b) *Sub-question:* a smaller, more focused question that may be limited to a particular species, resource, or project, but will contribute information necessary to address the broad monitoring question.

4.1.2 Priority

Individuals from the MMWG ranked each sub-question as high (score = 3), medium (score = 2), or low (score = 1). Numeric scores were then averaged to obtain an overall priority score. The ranking criteria described above (call out box), as well as the information below, were used to determine the prioritization rank. For each sub-question, the progress (e.g. "new", "in progress", or "near completion") and effort required was provided for use in the ranking process.

a) *High (score = 3)*: these are considered essential to management and/or address a key resource concern. Information from this monitoring effort will directly inform the way that projects are planned or implemented. Results will fill an important knowledge gap. Monitoring methodology is feasible to implement.
b) *Medium (score = 2)*: intermediate between high and low. These questions may inform the way that we do things, but may not be a high priority to the individual doing the ranking (e.g. our stakeholder).
c) *Low (score = 1)*: these are considered a "nice to-do" item, but may not address a key resource concern. Lower priority questions will likely be addressed if there is time, extra funding, or partnership opportunities.

4.1.3 Scale

Estimates the scale at which the monitoring will occur.

c) *Landscape:* monitoring will occur within multiple project areas and/or across the entire CFLRP landscape; will be used to address broad landscape-scale questions.
d) *Project*: monitoring will most likely occur within (but is not necessarily limited to) a specific project area; relevant projects are included in parentheses.

4.1.4 Type

Describes the type of information that will be obtained from the monitoring effort and demonstrates where in the adaptive management cycle (**Figure 1**) these results will be used.

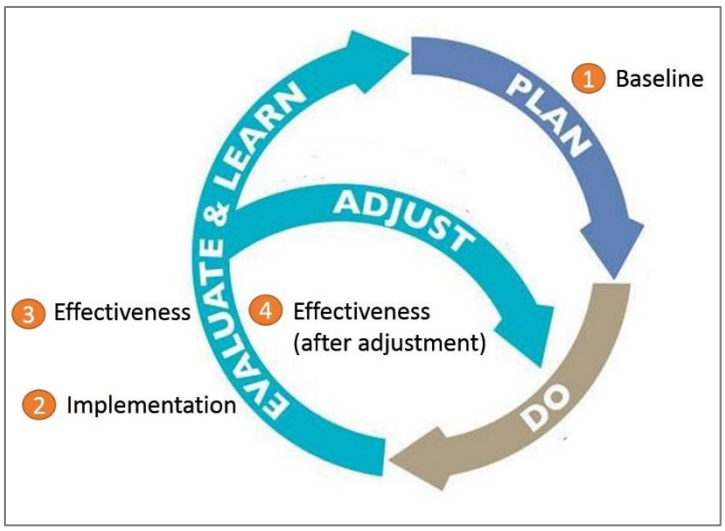

Figure 1. CFLR monitoring within the Adaptive Management Cycle

1) Provides baseline information to fill a critical knowledge gap; provides a foundation for project planning and development of management recommendations

2) Evaluates if the project was implemented as planned (compliance)

3) Tests the effectiveness of treatments at meeting the desired conditions and evaluates the impact of management actions on resources

4) Evaluates treatments after adjustments have been made based on prior monitoring efforts or targeted studies

4.1.5 Potential Indicators

Describes *what* will be measured. These will be updated and refined as individual monitoring plans are developed and refined for each sub-question.

4.1.6 Methodology

Describes *how* data will be collected. Project-specific sampling designs and methods for data collection and analysis will be provided in individual monitoring plans (not included in this strategy).

4.1.7 Responsibility

This identifies the parties responsible for implementing or coordinating the monitoring effort. This will be updated and refined as opportunities for partnerships arise.

5.0 Prioritization Results

The final step in development of the monitoring questions was prioritization. The purpose of this process was to provide a tool for stakeholders to communicate and identify their highest priorities for monitoring. Eleven members of the MMWG (six from the collaborative; five from the U.S. Forest Service) participated, ranking each of the 34 sub-questions presented in Tables 1-8 from high (score=3) to low (score=1). All of the questions received an average score of 1.5 (medium) or higher, suggesting that the process of identifying and refining priority questions was effective. The highest ranked questions, (i.e. those that received an average score of 2.5 or higher) were focused on:

- Resilience to insect outbreaks and drought (FOR. 2.)
- Reforestation strategies (RF.1.)
- Hydrologic and vegetative response to meadow restoration (EC1.3.)
- Effects of thinning on snow melt and soil moisture (HYD.1.1. and HYD.1.2.)
- Reduction in high severity fire and fire regime restoration (FIRE 1.1. and FIRE 1.2.)
- Creation, retention, and maintenance of key habitat features for spotted owl and goshawk (WL.1.1.)

These results will be combined with other priorities (e.g. monitoring National CFLRP Indicators as required) and will be used to inform the program of work and to refine and focus monitoring efforts.

6.0 Individual monitoring plans

Project-specific sampling designs and methods for data collection and analysis, which will be developed for each question as part of the individual monitoring plans, are not included in this strategy. These management plans will be developed by and shared with all interested stakeholders. They will include (but are not limited to) the following components:

- Specific monitoring objectives and goals: *what monitoring will accomplish*
- Indicator measures: *what will be measured to track progress on meeting goals and objectives*
- Thresholds: *what would trigger a need to reassess sampling design or management practices*
- Methods: *how indicators will be measured*
- Schedule: *when and how often will indicators be measured*
- Responsible parties: *who will collect, analyze, and summarize the data*
- Data storage: *where and how data will be stored and shared*
- Budget: *how much it will cost*

7.0 Communication and Reporting Results

All of the individual monitoring plans, data, and results will be available and accessible to stakeholders. Monitoring projects will be tracked in the Burney-Hat Creek Basins CFLRP Monitoring Database, which will be managed by the monitoring coordinator (U.S. Forest Service). Monitoring results will be presented in reports, presentations, and monitoring briefs. One of the primary objectives of this strategy is to incorporate flexibility (see box on page 1). Some monitoring projects may rely on a particular project being implemented or a specific funding source. Other opportunities may arise after a disturbance, such as fire or insect mortality, results in altered conditions on the ground. New monitoring projects will be approved by the collaborative and line offer using the monitoring project form provided below.

To allow for maximum flexibility, the MMWG will need to continue to play an active role in developing, reviewing, and refining the monitoring questions presented above. The MMWG will complete the following tasks on an annual basis (see Appendix B for details):

- Field season planning and approval of annual monitoring activities
- Presentation and discussion of monitoring results from the previous season(s)
- Review and revision of monitoring strategy

Appendix A: Burney Hat Creek CFLR Monitoring Project Proposal

Project Name (Fiscal Year)

Project Proponent (Job Title)**:** _____

Monitoring question: (*clearly state monitoring question; identify link to BHC monitoring strategy)*

Monitoring project description: *(state monitoring objective, methods, data to be collected and how they will address the monitoring objective, statistical design for quantitative monitoring, how frequently monitoring will be conducted, frequency of evaluation, standards used in evaluation, trigger points for success or adjustment of project)*

Estimated cost: *(Provide cost estimate for project, separated out by year if known)*

Timeline and associated accomplishments: *(Identify whether the project will span multiple years and if so specify tasks, accomplishments, and targets by year)*

Year	Task	Product / Accomplishment

Checklist (*Complete checklist below; provide clarification in comment section at the end in necessary*)

yes		no	
☐	☐	☐	*Will the monitoring question provide potential answers that may inform future decisions and management actions?*
☐	☐	☐	*Does the project meet a core objective of the CFLRP project?*
☐	☐	☐	*Does the project meet other specified and agreed upon BHC collaborative goals?*
☐	☐	☐	*Has the question been answered through previous monitoring or research efforts?*
☐	☐	☐	*Is the project cost effective and practical to implement?*
☐	☐	☐	*Is the question focused and outcome based? Will it provide the quality of evidence needed to answer the question?*
☐	☐	☐	*Do other stakeholders (e.g. the multiparty monitoring group) have ownership in the question?*

Provide Comments and Clarifications on BACK

Appendix B: Changes from previous versions of the monitoring strategy

2018 Updates and changes

In 2018, the MMWG held two meetings to review and discuss revisions to the Multiparty Monitoring Plan for Ecological Resources (Version 1.0). The outline below summarizes the outcome of these meetings and the resulting changes that were made to the monitoring plan (represented in version 2.0).

- March 27, 2018: the MMWG held a conference call with Lassen National Forest resource specialists and monitoring project leads. Kirstin Bovee (botanist) recommended dropping monitoring question BOT 1.5 and Karen Harville (wildlife biologist) recommended dropping WL.2.1. The rationale for these recommendations is outlined below.
- May 1, 2018: the MMWG held a conference call to review the 2018 annual monitoring activities and to discuss the recommended changes to the monitoring plan. The group, in collaboration with the wildlife biologist, suggested changing (rather than dropping) monitoring question WL.2.1 to focus on habitat condition and occupancy, rather than monitoring individual birds.

Summary of changes from Version 1.0

1. Dropped the following sub-question:
    - **BOT.1.5**: How does prescribed fire affect the density and cover of Liddon's sedge (*Carex petasata*), an ecotonal rare species?
    - **Rationale**: After careful review of the amount of Liddon's sedge within treatment units, it was determined that there were too few occurrences/replicates to be able to answer the proposed question.
2. Changed the following sub-question:
    - **WL.2.1.** How do thinning and prescribed fire treatments within and adjacent to protected activity centers (PACs) and home range core areas (HRCAs) affect northern goshawk nesting and foraging patterns?
    - **Rationale:** It was determined that both the cost and effort (i.e. radio tracking individuals) required to accurately answer this question surpassed the capacity of our current monitoring program. The multiparty monitoring working group suggested pairing pre- and post-treatment occupancy surveys with detailed habitat data to try and make inferences regarding treatment effects to species of concern.
    - The revised WL.2.1 reads as follows: *Did spotted owl and northern goshawk occupancy within Protected Activity Centers (PACs) change after thinning and prescribed fire treatments?*