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John F. Marshall



North Central Washington Collaborative Forest Landscape Restoration Project

Multi-Party Monitoring Plan

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Introduction

The North Central Washington Collaborative Forest Landscape Restoration Project (CFLRP) was selected for funding in 2022 (Figure 1). Funded projects are required to complete annual multiparty monitoring as a method to evaluate the social, economic, and ecological impacts of project implementation and create accountability.

In response to feedback from projects funded over the first 10 years of the program, in 2022, the Washington office of the USFS developed a common monitoring strategy for all newly funded CFLRP projects and extensions ([CFLRP CMS 2022](#)) that relies on regional and national level datasets to standardize monitoring across the CFLRP landscapes within each region. In addition to the national common monitoring strategy (CMS), each project is encouraged to work through a collaborative process with partners to determine if there are additional questions or refinements to the CMS that local partners are interested in.

Over the past 10 months, partners from the North Central Washington Forest Health Collaborative and others have engaged with the USFS to develop and refine the monitoring plan for the North Central Washington CFLRP to guide monitoring over the next 10-15 years. The goal of this monitoring plan is to describe the questions, partner contributions, leveraged resources, and adaptive management framework for the restoration treatments implemented by the USFS and partners within the North Central Washington CFLRP. This plan should be considered a living document that may be updated based on new science or emerging issues.

Background

The NCW CFLRP landscape contains an estimated 1,148,367 acres of disturbance-prone ecosystems of dry and moist-mixed conifer and cold forests. This landscape sits on the eastern slopes of the Cascade Mountains, between the high-severity fire regimes at the Cascade crest and the wildland urban interface adjacent to the Columbia River and its tributaries. As the second most steep, rugged, and inaccessible national forest in the country, the terrain also makes access to much of the NCW CFLRP difficult, both for conducting treatments and responding to unplanned fire ignitions.

The USDA Forest Service and State of Washington Department of Natural Resources are the major land managers within the proposed NCW CFLRP landscape. Both agencies are utilizing the same strategy to restore landscape resilience to ecological systems. This strategy builds on the Okanogan-Wenatchee National Forest Restoration Strategy (USFS 2012), which was developed in 2010 (revised in 2012) to utilize the most recent science in managing highly dynamic dry to moist forest ecosystems east of the Cascade crest in Washington. Monitoring is a key component of the Okanogan-Wenatchee Forest Restoration Strategy and the Washington DNR 20-Year Forest Health Strategic Plan. Both guiding documents emphasize the importance of multiparty monitoring as a tool to validate the effectiveness of restoration treatments across the forest.

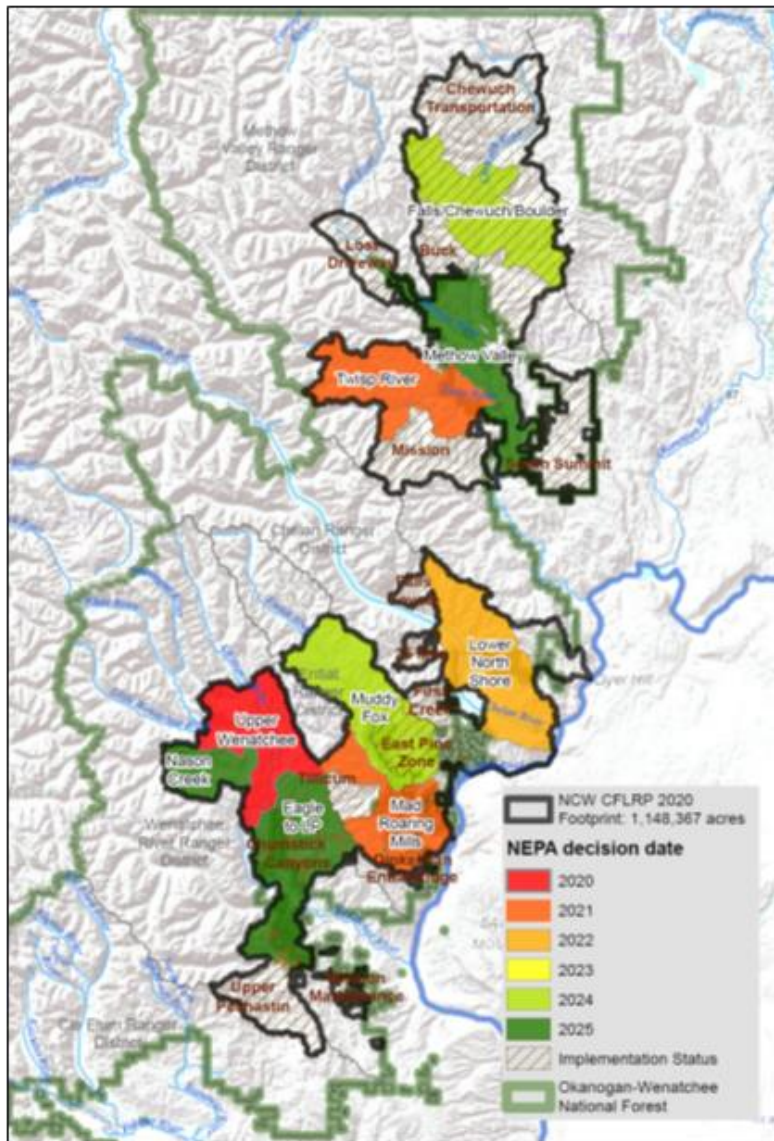


Figure 1. The North Central Washington CFLRP landscape with implementation-ready and planned projects. Much of the field data collection will occur within already signed project areas or those with an imminent decision, such as Mission, Twisp, Upper Wenatchee Pilot Project, and Mad Roaring mills and much of the aquatic habitat data collection will focus in the Chiwawa drainage within the Upper Wenatchee and Nason Creek project areas.

The State of Washington’s 20-Year Forest Health Strategic Plan includes the development of cutting-edge monitoring tools and data sets to track progress on the outcomes of forest restoration treatments and the change in forest conditions over time. It incorporates both regional, landscape, and stand-level tools and datasets, including a multi-party monitoring protocol with associated ArcGIS online web application to collect and store data, an online public platform to transparently track planned and completed treatments ([DNR Forest Health Tracker](#)), and a data set and system that allows change detection from our current condition (established from 2015 to 2019) to be updated every 2 years with information from Digital Aerial Photogrammetry (DAP) flights.

The administrative boundary of the Okanogan-Wenatchee National Forest and the NCW CFLRP project also fall within the Northwest Forest Plan Area. A rigorous monitoring program was developed following the adoption of the NWFP in 1994 and has been ongoing for 30 years. This includes focused efforts for monitoring habitat for Northern Spotted Owl and Marbled Murrelet, old growth and mature forest conditions, aquatic and riparian habitat, tribal relationships, and socioeconomic changes. Importantly, this effort provides long-term and large-scale data that has been used to evaluate the effectiveness of the Northwest Forest Plan in achieving its management objectives on federal lands in the planning area.

Several other ongoing monitoring efforts at the local level have also been integrated to various degrees with the NCW CFLRP monitoring plan. The North Central Washington Forest Health Collaborative established an Upper Wenatchee Monitoring Subgroup (UWMS) to work in close coordination with the Forest's Wenatchee River Ranger District's Interdisciplinary Team (ID Team) to develop and provide monitoring support on the Upper Wenatchee Pilot Project. Although the project does not currently have a signed decision, several of the identified monitoring questions and indicators from the UWMS plan were carried forward into this CFLRP Monitoring Plan. Similarly, issues identified as part of a partner-led effort to monitor treatment implementation on the Mission Restoration Project on the Methow River Ranger District were integrated into the development of this plan. Some of the questions identified in this plan will also contribute to addressing questions in the Forest's transitional monitoring plan for the districts on the north half of the forest.

Finally, partner organizations that conduct aquatic restoration projects on National Forest System lands are often tasked with monitoring the outcomes of those investments. The Upper Columbia Salmon Recovery Board Regional Technical Team (RTT) developed a data-intensive, scientific framework ([link](#)) to prioritize restoration and protection actions to recover the three ESA-listed species in the region: Spring Chinook, Steelhead, and Bull Trout. The RTT has a working group called the Monitoring and Data Management Committee (MaDMC), which lays out the existing open questions and data needs to better understand the impacts of aquatic restoration projects and landscape treatments on ESA listed fish. Priority aquatic questions identified in this document align with some open questions identified by the RTT and will provide additional opportunity to leverage monitoring efforts by different partner groups to address priority questions on aquatic habitat and watershed conditions at a broader scale.

These existing investments put NCW CFLRP partners in a strategic position to track progress towards our shared goals annually, over the life of the CFLRP, and beyond. The addition of dedicated monitoring funding from CFLRP will allow the forest and our partners to work together to expand existing monitoring efforts and generate shared data that can be leveraged to report on treatment outcomes.

Multiparty Monitoring Goals

Monitoring the expected outcome from management actions is needed to evaluate if management objectives are being achieved. However, the resources that can be invested into monitoring are often relatively sparse. Therefore, there is a need to develop effective monitoring programs that are also efficient to be able to support data-driven decision making with limited resources.

Our goal throughout this CFLRP project is to create opportunities for shared learning and to build trust and investment among collaborative partners by ensuring clear communication and transparent

monitoring results. This approach will inform collaborative discussions and decisions needed to adapt and create more effective restoration processes.

We recognize that monitoring can take many different forms and that evidence exists along a continuum that includes many different ways of acquiring knowledge and understanding change. However, two key elements were identified that were central to the development of all monitoring questions, namely, that the monitoring approaches were measurable and repeatable and mutually agreed upon by the Forest Service and the partners. Discussions between agencies, local governments, non-governmental organizations, and other interested partners in the development of this plan focused on determining the best forms of evidence that were needed to answer the questions without burdening cooperators, contractors, or the Forest with collecting more data than is useful or necessary.

Many of the questions included in this plan are intended to evaluate project implementation and effectiveness relative to overarching questions, stakeholder interests, and project designs. Our CFLRP monitoring plan focuses on four different categories of monitoring, the definitions of which were adopted from the Okanogan-Wenatchee Forest Restoration Strategy (USFS 2012) and the Upper Wenatchee Pilot Project Monitoring Plan. These types of monitoring include:

- *Implementation Monitoring* – helps to evaluate how closely management plan guidelines were followed.
- *Effectiveness Monitoring* – helps to evaluate whether the management plan achieves the desired conditions.
- *Validation Monitoring* – helps to evaluate if the underlying assumptions regarding cause-and-effect relationships are correct.
- *Public Perception and Values Monitoring* – helps to gauge public perception of project implementation, and public values in the project area. This monitoring includes both stakeholder concerns that implementation, effectiveness, and validation monitoring can address and specific efforts aimed at gaging public perception and values.

Partners involved in the development of this plan are committed to answering the selected questions and to use the results to inform management decisions in an adaptive management process (see *Adaptive Management* section). Further, the forest is committed to working with partners and the Pacific Northwest Regional Office to answer the common monitoring questions that are required of all newly funded CFLRP projects.

Finally, a key goal of this monitoring effort will be to communicate the restoration work that is being done on the Okanogan-Wenatchee National Forest in collaboration with the many partners that are engaged in both implementing and monitoring restoration projects. We will strive to find a way to communicate our story with both data and visuals in a way that is open and engaging for the public.

Monitoring Scale

Restoration treatment effects will be measured at local, meso- (e.g., watershed) and landscape-scales within the CFLRP footprint. To effectively understand how treatments collectively influence ecological, economic, and social processes, it is important to measure outcomes at multiple scales as different patterns will emerge at different scales. Each of these scales is nested, such that collectively, patterns

that emerge at local scales will influence patterns and processes at watershed (or county) and landscape (regional) scales. Hessburg et al. (2015) highlight the importance of understanding landscapes as connected hierarchies of different size patchworks in order to successfully restore fire-prone landscapes in the Inland Northwest. For example, to affect landscape processes like wildfire, planning must consider how the location and arrangement of individual stand level treatments impact fire spread, behavior, and opportunities for containment.

Several supplemental questions in this monitoring plan aim to integrate measurements at landscape scales (developed with regional or national datasets for the CFLRP Common Monitoring Strategy) with more meso-scale (e.g., drone photogrammetry, LiDAR) and local scale (e.g., Level II surveys, stand based tree measurements) measurements to better understand how restoration treatments at the local scale feedback and influence patterns and model-based processes at the landscape scale that will be reported up and integrated across the region as national performance indicators.

Throughout the plan, we identify the appropriate scale of inference for each measured indicator as either landscape/regional, meso-, or local scale. For ecological indicators, we have identified three scales: landscape, watershed, and stand (unit)/reach. For social and economic monitoring questions, scales shift to individual or community (local), county (meso-), and multiple counties, state, or region (e.g., Eastern Cascades, Pacific Northwest).

Landscape or Regional Scale

Landscape or regional measurements will include measurements at the scale of the CFLRP project boundary or the Washington East Cascades ecoregion for ecological indicators and at the state or regional level (e.g., Oregon, Washington) for economic or social indicators. Landscape and regional scale ecological measurements occur at the scale of $10^6 - 10^7$ hectares.

Mesoscale

Mesoscale measurements will include measurements at the NEPA planning project level or subwatershed and watershed scale for ecological indicators and at the county or CFLRP project level for economic or social indicators. Mesoscale ecological measurements occur at the scale of $10^3 - 10^5$ hectares.

Local Scale

Local scale measurements will include measurements at the stand, unit, and/or stream reach for ecological indicators and at the individual or community/collaborative level for economic or social indicators. Local scale ecological measurements occur at the scale of $10^1 - 10^2$ hectares (for forest stands) or meters (for stream reaches) and are defined as an area similar in appearance and/or condition that differs from neighboring areas.

Questions Development and Prioritization

Multi-party monitoring involves numerous partners—land management agencies, tribes, forest collaboratives, research institutions, private landowners, local government agencies, the forest products industry, NGOs, community members, and other stakeholders—working together to design, fund, implement, and oversee monitoring programs. To ensure a robust monitoring process was established,

we initiated conversations around multi-party monitoring with the NCWFHC and interested partners several months after receiving funding for the NCW CFLRP. Collaborative partners were asked to express interest and participate in an initial meeting in August 2022 to learn more about the process and define next steps.

As a result of the initial kickoff meeting, the group collectively decided to establish six different CFLRP monitoring subcommittees that worked to assess whether additional refinement or monitoring questions and indicators were needed to supplement the existing CFLRP Common Monitoring Strategy. The six monitoring subcommittees were formed based on expressed interest of the partners and focused on the CMS questions and indicators for (1) fire risk reductions/fuels (2) vegetation structure and departure, (3) terrestrial habitat and wildlife, (4) aquatic habitat and watershed conditions, (4) invasive and cultural plants, and (5) social perceptions and partner engagement.

Over an eight-month period from September 2022 through April 2023, subcommittees met up to eight times to (1) review the national CFLRP CMS questions (2) define their specific goals for multiparty monitoring, (3) identify the need for refinement and/or additional questions, and (4) determine the best approach for collecting data and answering each question. Each subcommittee was charged with thinking through what questions and data would be most useful for both the forest and partners and prioritized questions and approaches that had longer term benefits in either informing whether restoration treatments had the intended effect, could inform adaptive management, or generated data sources that could be used in future planning efforts. Where possible, we leveraged ongoing monitoring or data collection efforts that addressed our questions to increase efficiencies and avoid duplicating effort. We also looked to approaches that were being utilized by other CFLRPs in the region to benefit from the experience and knowledge other groups had in collecting and managing data to answer similar questions.

Specific projects that are funded for monitoring at the site or reach scale must meet the CFLRP criteria laid out by the forest, namely, that the project occurs on National Forest System lands within the boundary of the CFLRP and the proposed project meets the restoration goals outlined in the original CFLRP proposal. Monitoring efforts that are landscape-scale in scope will be focused on the whole CFLRP boundary, or a variety of field sites distributed across the CFLRP project area.

Furthermore, we will focus monitoring efforts on projects that have a high likelihood of being implemented in the next 1-3 years so that there is ample time to collect post-treatment data over the life of the CFLRP project. Some project planning areas that have been identified for potential terrestrial field-based monitoring include the Mission Restoration and Twisp projects on the Methow Valley Ranger District, the Upper Wenatchee Pilot Project on the Wenatchee River Ranger District, and the Mad Roaring Mills project on the Entiat/Chelan Ranger District (Figure 1). Each of these projects already has a signed decision or a decision is imminent. For aquatic field and remotely sensed monitoring, we will initially focus on the Chiwawa subbasin, where multiple types of aquatic restoration treatments are planned in cooperation with partners over the next several years.

Ultimately, we will rely on the participation of partners in collecting and analyzing monitoring data and reporting results for most of the supplemental questions that were prioritized for future effort. To formalize the critical role for partners in this effort, we will look to create a standing monitoring working

group that will help with the technical, organizational, and communication work of implementing this monitoring plan.

Adaptive Management Framework

Our CFLRP Monitoring Committee anticipates a need to meet regularly to both coordinate logistics, funding, and reporting and to share results to inform adaptive management (Figure 2). The Monitoring Committee envisions a monitoring program that follows an annual cycle of planning, implementation, and reporting and using regular feedback during this process to respond to emerging manager needs and stakeholder interests or changes in implementation schedules over the ten years of the CFLRP and beyond. We will meet quarterly starting in late winter (Jan/Feb) to review projects for the fiscal year and determine how to allocate the allotted CFLRP funding, in late spring (May) to review implementation schedules and monitoring plans for the field season, in early fall (September) to collect and summarize data, and in late fall/early winter (Nov./Dec.) to collaboratively build the annual monitoring report and share out results with partners and the NCWFHC.

Additionally, starting in year 4, in collaboration with either the NCWFHC Projects or Monitoring Workgroup, we will host an annual monitoring workshop that allows partners, researchers, and contractors to share results and discuss opportunities for shared learning and adaptive management. We recognize that some questions and results are better suited than others to immediate feedback into an adaptive management approach, but in all cases, results can inform whether the questions we are asking are the right ones to help us understand the benefits of the restoration work on the ecosystems, economics, and social systems of North Central Washington.

As such, we anticipate the need to make regular changes to this plan, particularly in the early years of the CFLRP project, as we encounter new situations and work through the logistics of coordinating these efforts for the first time. While our goal is to honor a commitment to monitoring and answering questions we have established, we want this to be a living document that can adapt to the realities of monitoring, adaptive management, and communicating findings.



Figure 2. An adaptive management framework depicting the seasonal cycle of activities undertaken by the Monitoring Committee and partners and feedback from annual monitoring workshops starting in year 4 of the project.

Monitoring Questions

Table 1. Questions, indicators, scale and reporting frequency for common and supplemental monitoring questions.

Monitoring Question	CFLRP CMS or Local?	Indicators	Scale	Type of Monitoring	Reporting Frequency
1. What is the reduction in fuel hazard based on our treatments?	Common	<ol style="list-style-type: none"> 1. Fire intensity (predicted flame lengths) 2. Probability of crown fire (crown fire potential) 3. Surface fuels, crown base height, and crown bulk density 	Landscape	Effectiveness, Validation	Annually
1A. How do previous treatments interact with wildfires within the CFLRP project boundary (when they occur)?	Local	<ol style="list-style-type: none"> 1. Contribution of treatment to change in fire behavior or spread 2. Whether treatments were strategically located 3. Dominate fire spread type inside and outside treatment units 4. Burn severity within treatments relative to overall fire burn severity 	Unit to Landscape	Effectiveness	Opportunistically
2. What is the effect of the treatments on moving the Forest landscape toward a more sustainable condition that includes the scale and intensity of historical disturbances?	Common + Local	<ol style="list-style-type: none"> 1. Vegetation departure across the CFLRP landscape 2. Vegetation departure in planned project areas 3. Landscape change photographs 	Landscape	Effectiveness	<ol style="list-style-type: none"> 1. Every 5 years 2. Year 10 3. Opportunistically
2A. What is the prevalence of insects and disease in project units that are treated as part of the CFLRP?	Local	<ol style="list-style-type: none"> 1. Percent of trees by species impacted pre- and post-treatment 2. Severity of damage by agents (binned by category) pre- and post-treatment 	Project	Effectiveness	Pre-treatment, 1, 5, 10 years post-treatment

2B. How well did treatments meet the prescription targets for tree density, composition, and spatial pattern?	Local	<ol style="list-style-type: none"> 1. Pre- and post-treatment photos 2. Trees per acre (TPA), basal area, proportion of trees by species pre- and post-treatment 3. Proportion of units in different size clumps and openings, variation in canopy cover across the units/landscape 	Stand/unit, project	Implementation	Pre-treatment, 1, 5, 10 years post-treatment
2C. Were large trees (> 25" DBH) and snags (>12" DBH) retained or created through successive treatments? How much post-harvest mortality or loss of large trees and snags occurs over time (e.g., from windthrow, mechanical damage, etc.)?	Local	<ol style="list-style-type: none"> 1. Size distribution of trees 2. Trees per acre > 25", 3. Snags per acre > 12" 	Stand/unit	Implementation, Effectiveness	Pre-treatment, 1, 5, 10 years post-treatment
3. What are the specific effects of restoration treatments on the habitat of at-risk species and/or the habitat of species of collaborative concern across the CFLR project area?	Common	Acres treated to move towards desired condition (HRV/current departure) for focal species and species at risk	Landscape	Effectiveness	Every 5 years
3A: How do treatments impact potential distribution, richness, and abundance of avian focal species across the CFLRP project area?	Local	<ol style="list-style-type: none"> 1. Probability of occurrence 2. Relative abundance of different bird species 	Stand and Landscape	Effectiveness	Point counts: Pre-treatment, post-treatment SDMs: Every five years
3B: How is Northern Spotted Owl habitat impacted by restoration treatments and fire within the CFLRP footprint?	Local	Status and trends in the distribution and amount of Northern Spotted Owl (NSO) Habitat within the CFLRP footprint	Landscape	Effectiveness, Validation	Every 5 years

3C: What are the impacts of restoration treatments on the presence of special status (MIS) species such as the White-Headed Woodpecker, Northern Goshawk, Clark's Nutcracker, and other priority species?	Local	<ol style="list-style-type: none"> 1. Presence/absence of different bird species 2. Probability of occurrence of different bird and mammal species 3. Intensity of habitat use of different bird species 	Stand, Landscape	Effectiveness, Validation	Every 5 years
3D: How do habitat restoration projects affect the distribution and abundance of juvenile and adult salmonids (including non-anadromous species such as bull trout, west-slope cutthroat, and resident <i>O. mykiss</i>)?	Local	<ol style="list-style-type: none"> 1. Relative difference in juvenile salmonid density between treatment and control reaches before and after completion of restoration actions. 2. Distribution of juvenile salmonids between treated and untreated areas of a stream reach 3. Adult presence and distribution in control and treated reaches 	Stream reach	Effectiveness, Validation	2 years pre-treatment and 3 years post-treatment with option to resample at 10 and 15 years
3E: How quickly do focal fish species colonize stream reaches after a fish passage projects?	Local	<ol style="list-style-type: none"> 1. Presence/absence of focal fish species before and after fish passage projects 2. Pace of fish recolonization above the barrier pipe locations (presence/km/year) 	Subwatershed	Effectiveness	Annually
3G: How do aquatic, floodplain, and riparian habitats respond to restoration projects aimed at increasing habitat complexity?	Local	<ol style="list-style-type: none"> 1. Number and depth of deep-water pools, side channel activation, entrenchment ratios 2. Floodplain inundation 3. Large wood density, wetted width/depth 	Stream reach	Effectiveness	<ol style="list-style-type: none"> 1. Pre-treatment, at 10 years 2. Bi-annually or after major flow events 3. Pre-treatment, at 10 years

4. What is the status and trend of watershed conditions in the CFLR area, with focus on the physical and biological conditions that support key soil, hydrologic and aquatic ecosystem processes?	Common	<ol style="list-style-type: none"> 1. Subwatersheds affected by restoration actions and/or disturbance events 2. Priority subwatersheds affected by restoration actions and/or disturbance events with a change in overall Watershed Condition Class 	Subwatershed	Effectiveness	<ol style="list-style-type: none"> 1. Every 5 years 2. Annually
4A: How do roads affect hydrologic connectivity and sediment delivery in a sub-watershed pre- and post-treatment?	Local	<ol style="list-style-type: none"> 1. Number of problem sediment delivery points 2. Distance sediment travels 3. Magnitude of sediment delivery 4. Zones of increased drainage network 	Subwatershed	Implementation, Effectiveness	Pre-treatment, post-treatment
5. What is the trend in invasive species within the CFLRP project area?	Common	Trend in invasives within the CFLRP project area	Project, unit	Effectiveness	Annually
5A. How do populations of culturally important plant species respond to forest restoration treatments?	Local	<ol style="list-style-type: none"> 1. Extent of plant population & direction of change (increase, decrease, no change) 2. Estimated density before and after treatments 3. Number of cultural plant populations identified across sampled area 	Site, Project	Effectiveness	Pre-project, 1-3 years post-implementation
6. How has the social and economic context changed, if at all, from the beginning of CFLRP to the end?	Common	<ol style="list-style-type: none"> 1. Changes in local population, demographic information, unemployment, per capita income, and wildfire exposure 2. Changes in local FS capacity (funding and full-time equivalents (FTEs)) 	<ol style="list-style-type: none"> 1. County 2. National Forest & District 	Validation	Baseline; every 5 years
7. How have CFLRP activities supported local jobs and labor income?	Common	<ol style="list-style-type: none"> 1. Modeled number of full and part time jobs supported by project activities 	County	Validation	Annually

		2. Modeled local labor income supported by project activities			
8. How do sales, contracts, and agreements associated with the CFLRP affect local communities?	Common	1. Local contract capture 2. Type of work captured locally 3. Characteristics of local entities capturing work	County	Validation	Annually
9. Did CFLRP maintain or increase the number and/or diversity of wood products that can be processed locally?	Common	1. Number, size, and types of mills in and around the CFLRP area 2. Volume and type of wood products generated in mills in and around the CFLRP area	CFLRP Project Area, County	Validation	Every 5 years
10. Did CFLRP increase economic utilization of restoration byproducts?	Common	Biomass utilized	CFLRP Project Area	Validation	Baseline; Annually
11. Who is involved in the collaborative and if/how does that change over time?	Common	Individuals, organizations, and areas of interest represented in the collaborative over time	N/A	Social Values & Perceptions	Baseline; Annually
12. How well is CFLRP encouraging an effective and meaningful collaborative approach?	Common	Perceptions of whether and to what extent collaborative process is meaningful and effective	N/A	Social Values & Perceptions	2-3 years
13. If and to what extent have CFLRP investments attracted partner investments across the landscapes?	Common	Use of direct CFLRP funds; matching funds provided by the agency; contributed funds by partner organizations (both funding and in-kind)	N/A	Validation	Annually

13A. What partners are engaged in cross-boundary restoration and fire mitigation work? How has this changed over time with the addition of focused efforts and investments on public and state lands?	Local	<ol style="list-style-type: none"> 1. Numbers and types of organizations and practitioners engaged in wildfire and risk management 2. Number and diversity of boundary spanners/bridgers and/or individual coordinators 3. Connectedness of different organizations and actors 	Landscape/Region	Social Values & Perceptions	1-2 years after project inception and 5-7 years later
13B. What are community perceptions around wildfire risk, and how do community education tools and outreach efforts tailored to those perceptions help partners to plan and implement more effective, strategic, and large-scale cross-boundary projects over time?	Local	<ol style="list-style-type: none"> 1. Number of cross-boundary projects planned by partners 2. Number of cross-boundary planning meetings 3. Increase in number of collaborators our partners work with on a regular basis 4. Increased trust and engagement from community members in landscape restoration projects 	Community	Social Values & Perceptions	1-2 years after project inception and 5-7 years later

Ecological Monitoring Overview

Fire



Figure 3. Firefighter igniting a dry ponderosa pine forest area during a prescribed burn implemented as part of a Washington Prescribed Fire Training Exchange (Trex) © John Marshall & Washington Prescribed Fire Council

Background

The NCW CFLRP landscape contains an estimated 1,148,367 acres of disturbance-prone ecosystems. The most frequent disturbance on this landscape is wildfire (though insects and disease are increasingly important widespread mortality agents as well). The unique arrangement of west to east drainages, dry-mixed conifer forests, and steep precipitation gradients of the Cascade Mountain range result in conditions conducive to frequent fire, including extensive areas historically dominated by mixed- or low-severity fire regimes. Over the last 3 decades, wildfires have burned over 1,486,000 acres on the forest, including extensive areas within or adjacent to the CFLRP project area. More extensive, high severity wildfires continue to be a concern across this landscape.

This landscape sits on the eastern slopes of the Cascade Mountains, between the high-severity fire regimes at the Cascade crest and the wildland urban interface adjacent to the Columbia River and its tributaries. Predominant winds are westerly and push wildland fire towards productive and developed valleys. As the second most steep, rugged, and inaccessible national forest in the country, the terrain also makes access to much of the NCW CFLRP difficult, both in terms of conducting treatments and in responding to unplanned fire ignitions. This requires that the Okanogan-Wenatchee National Forest and collaborative partners carefully select and implement projects reflecting these realities. Where fuel treatments have been implemented, they have been successful at moderating the behavior and severity of subsequent wildfires on the Okanogan-Wenatchee National Forest (Prichard et al. 2010, Prichard & Kennedy 2014, Prichard et al. 2022).

In order to monitor the impacts of fire on the landscape and to measure how treatments are moving the NCW CFLRP landscape towards desired conditions, we plan to collect and analyze data at a variety of scales while leveraging ongoing monitoring efforts developed by Washington Department of Natural Resources (WDNR) as part of their 20-Year Forest Health Strategic Plan: Eastern Washington (20-Year Plan; WDNR 2017). For example, WDNR compiles annual data on wildfires that burn within Washington state and evaluates their impacts, burn severity trends, and interactions between treatments and wildfire.

Desired Condition

Implementation of the NCW CFLRP project will result in strategic fuels reduction work to mitigate wildfire risk on 54,000 acres, 92% of which will be located within the wildland urban interface. Fuels treatments will alter fire behavior, improved community and firefighter safety, and result in more efficient and cost-effective fire suppression. Tree survival and habitat condition after the fire will also be improved.

To meet landscape-scale restoration objectives, treatments will be positioned in accessible areas and adjacent to communities to improve firefighters' ability to more safely and successfully engage wildfire while increasing the potential for beneficial outcomes from unplanned ignitions. Fire will be allowed to play a natural role in managing ecosystems when conditions are favorable (e.g., moderate weather, low fire danger). Ultimately, our desire is to set up the CFLRP landscape in a way that allows us to improve our ability to manage unplanned ignitions and achieve restoration goals well beyond the treatment areas.

Question 1: What is the reduction in fuel hazard based on our treatments?

Indicators:

1. Fire intensity (predicted flame lengths)
2. Probability of crown fire (crown fire potential)
3. Surface fuels, crown base height, and crown bulk density

CFLRP common monitoring strategy or local? Common

Type of Monitoring? Effectiveness, Validation

Data source:

1. Landfire, Interagency Fuel Treatment Decision Support System (IFTDSS), and FS Databases (to update landscape treatment file from Landfire)
2. Landfire, IFTDSS, and FS Databases
3. Plot data within treated units

Who collects the data:

1. Local CFLRP Monitoring Coordinator, forest fuels staff, and R6 Ecologist will compile necessary treatment data layers and run analysis
2. Local CFLRP Monitoring Coordinator, forest fuels staff, and R6 Ecologist will compile necessary treatment data layers and run analysis
3. NCW CFLRP monitoring team or contractor

Scale: Landscape

Methods:

1. Fire models will be run within the IFTDSS platform using FLAMMAP. The local CFLRP team (ecologist and fuels specialists) will generate and maintain an existing vegetation layer with the necessary forest structural variables, including canopy cover (from Lidar) and canopy base heights (from field data collected for indicator #3). Vegetation layers will be maintained by updating with effects of wildfires and treatments each year using RAVG data, LCMS, and FS databases such as FACTS.
2. Fire models will be run within the IFTDSS platform using FLAMMAP and summarized by fireshed. Crown fire probability will be generated for forest patches and patch size distribution will be summarized with FragStats.
3. Data will be collected on 1/10th acre plots for a subset of units in projects that are treated with a variety of different methods (e.g., commercial thinning, non-commercial thinning/mechanical fuels reduction, prescribed fire) and combination of treatments (e.g., CT+NCT+Rx Fire, NCT + Rx Fire, Rx Fire only). Surface fuel loads will be collected using the photoload methods developed by Keane & Dickinson (2007), and canopy base height will be measured with a laser range finder. Canopy bulk density will be estimated from...

Data collection frequency: Annually

Where is the data stored? The R6 Regional Ecology will store and report out on the IFTDSS analysis. Copies of this and all other data will be stored internally in a FS Pinyon Folder for our CFLRP project.

Question 1A: How do previous treatments interact with wildfires within the CFLRP project boundary (when they occur)?

Indicators:

1. Contribution of treatment to change in fire behavior or spread
2. Whether treatments were strategically located
3. Dominate fire spread type inside and outside treatment units
4. Burn severity within treatments relative to overall fire burn severity

CFLRP common monitoring strategy or local? Local

Type of Monitoring? Effectiveness

Data source:

1. IFTDSS Fuels Treatment Effectiveness Monitoring (FTEM) system (for indicators 1, 2, 3)
2. Forest Health Treatments (2017- 2022, updated annually): <https://foresthealthtracker.dnr.wa.gov> (for indicator 4)
3. Fire Severity & Perimeters (1984- 2021, updated annually): bit.ly/ForestHealthData, 2_Base_Data/Fire_Severity_Perimeters folder (for indicator 4)

Who collects and analyzes the data: Washington DNR and/or FS fire and fuels staff

Scale: Unit and wildfire incident (meso- to landscape scale)

Methods: All wildfires which start in or burn into a fuel treatment completed within the last ten years are required by FS policy to have a fuel treatment effectiveness assessment conducted and results entered into the Fuel Treatment Effectiveness Monitoring (FTEM) database. For each completed treatment that is recorded in FACTS, information of whether treatments influenced fire behavior, if they were strategically located, and what type of fire spread was observed can be qualitatively summarized to better understand the interactions between treatments and wildfire.

Furthermore, starting in 2021, the WDNR Forest Resilience division science team piloted an approach to assess how forest health treatments interacted with wildfires. The methods used are summarized below; a more detailed summary may be found in the [WA DNR 2021 Work of Wildfire report](#).

Assessments relied on data from areas in which specific fires and treatment units overlapped during a given fire season. Fire perimeters and fire progression data on treatment data were overlaid to identify when and where treatments were breached. Treatment and wildfire overlap locations were then combined with fire weather information for the days of the breach, collected from incident Remote Automated Weather Stations (iRAWS), if available, or RAWS. These data were used to characterize relative humidity and wind speed during the days in which the fire-treatment interaction occurred. Fire severity data were determined using methods from USFS Region 6, relying on pre- and post-fire composite satellite imagery. Severity was summarized within each treatment unit and evaluated the entire wildfire.

Data collection and reporting frequency: Annually, or opportunistically when fires occur

Where is the data stored? The FTEM database is a component of the [Interagency Fuels Treatment Decision Support System](#) (IFTDSS) and can be found online. Data are reported and stored within the IFTDSS platform. Narrative descriptions of indicators 1, 2, and 3 will be compiled and submitted as part of annual CFLRP reports, which are available on the [national CFLRP public facing website](#). Copies of the annual report will also be stored internally in a FS Pinyon Folder for our CFLRP project. Data for indicator 4 will be stored in an open WDNR data sharing folder online: bit.ly/ForestHealthData.

Forest Vegetation Condition



Figure 4. Mission Creek Drainage on the Okanogan-Wenatchee National Forest. The original 1934 photo was part of a collection of Osborne panoramas taken by the US Forest Service from fire lookouts across the Pacific Northwest and a replicate image was produced in 2010. From Hessburg et al. 2015. © John Marshall, 2010

Background

The Okanogan-Wenatchee National Forest Restoration Strategy (FRS; USFS 2012) guides the development of landscape restoration projects across the forest and has been used help plan many of the upcoming projects that will be implemented on the NCW CFLRP landscape. Importantly, the FRS provides a framework and assessment methods for evaluating departed forest structural conditions across broad landscapes (e.g., multiple subwatersheds). The analysis conducted as part of the FRS helps provides the rationale to justify restoration actions that is built on a strong science foundation grounded in the management of the forest’s highly dynamic ecosystems.

This strategy uses landscape ecology principles to rebuild resilience at multiple spatial scales. It focuses on arranging patches across the landscape with patterns, composition, and structure to which natural ecological processes can respond. Further, this successional patchwork operates at multiple scales where individual patches at the landscape scale have distinct and characteristic patterns of individual trees, tree clumps, and opening that are also important for restoring historic characteristics and function (Hessburg et al. 2015).

To monitor the impacts of treatments on the landscape and measure how treatments are moving the NCW CFLRP landscape towards desired conditions, we plan to collect and analyze data at a variety of scales and leverage pre-treatment remotely sensed data (Lidar and/or aerial imagery) already collected to evaluate landscape departure within specific project areas. We propose to collect follow up post-implementation data to assess changes in species composition, density, and pattern metrics at the end of the CFLRP project lifespan that will correspond with pre-treatment assessments.

Desired Condition

The NCW CFLRP will help reestablish and maintain a landscape where fire, insect, and disease disturbances occur with more historically characteristic results. Under these conditions, large and old trees will be retained, and conditions will foster additional large tree recruitment. As a result, forests will be more complex with different types of vegetation and structure.

Question 2: What is the effect of the treatments on moving the forest landscape toward a more sustainable condition?

Indicators:

1. Vegetation departure across the CFLRP landscape
2. Vegetation departure in planned project areas
3. Landscape change photographs

CFLRP common monitoring strategy or local? Common and local

Type of Monitoring? Effectiveness

Data source(s):

1. PNV/Landfire Departure Analysis
2. Aerial Photo Interpretation (PI) Departure Analysis
3. Osbourne panorama photographs

Who collects and analyzes the data:

1. Local CFLRP Monitoring Coordinator and R6 Ecologist will compile necessary treatment data layers and run analysis
2. Contractor will complete PI analysis working with FS Ecologist and Forest Silviculturist.
3. Contractor will retake subset of images from Osborne panorama series.

Scale: Landscape

Methods:

1. Using methods outlined in Haugo et al. 2015 and DeMeo et al. 2018, the region will conduct a departure analysis, which reports which forest structural classes are in excess or deficit across the landscape and if disturbance or growth is needed to move the landscape back towards the historical balance (HRV) of these classes.
2. Using methods outline in Okanogan-Wenatchee Forest Restoration Strategy (USFS 2012) we will complete repeat aerial PI by forest structural classes using NAIP imagery and compare to pre-treatment and historic ranges of variability.
3. Repeat photos from a subset of historic lookout sites where historic Osborne panoramas and pre-treatment (2010s) paired imagery exists and where treatments have been completed or wildfire has occurred.

Data collection frequency:

1. Every 5 years
2. At the completion of restoration projects (Year 10)
3. Opportunistically throughout the life of the project

Where is the data stored? The R6 Regional Ecology will store and report out on the departure analysis results (Indicator #1). Copies of this and all other data will be stored internally in a FS Pinyon Folder for our CFLRP project. Repeat imagery will be displayed as part of GIS storymap that is publicly accessible.

Question 2A: What is the prevalence of insects and disease in project units that are treated as part of the CFLRP?

Indicators:

1. Percent of trees by species impacted pre- and post-treatment
2. Severity of damage by agents (binned by category) pre- and post-treatment

CFLRP common monitoring strategy or local? Local

Type of Monitoring? Effectiveness

Data source: Field data

Who collects and analyzes the data: NCW CFLRP monitoring field crew or contractor

Scale: Stand

Methods: Data will be collected on nested 1/10th and ¼ - ½ acre plots for a subset of units in projects that are treated with a variety of different methods (e.g., commercial thinning, non-commercial thinning/mechanical fuels reduction, prescribed fire) and combination of treatments (e.g., CT+NCT+Rx Fire, NCT + Rx Fire, Rx Fire only).

Insect and disease agents will be recorded for all trees within the plot by binned damage agent (e.g., beetle, defoliator, mistletoe, or decay) and severity estimated by bin using standard stand exam damage severity ratings. The presence of damage agents will also be noted in the stands more broadly as a whole and can be verified with drone imagery for the select monitoring units.

Data collection and reporting frequency: Immediate pre-treatment, 1-year post-treatment, 5 & 10 years post-treatment.

Where is the data stored? Copies of the data will be stored internally in a FS Pinyon Folder for our CFLRP project.

Question 2B: How well did treatments meet the prescription targets for tree density, composition, and spatial pattern?

Indicators:

1. Pre- and post-treatment photos
2. Trees per acre (TPA), basal area, proportion of trees by species pre- and post-treatment
3. Proportion of units in different size clumps and openings, variation in canopy cover across the units/landscape

CFLRP common monitoring strategy or local? Local

Type of Monitoring? Implementation

Data source:

1. Photo points
2. Field plots
3. Drone orthoimagery (structure for motion data), LiDAR

Who collects and analyzes the data: NCW CFLRP monitoring field crew (FS and volunteers) or contractor

Scale: Stand, Unit, Project

Methods: Specific targets from treatment prescriptions will be used to assess whether the treatment met various objectives. In cases where there were no targets, the pre- and post-treatment data can be compared to assess directional change in metrics. Two basic types of data will be used for monitoring:

First, plot data will be used to derive tree density, species composition, and distribution of size classes by species. 1/10th acre fixed area plots will be used to capture all trees > 7" (except for ponderosa pine which is > 9") and smaller plots (1/100th acre) will be used to capture saplings and seedlings < 7" DBH. Plot locations will be monumented for re-measurement in the future. Landscape photos will be shot from plot center facing north and south.

Second, remotely sensed data will be used to summarize spatial patterns of individual trees, clumps and openings, and canopy cover. Maps of individual trees derived from 1 to 3-ft-resolution canopy height models (CHMs) will be captured either from LiDAR where it is available pre- and post- treatment conditions or from structure from motion data derived from drone-based imagery. CHMs show the height of vegetation above ground and are segmented into approximations of tree crowns based on their shape—called “tree approximate objects” or TAOs (Jeronimo et. al 2019).

Data collection and reporting frequency: Immediate pre-treatment, 1-year post-treatment, 5 & 10 years post-treatment.

Where is the data stored? Data can be collected using a Survey123 application developed by Washington DNR, and will be stored on DNR servers as be made available as part of GIS storymap. Copies of the data will also be stored internally in a FS Pinyon Folder for our CFLRP project.

Question 2C: Were large trees¹ (> 25" DBH) and snags (>12" DBH) retained or created through successive treatments? How much post-harvest mortality or loss of large trees and snags occurs over time (e.g., from windthrow, mechanical damage, etc.)?

Indicators:

1. Size distribution of trees
2. Trees per acre > 25"
3. Snags per acre > 12"

CFLRP common monitoring strategy or local? Local

Implementation or Effectiveness Monitoring? Implementation & Effectiveness

Data source: Field data

Who collects the data: NCW CFLRP monitoring field crew or contractor

Scale: Stand, Unit

Methods: Field plot data will be used to collect tree and snag size and species composition, as well as distribution of size classes by species. Large trees (>25" DBH) and snags (>12" DBH) will be measured on ¼ - 1/2 acre fixed area plots. Insect and disease damage agents will be noted if discernable. Plot locations will be co-located with 1/10th acre monumented stand structure plots so that individual trees can be re-measured into the future.

Data collection and reporting frequency: Immediate pre-treatment, 1-year post-treatment, 5- & 10-years post-treatment.

Where is the data stored? Data can be collected using a Survey123 application developed by Washington DNR and will be stored on DNR servers as be made available as part of GIS storymap. Copies of the data will also be stored internally in a FS Pinyon Folder for our CFLRP project.

¹ Current national review of the definitions of "large" and "old" trees in ongoing as a result of Executive Order 14072: Protecting Mature and Old Forests, both Foreign and Domestic. We will review this question and our definitions of "large" trees as further guidance becomes available.

Wildlife & Aquatic Habitat



Figure 5. Mountain bluebird (left), red breasted nuthatch (middle), and white-headed woodpecker (right) are three bird species found on the Okanogan-Wenatchee National Forest that use open ponderosa pine and dry-mixed conifer forests habitats at various successional stages. Photography funded by The Icicle Fund. © John Marshall, 2016

Background

The NCW CFLRP is home to important native fish and wildlife populations and provides critical habitat for northern spotted owl (NSO; threatened), Canada lynx (threatened), grey wolves (endangered), bull trout, summer-run steelhead trout (threatened), and spring-run chinook salmon (endangered). The entire CFLRP project area falls within the range of the northern spotted owl as well as designated critical habitat under the US Fish and Wildlife Service NSO Critical Habitat Rule (USFWS 2011) and includes the management of late successional reserves which were set aside by the Northwest Forest Plan (USFS 1994) in part for the conservation of late-successional dependent species, such as the NSO. Additionally, the Upper Columbia basin, located in the northern portion of the project area, provides the only designated critical habitat for spring-run chinook salmon and has been the restoration focus of the Yakama Nation fisheries program and numerous other partner groups working with the Okanogan-Wenatchee National Forest to support aquatic species recovery and habitat restoration.

The Okanogan-Wenatchee National Forest and partners continue to implement extensive in-stream and road-related projects to benefit aquatic resources within the NCW CFLRP. Planned treatments in the NCW CFLRP landscape include culvert replacement and upsizing to provide aquatic organism passage, road rerouting, road maintenance and improvement, and in-stream wood structure placement. These treatments will increase the resilience of the existing hydrologic system, maintain and improve critical habitat, and create more functional aquatic systems.

We propose to leverage several existing monitoring and data collection efforts, especially to provide additional habitat and occurrence data for special status terrestrial and aquatic species. For example, we plan to leverage data collected as part of ongoing NWFP monitoring efforts to monitor trends in NSO habitat over the life of our CFLRP project. Also, we plan to work with several existing partners to supplement and expand planned implementation and effectiveness monitoring on aquatics restoration projects across the Upper Columbia basin.

Desired Condition

Re-establishment of disturbance regimes occurring within the historic range of variability, as well as the deliberate restoration of fine- to meso-scale spatial patterns of vegetation and the maintenance of large tree and old trees will improve an estimated 85,000 acres of wildlife habitat, including critical habitat for Canada lynx and northern spotted owl, across the lifetime of our CFLRP project.

Improved aquatic and hydrological systems will support native fish and increased populations of at-risk bull trout, steelhead trout and chinook salmon. Additionally, our restoration projects will create stream systems that are more resilient to disturbances and climate change while supporting more high-quality habitat for federally listed species.

Question 3: What are the specific effects of restoration treatments on the habitat of at-risk species and/or the habitat of species of collaborative concern across the CFLRP project area?

Indicators: Acres treated to move towards desired condition (HRV/current departure) for focal species and species at risk.

CFLRP common monitoring strategy or local? Common

Type of Monitoring? Effectiveness

Data source(s): Departure analysis by seral stage for each PNV type (following Haugo et al. 2015/DeMeo et al. 2018). Treatments and disturbances will come from FS Databases or LCMS.

Who collects and analyzes the data: Local CFLRP Monitoring Coordinator and R6 Ecologist will compile necessary treatment data layers and run analysis.

Scale: Landscape

Methods: This method employs the coarse-filter approach to biodiversity conservation and uses landscape-scale metrics to assess wildlife habitat. The assumption is that if the landscape is functioning well, its components and processes (including wildlife and wildlife habitat) are also functioning well. Measures of departure from a natural range of variation (NRV) will help us understand wildlife habitat holistically. By identifying what seral stages in what vegetation types are in excess or deficit compared to NRV, we then have implications for the wildlife species associated with those seral stage-vegetation combinations. We can track how much or how little habitat is available for species, and how management actions (or disturbances) are “moving the needle.”

Data collection and reporting frequency: Every 5 years

Where is the data stored? The R6 Regional Ecology will store and report out on the departure analysis results. Copies of the data will also be stored internally in a FS Pinyon Folder for our CFLRP project.

Question 3A: How do treatments impact potential distribution, richness, and abundance of avian focal species across the CFLRP project area?

Indicators:

1. Probability of occurrence
2. Relative abundance of different bird species

CFLRP common monitoring strategy or local? Local

Type of Monitoring? Effectiveness

Data source:

1. Landsat imagery
2. Field collected avian point counts

Who collects the data: Klamath Bird Observatory (KBO)

Scale: Stand, Landscape

Methods: KBO has developed a landscape scale effectiveness monitoring project that will improve our understanding of ecosystem response to restoration using a combination of field surveys and distribution modelling.

Stand scale: In the first three years, KBO will design and initiate a study to assess stand scale effects to achieve desired conditions. We will develop a Before After Control Impact (BACI) study design that aligns with restoration implementation plans. At the culmination of the study, data will be analyzed to identify whether 1) relative abundance of common species and/or coniferous forest focal species and 2) songbird community composition differed before and after treatments or differed on treated and untreated stands. Results will be presented within the context of the Partners in Flight conservation planning and adaptive management, to quantify whether restoration achieved desired conditions and inform future actions (Altman and Bresson 2017).

Landscape scale: KBO will develop a landscape scale effectiveness monitoring project to improve our understanding of ecosystem response to restoration using a combination of field surveys and distribution modelling. In the first two years, we will design and implement a bird monitoring framework to collect data needed to generate distribution models for the CFLRP geography. In year three, we will develop bird distribution models following methods outlined by Shirley et al. (2013) and recently applied in Halstead et al. (2019). Boosted regression tree (BRT) models will be used to analyze information on bird observations and reflectance data obtained using 30 m resolution Landsat imagery to analyze relationships between distributions of birds and reflectance values.

Initially, models will be used to evaluate differences in predicted species occurrence of select songbird species representative of coniferous forests (stratified by warm/dry vs. cool/moist forest types) between current and desired conditions at various spatial scales. Analyses will quantify the degree to which temporal changes in ecological conditions are expected to be measurable with bird community change. The bird distribution models can then be applied in a time series framework (before and after treatment, disturbance) to measure change over time.

Data collection and reporting frequency: For the BACI design, one pre-restoration observation year and one post-restoration observation year. For Landscape scale monitoring, after data are collected in the first two years, results from species distribution can be summarized annually, and will be included at year 5 and every 5 years thereafter.

Where is the data stored? Avian Knowledge Northwest. Copies of the data will also be stored internally in a FS Pinyon Folder for our CFLRP project.

Question 3B: How is Northern Spotted Owl habitat impacted by restoration treatments and fire within the CFLRP footprint?

Indicators: Status and trends in the distribution and amount of Northern Spotted Owl (NSO) Habitat within the CFLRP footprint

CFLRP common monitoring strategy or local? Local

Type of Monitoring? Effectiveness & Validation

Data source: NWFP Monitoring Reports and data (NSO Suitable Habitat layers)

Who collects and analyzes the data: Data is collected and analyzed by the NWFP Monitoring Team (R6 RO, Pacific Northwest Research Station, Oregon State University LEMMA Group), led by Ray Davis. CFLRP Monitoring coordinator will work with Davis to obtain and summarize data.

Scale: Landscape

Methods: Nesting/roosting habitat monitoring uses species distribution modeling methods, owl pair locations, and remotely sensed forest vegetation data (GNN/Landsat) to produce annual habitat maps from 1984 to the present.

Habitat maps can be analyzed for differences in the amount and distribution of nesting/roosting habitat from two different points in time (e.g., bookend analyses) or annually to create an annual time series to estimate amount and distribution of nesting/roosting habitat losses, gains, and net change. These analyses have been automated through Google Earth Engine (GEE) by the NWFP Monitoring Team. Remotely sensed forest vegetation disturbance (change detection) data are used to determine the causes for habitat losses and correct for canopy cover changes that might appear in the satellite imagery but are not a true reflection of characteristics on the ground.

Data collection and reporting frequency: Data is generated annually but will be reported for the first year and every 5 years thereafter.

Where is the data stored? The NWFP Monitoring Team stores data both internally (on the T:drive) and on a GEE platform that is accessible to FS employees. Copies of the data will also be stored internally in a FS Pinyon Folder for our CFLRP project.

Question 3C: What are the impacts of restoration treatments on the presence of special status (MIS) species such as the White-Headed Woodpecker, Northern Goshawk, Clark's Nutcracker, and other priority species?

Indicators:

1. Presence/absence of different bird species
2. Probability of occurrence of different bird and mammal species
3. Intensity of habitat use of different bird species

CFLRP common monitoring strategy or local? Local and landscape

Type of Monitoring? Effectiveness & Validation

Data source: Field data, bioacoustics data, GNN vegetation data, Landsat imagery, species distribution models trained on audio detection data

Who collects and analyzes the data: USFS Pacific Northwest Research Station (Adam Duarte) processes and analyzes data.

Scale: Stand and Landscape

Methods: Acoustic recording units would be deployed according to the NWFP Northern Spotted Owl sampling scheme (500 ha hexagon tessellation) and within mapped proposed treatment areas.

Landscape scale (hexagon) monitoring will implement a rotating frame sampling design with random hexagon selection. This sampling design will include a set of static hexagons that will be monitored every year and sets of hexagons that will be monitored every 3rd or 5th year (depending on the number of ARUs available). Importantly, the static hexagons will allow for the estimation of dynamic processes (i.e., change in species distributions and/or intensity of habitat use across time) and the rotating frames will allow for greater representation in forest conditions that is needed to accurately predict species distributions and intensity of habitat use across the forest. These data will also inherently capture treatment effects across time as well. Units will be retrieved after 3 weeks, which is a time required to correct monitoring data for species detection probabilities and provide robust estimates of species occurrence and habitat use (i.e., we will statistically account for the fact the surveys can and often do miss species of interest even when they are present).

Local scale (within proposed treatment areas) monitoring will implement a stratified random sampling design in an effort to select locations across a range of potential forest management and across vegetation and topography conditions. Consistency in the randomly selected ARU locations across years will provide a robust before-after-control-impact (BACI) study design and aid in being able to document occupancy and use dynamics following the implementation of management actions. Also, paired game cameras will be deployed ARU stations to capture changes in mammalian species occurrence in relation to forest management actions. Units will be retrieved after 2 weeks, which will allow for the monitoring of a greater number of treatment plots.

Importantly, these two scales of monitoring will be integrated to borrow strength across the data and increase power of analyses to accurately estimate the indicators of interest. Furthermore, these data can be integrated with the existing CFLRP in the Northern Blue Mountains and rangewide NSO monitoring

efforts. A neural network model is currently being developed with audio data collected as part of the CFLRP in the Northern Blue Mountains. The current beta model has a 97% accuracy for White-headed Woodpecker, but we are in the process of adding other focal species to the model. Training data from this effort will be integrated with training data from the Northern Blue Mountains to increase the representation of species and call types on the east side of the Cascades Range for use by forest biologists working in the region.

Using the neural network model, audio recording data will be processed and translated into detection/non-detection data for analysis using occupancy models (MacKenzie et al. 2017). Using estimates of the spatial and temporal variation in occupancy and detection probabilities and a simulation exercise, an evaluation of the sample sizes (i.e., number of ARUs, number of visits, etc.) that are needed to detect change in occupancy across years and following forest management actions for a range of effect sizes for different species will be conducted. Further, these data will be paired with remotely sensed habitat products (i.e., GNN and Landsat imagery) to develop species distribution models pre and post forest management actions.

This effort can help managers make better data-driven decisions with limited resources while monitoring landscape-scale and local-scale responses of White-Headed Woodpecker, Northern Goshawk, Clark's Nutcracker, and other priority species to forest management actions on the eastern side of the Cascade Range through the training of neural network models for processing big data and the passive collection of large-scale audio recordings. Importantly, audio data will be revisited every 5 years to extract new species detections as species are added to the neural network model.

Data collection and reporting frequency: Data is generated annually but will be reported for the first year and every 5 years thereafter. Results from species distribution will be included at year 5 and every 5 years thereafter.

Where is the data stored? Data will be stored both internally (on the T:drive) that is accessible to FS employees. Copies of the data will also be stored internally in a FS Pinyon Folder for our CFLRP project and backups of the data will be stored in fireproof cabinets at the Olympia Forestry Sciences Laboratory.

Question 3D: How do habitat restoration projects affect the distribution and abundance of juvenile and adult salmonids (including non-anadromous species such as bull trout, west-slope cutthroat, and resident *O. mykiss*)?

Indicators:

1. Relative difference in juvenile salmonid density between treatment and control reaches before and after completion of restoration actions.
2. Distribution of juvenile salmonids between treated and untreated areas of a stream reach
3. Adult presence and distribution in control and treated reaches

CFLRP common monitoring strategy or local? Local

Type of Monitoring? Effectiveness, Validation

Data source(s): Field collected data

Who collects and analyzes the data: Yakima Nation Upper Columbia Action Effectiveness Monitoring (AEM) Project team

Scale: Stream reach

Methods: The YN AEM team will monitor change in juvenile and adult salmonid density following floodplain and side channel restoration actions in the Chiwawa River using a multiple-before-after-control-impact (MBACI) study design. Juvenile and adult salmonid density in a single treatment reach (Big Meadow Project) will be compared against multiple upstream control and separate reference reaches (Huckleberry Ford and Nason Creek) with multiple sampling events. The mean difference between fish density in the treatment and control reaches before restoration will be compared to the mean difference between treatment and control reaches after restoration.

Level 2 stream habitat surveys will be conducted in all study reaches prior to sampling. Seasonal snorkel surveys will be applied to monitor fish density in treatment and control reaches. Up to four snorkelers will move upstream through selected habitat units and enumerate fish by species and life-stage. Snorkel counts will be adjusted for detectability based on water temperature. The adjusted counts for each habitat unit will be divided by the surface area of the habitat units, as measured during the habitat survey, to express fish density as fish/m².

Monitoring efforts will focus primarily on anadromous ESA listed species present in the Upper Columbia Basin: spring Chinook salmon and summer steelhead. Non-target species, particularly coho salmon and bull trout, will be sampled alongside target species.

Data collection and reporting frequency: Data will be collected for 2 years pre-treatment and 3 years post-treatment, with an option to continue monitoring every 5 years up to out to 15 years; annual data summaries will be provided for years 1-5.

Where is the data stored? Yakima Nation will store field data on an online dashboard: dashboard.yakamafish-star.net. Copies of the data will also be stored internally in a FS Pinyon Folder for our CFLRP project.

Question 3E: How quickly do focal fish species colonize stream reaches after a fish passage projects?

Indicators:

3. Presence/absence of focal fish species before and after fish passage projects
4. Pace of fish recolonization above the barrier pipe locations (presence/km/year)

CFLRP common monitoring strategy or local? Local

Type of Monitoring? Effectiveness

Data source: eDNA sampling

Who collects and analyzes the data: Project sponsor of fish passage project collects data. Laboratory eDNA analysis done by USFS Rocky Mountain Research Station.

Scale: Subwatershed (HUC12)

Methods: Standardized eDNA sampling methods will be used for collection and analysis following methods outlined in “USFWS Environmental DNA: Best Management Practices for Project Planning, Deployment, and Application (2022)”. Cascade Fisheries staff has experience using this method for bull trout eDNA collection in the Methow Basin with the Methow Salmon Recovery Foundation, and USFWS has offered to provide additional training for CF staff.

eDNA samples will be collected pre-project (spring before implementation) up and down stream of a project site to establish a baseline, then annually following implementation until the species of interest have colonized all the accessible stream area or until the conclusion of the CFLRP project. The project would assess multiple barrier pipes within the CFLRP area. The first-year post-implementation, we will sample just above project site and 1 km upstream. Subsequent years we will resample our initial sampling sites and extend upstream sequentially by 1km intervals if downstream samples were positive for focal species. Upstream sampling extent will be terminated at known natural barriers.

Data collection and reporting frequency: Pre-project implementation and annually until focal fish presence is noted up to the next existing natural barrier or the CFLRP project is complete.

Where is the data stored? Data will be held locally by project sponsors and a copy will be stored internally in a FS Pinyon Folder for our CFLRP project.

Question 3G: How do aquatic, floodplain, and riparian habitats respond to restoration projects aimed at increasing habitat complexity?

Indicators:

1. Number and depth of deep-water pools, side channel activation, entrenchment ratios
2. Floodplain inundation
3. Large wood density, wetted width/depth

CFLRP common monitoring strategy or local? Local

Type of Monitoring? Effectiveness

Data source(s):

1. Groundwater and surface water measurements, green LiDAR, as-built surveys
2. Groundwater measurements, remotely sensed NDVI or NDWI imagery, drone photogrammetry
3. Groundwater measurements, Level II surveys (for tributaries and small streams) and Green Lidar/drone photogrammetry (for larger streams and rivers)

Who collects and analyzes the data:

1. Chelan County Natural Resources Department (CCNRD) or contractor
2. CCNRD or contractor
3. CCNRD or contractor for remote sensing and groundwater measurements; Cascade Fisheries for Level II surveys

Scale: Stream reach

Methods: LiDAR comparisons, differencing, and the creation of relative elevation models (REM) will be used to demonstrate how restoration elements effect the geomorphology and change the complexity of rivers through time. In between LiDAR acquisitions, drone photogrammetry can be used to target restoration areas and monitor metrics at a higher temporal resolution and at lower costs. Drone photogrammetry can capture project area orthographics that indicate the extents of inundation/channel activation during high flow, and yield detailed aerial imagery during low flows which can be used to inventory accumulated wood, baseflow inundation extents, and other geomorphic metrics through the creation of Digital Surface Models (DSM).

Accompanying remote sensing data, hydrologic monitoring with pressure transducers can yield a continuous record of ground and surface water data that can help characterize the extent and duration of inundation in project area floodplains and side channels to determine to what degree project goals are being met. Additionally, game cameras can be employed alongside channels (focused on geo-referenced staff plates) to determine the activation period of side channels.

Together, the hydrologic data paired with remote sensing data can yield detailed information on how restoration treatments effect geomorphology, hydrology, and aquatic, riparian, and floodplain habitat within project areas.

Data collection and reporting frequency:

1. LiDAR/Survey: Pre-restoration green LiDAR was collected in 2021, as-built surveys will be obtained immediately following each restoration project, and green LiDAR will be flown again at the end of the 10-year monitoring period.
2. Drone Photogrammetry: Bi-Annually (High & Low flow) or based on a flow trigger of subsequently larger discharge events impacting the project area.
3. Level II Surveys: Conducted pre-treatment and at the end of the project life cycle (10 years)
4. Ground/Surface Water Data: Hourly pressure transducer logging in groundwater wells and in-stream stilling wells. Where well data is not feasible or necessary, game cameras may be employed to monitor side channel/wetland activation.

Data summaries will be provided annual with a progress report at year 5 and final report in year 10 following final green LiDAR analysis.

Where is the data stored? LiDAR data will be stored at the [WDNR LiDAR Portal](#). Reports and any relevant data files could be stored with Upper Columbia Salmon Recovery Board's data portal. Raw data would be stored on Chelan Counties Network Drive and backed up to external hard drives, with copies also stored internally in a FS Pinyon Folder for our CFLRP project.

Watershed Conditions

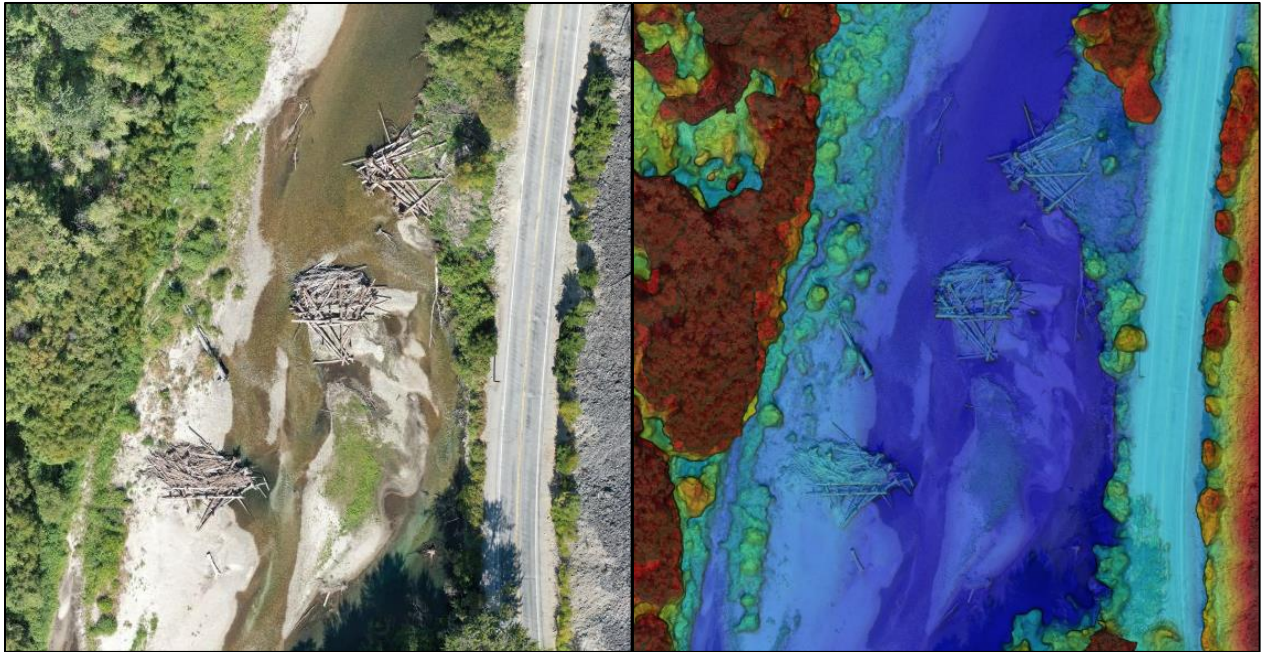


Figure 6. Ortho-imagery and a photogrammetric DEM produced from drone images. These images highlight several structures within the Middle Entiat River at Stormy Reach, Area C Restoration Site (completed in 2020). Photo credit: Matt Holland, Chelan County Natural Resources Department.

Background

The Okanogan-Wenatchee National Forest continues to implement extensive in-stream and road-related projects to benefit aquatic and watershed conditions within the NCW CFLRP. Planned treatments in the NCW CFLRP landscape include culvert replacement and upsizing, road rerouting, road maintenance and improvement, and in-stream wood structure placement. These treatments will increase the resilience of the existing hydrologic system, maintain and improve critical habitat, and create more functional aquatic systems.

Desired Condition

Maintenance, improvements, or select decommissioning on up to 350 miles of National Forest System roads will reduce impacts to watershed health. Combined with planned stream crossing improvements, it will also result in improved watershed function and move three key watersheds identified through the Watershed Condition Framework to an improved condition class. These improved aquatic and hydrological systems will support native fish and increased populations of at-risk bull trout, steelhead trout and chinook salmon.

Question 4: What is the status and trend of watershed conditions in the CFLRP area, with a focus on the physical and biological conditions that support key soil, hydrologic and aquatic processes?

Indicators:

1. Subwatersheds affected by restoration actions and/or disturbance events (e.g. fire, etc).
2. Priority subwatersheds affected by restoration actions and/or disturbance events with a change in overall Watershed Condition Class

CFLRP common monitoring strategy or local? Common

Type of Monitoring? Effectiveness

Data source:

1. Watershed Condition Framework and FS Databases (e.g., FACTS, WIT)
2. Watershed Condition Assessment and Tracking Tool (WCATT)

Who collects and analyzes the data: FS Hydrologist and CFLRP Monitoring Coordinator

Scale: Subwatershed

Methods:

1. Within each of the watersheds affected by restoration or fire, we will report on all twelve 12 WCF indicators, using information tracked in FACTS and WIT. If there is no change in an indicator, it will be reported as indicating no change.
2. We will document change in overall Watershed Condition Class using information in the Watershed Condition Assessment and Tracking Tool (WCATT) as part of the program of work for the Forest.

Data collection and reporting frequency:

1. Every five years
2. Annually

Where is the data stored? The R6 Regional Ecology will store and report out on data for the 12 WCF indicators. Tabular descriptions of the indicators will be summarized as part of annual CFLRP reports, which are available on the [national CFLRP public facing website](#). Copies of the annual report will also be stored internally in a FS Pinyon Folder for our CFLRP project.

Question 4A: How do roads affect hydrologic connectivity and sediment delivery in a sub-watershed pre- and post-treatment?

Indicators:

1. Number of problem sediment delivery points
2. Distance sediment travels
3. Magnitude of sediment delivery
4. Zones of increased drainage network

CFLRP common monitoring strategy or local? Local

Type of Monitoring? Implementation, Effectiveness

Data source: pre-and post-treatment road surveys; photo-points

Who collects and analyzes the data: Data collected by FS field crew and analyzed by FS hydrologists.

Scale: Subwatershed

Methods: Forest Service staff would conduct pre- and post-treatment road surveys with a field crew of at least two hydrologist technicians to collect data on problem sediment delivery points and zones of increased stream network. The data gathered at each of these problems points would include: (1) how far sediment is delivered off-site, (2) does sediment go to a drainage network, and (3) a qualitative assessment of the magnitude of the sediment delivery using a data form that is compatible with GRAIP or [GRAIP-lite](#). Following post-treatment implementation surveys will be conducted at the same locations to assess treatment efficacy. Photo points can also be taken pre and post implementation.

Data would be collected for one of our landscape restoration projects, TBD.

Data collection and reporting frequency: 1 season of pre-treatment road surveys and 1 year of post-treatment surveys along with data analysis.

Where is the data stored? Copies of the data will be stored internally in a FS Pinyon Folder for our CFLRP project.

Invasives & Cultural Plants



Figure 7. Before (left) and after (right) photos of Orange Hawkweed treatments in the Blue Buck project, Methow Valley Ranger District, Okanogan Wenatchee National Forest. Photo credit: Dean McFetridge, USFS.

Background

The Okanogan-Wenatchee National Forest completed environmental analysis for invasive plant management and a forest-wide decision was made in 2017 allowing invasive treatment implementation to proceed in a more timely and efficient manner. Since the adoption of the forest-wide invasive treatment EA, the forest has worked to establish additional capacity for invasive plant treatments through partnership with the Washington State University Extension Biocontrol Agent Program, contracts with county Weed Boards, agreements with youth groups like the Washington Conservation Corps and Northwest Youth Corps, community engagement through small contracts, and an extensive volunteer base. The forest is now treating an average of 1100 acres a year within the CFLRP project boundary.

Additionally, the forest has been working with the local area tribes to prioritize a list of culturally important plant species that can be identified during project planning. There is enthusiasm for monitoring identified populations and their response to treatments, as well as sharing of knowledge to better manage and increase populations of culturally important plants that are accessible for harvest by elders. Proposed monitoring efforts will leverage data already collected by the botany program during pre-NEPA surveys to identify potential treatments and treatment locations and monitor plant response.

Desired Condition

Culturally-important plant populations will increase with active management or better identification and protection. Populations of these plants will occur in accessible locations across the CFLRP project area and be significant enough in size that traditional harvesting methods can be applied sustainably to support tribal food sovereignty into the future.

Additionally, on National Forest lands, healthy native plant communities remain diverse and resilient, and damaged ecosystems are restored. High quality habitat is provided for native organisms throughout the region. Invasive plants do not jeopardize the ability of the National Forests to provide goods and services communities expect. The need for invasive plant treatment is reduced due to the effectiveness and habitual nature of preventative actions, and the success of restoration efforts (2005 R6 PNW ROD).

Question 5: What is the trend in invasive species in the project area?

Indicators: Trend in invasives within the CFLRP project area

CFLRP common monitoring strategy or local? Common

Type of Monitoring? Effectiveness

Data source: Field plot data

Who collects and analyzes the data: Local USFS field crew and/or contractors will collect data and analysis will be completed by a R6 RO Ecologist

Scale: Unit & Project

Methods: Percent cover of 6-15 of invasive species of concern on 1/10th acre plots stratified across treatment types and vegetation groups.

Up to 100 plots will be monitored across the CFLRP project area in pre-identified units (75 plots) and control (25 plots) locations, with data collected as soon as feasible pre-treatment and one-year post-treatment and every three years thereafter. Plots will be collocated with vegetation and fuels monitoring plots.

Data collection and reporting frequency: Data will be collected pre-treatment, post-treatment, and every three years thereafter for the life of the CFLRP project. Results from a subset of plots with data collected in a given year will be reported annually.

Where is the data stored? Copies of the data will be stored internally in a FS Pinyon Folder for our CFLRP project and with the R6 Regional Ecology program.

Question 5A: How do populations of culturally important plant species respond to forest restoration treatments?

Indicators:

1. Extent of plant population & direction of change (increase, decrease, no change)
2. Estimated density before and after treatments
3. Number of cultural plant populations identified across sampled area

CFLRP common monitoring strategy or local? Local

Type of Monitoring? Effectiveness

Data source:

1. Field mapped polygons
2. Field data

Who collects and analyzes the data: FS botany and ecology programs

Scale: Site, Project

Methods: During pre-project planning, Consortium of Pacific Northwest Herbaria and other native plant databases for Washington State flora would be consulted to determine likelihood of cultural plants within survey areas. Potential units will then be inventoried using standard botany inventory protocols.

Culturally important plant species (using list of high priority species for the forest) will be noted and recorded alongside inventory of other species (including rare and invasive species). Identified species will be mapped using a GPS to estimate extent. A variety of data collection protocols, such as point-intercept, belt transect or a 1-m² plot frame (or preferred size) can be used to count individuals within a representative patch to estimate relative density across the mapped area. The method used to collect data will be determined by site characteristics during set up to allow for efficient sampling. Crews should also note whether the plant population is close to a road and potentially accessible for elders to harvest.

Using information from the Fire Effects Information System (FEIS 2023) and local traditional knowledge (when available), forest resources specialists may propose appropriate management actions to either try to increase plant populations or mitigate potential impacts. After the proposed treatments or mitigation actions (e.g., changing the timing of prescribed fire) have been completed, botany or ecology crews will revisit sites and repeat measurements to evaluate directional change in the extent and relative density post-treatment.

The amount of area surveyed for culturally important plants (and other species) and the occurrences recorded can also be summarized pre- and post- treatment to generate a relative measure of how the occurrence of these species is changing over time across a project area.

Data collection frequency: Once during the project planning phase and 1-3 years post-implementation.

Where is the data stored? Cultural plant data is considered controlled unclassified information (CUI). Copies of the data will be stored internally in the restricted OWNF Heritage Program Folders (on the T:drive and FS Pinyon Folder). Copies of the data will be shared with Tribal partners through secure external FS Pinyon Folders.

Economic Monitoring Overview



Figure 8. Logging operations on the Mission Restoration Project on the Methow Valley Ranger District, Okanogan Wenatchee National Forest. Photo credit: Hampton Lumber

Background

Although the forest products infrastructure within the NCW CFLRP area has declined over the last two decades, the remaining forest products businesses are highly engaged with the North Central Washington Forest Health Collaborative and are interested in ensuring existing mills and infrastructure remain viable.

The Yakama Forest Products Tribal Mill is the closest existing mill to the Okanogan-Wenatchee National Forest and utilizes all species and classes of logs. The mill is planning to expand capacity and is interested in utilizing between 20 and 30 million board feet annually from projects on the Okanogan-Wenatchee National Forest and Washington Department of Natural Resources managed lands. The NCW CFLRP has the potential to provide restoration by-products which may help support renovations to increase capacity for Yakama Forest Products.

Other regional purchasers that have worked with the Okanogan-Wenatchee National Forest include: Vaagen Brothers Lumber (Colville, Washington), Boise Cascade (Kettle Falls, Washington and Elgin, Oregon), Sierra Pacific Industries (Mt. Vernon, Washington), Hampton Lumber (Darrington, Morton, and Randall, Washington), and Murphy Plywood (Elma, Washington). There are two existing chipping facilities within or near the Forest. Chip, sawdust, and shavings are also taken to Avista Power in Kettle Falls, Washington. The forest products industry in this area needs a dependable supply of timber and can utilize additional by-products from forest restoration efforts.

The Okanogan-Wenatchee National Forest and its partners are investing in ways to ensure future success in the industry. The North Central Washington Forest Health Collaborative has established an economics subcommittee, including representatives from the timber industry, to examine ways to sustain existing infrastructure, inform the development of new projects, evaluate and learn from prior sales to help ensure projects are economically viable, and explore new opportunities.

The restoration work proposed in the NCW CFLRP proposal is an important assurance that existing forest products jobs and infrastructure are protected while also providing opportunities to attract additional jobs and infrastructure investments for milling and restoration-related contractors and equipment.

Desired Condition

Our proposed work will help maintain a high quality of life for area residents and visitors, provide opportunities for local and regional businesses to engage in forest restoration work, and provide support for existing regional mills relying on forest restoration by-products from the Okanogan-Wenatchee National Forest.

6. How has the social and economic context changed, if at all, from the beginning of CFLRP to the end?

Indicators:

1. Changes in local population, demographic information, unemployment, per capita income, and wildfire exposure
2. Changes in local FS capacity (funding and full-time equivalents (FTEs))
3. Other local community characteristics data/optional indicators the Region/CFLRP project plans to track

CFLRP common monitoring strategy or local? Common

Type of Monitoring? Validation

Data source:

1. Headwaters Economic Profile System
2. FS Organization Chart & Databases

Who collects and analyzes the data: External CFLRP Partner Liaison (WA RC&D) or CFLRP Monitoring Coordinator

Scale:

1. County
2. National Forest & District

Methods:

1. The Headwater Economics Economic Profile System will be used to retrieve and summarize required socioeconomic data for the project area. The counties that are included in their project area are: Chelan, Douglas, Okanogan, Kittitas, Yakima.
2. CFLRP Monitoring Coordinator will query relevant databases or work with local administrative staff to document changes in funding and staffing.

Data collection and reporting frequency: Every 5 years

Where is the data stored? Narrative descriptions of the indicators will be compiled and submitted as part of annual CFLRP reports, which are available on the [national CFLRP public facing website](#). Copies of the annual report will also be stored internally in a FS Pinyon Folder for our CFLRP project.

7. How have CFLRP activities supported local jobs and labor income?

Indicators:

1. Modeled number of full and part time jobs supported by project activities
2. Modeled local labor income supported by project activities

CFLRP common monitoring strategy or local? Common

Type of Monitoring? Validation

Data source: FS databases (NRM); partners organizations

Who collects and analyzes the data: Data will be provided to the FS WO by the CFLRP Monitoring Coordinator and analyzed by the WO Restoration Economics Team.

Scale: Counties included as part of the “Local Impact Area”

Methods: This question uses the Treatment for Restoration Economic Analysis Toolkit (TREAT) and IMPLAN analysis software to analyze the economic impacts of restoration work within the CFLRP boundary. The results from modeling efforts will be incorporated into CFLRP annual report. Results will be interpreted based on project-specific goals, objectives, and context.

Data collection and reporting frequency: Annually

Where is the data stored? Tabular summaries of the indicators will be compiled and submitted as part of annual CFLRP reports (available on the [national CFLRP public facing website](#)) as well as part of the TREAT analysis spreadsheet. Copies of the annual report and TREAT analysis will be stored internally in a FS Pinyon Folder for our CFLRP project.

8. How do sales, contracts, and agreements associated with the CFLRP affect local communities?

Indicators:

1. Local contract capture (% of sales, contracts, agreements captured by local entities vs leakage outside local area)
2. Type of work captured locally (technical, equipment intensive, labor-intensive, supplies)
3. Characteristics of local entities capturing work (small business, minority owned, woman owned, etc.)

CFLRP common monitoring strategy or local? Common

Type of Monitoring? Validation

Data source: FS databases (e.g., NRM, TIM); partners organizations

Who collects and analyzes the data:

1. Data will be provided to the FS WO by the CFLRP Monitoring Coordinator and analyzed by the WO Restoration Economics Team.
2. Data will be provided to the FS WO by the CFLRP Monitoring Coordinator and analyzed by the WO Restoration Economics Team.
3. External CFLRP Partner Liaison (WA RC&D) or CFLRP Monitoring Coordinator

Scale: Counties included as part of the “Local Impact Area”

Methods: This question uses the Treatment for Restoration Economic Analysis Toolkit (TREAT) and IMPLAN analysis software to analyze the economic impacts of restoration work within the CFLRP boundary for indicators 1 and 2. The results from modeling efforts will be incorporated into CFLRP annual report. Results will be interpreted based on project-specific goals, objectives, and context

For indicator 3, the CFLRP Monitoring Coordinator and External CFLRP Partner Liaison will help gather this information from program managers, contracting officer representatives, and local organizations involved in restoration work.

Data collection and reporting frequency: Annually

Where is the data stored? Tabular and narrative summaries of the indicators will be compiled and submitted as part of annual CFLRP reports (available on the [national CFLRP public facing website](#)) as well as part of the TREAT analysis spreadsheet. Copies of the annual report and TREAT analysis will be stored internally in a FS Pinyon Folder for our CFLRP project.

9. Did CFLRP maintain or increase the number and/or diversity of wood products that can be processed locally?

Indicators:

1. Number, size, and types of mills in and around the CFLRP area
2. Volume and type of wood products generated in mills in and around the CFLRP area

CFLRP common monitoring strategy or local? Common

Type of Monitoring? Validation

Data source: Bureau of Business and Economics Research (BBER)

Who collects and analyzes the data: CFLRP Monitoring Coordinator with BBER

Scale: CFLRP Project Area, Counties within “Local Impact Area”

Methods: The CFLRP program works with the Bureau of Business and Economics Research (BBER) at the University of Montana to generate information on local wood processing. Analysis includes information on number and type of wood processing facilities as well as volumes processed.

We will incorporate BBER report results into annual report (when required) and interpret those results based on project-specific goals, objectives, and context.

Data collection and reporting frequency: Roughly every 5 years, depending on data availability.

Where is the data stored? Tabular and narrative summaries of the indicators will be compiled and submitted as part of annual CFLRP reports (available on the [national CFLRP public facing website](#)). Copies of the annual report will be stored internally in a FS Pinyon Folder for our CFLRP project.

10. Did CFLRP increase economic utilization of restoration byproducts?

Indicators: Biomass utilized (biomass harvested/cut across bioenergy and biobased products)

CFLRP common monitoring strategy or local? Common

Type of Monitoring? Validation

Data source: BIO-NRG Agency performance measure as reported in FS Database (TIM)

Who collects and analyzes the data: CFLRP Monitoring Coordinator

Scale: CFLRP Boundary

Methods: To track timber products from CFLR Projects on Forest Service lands, we will report biomass metrics from the Forest Service Timber Information Manager (TIM) database. Our local timber staff and/or CFLRP data manager will access TIM database, summarize required metrics, and interpret results.

Data collection and reporting frequency: Annually

Where is the data stored? Tabular summaries of the indicator will be compiled and submitted as part of annual CFLRP reports (available on the [national CFLRP public facing website](#)). Copies of the annual report will be stored internally in a FS Pinyon Folder for our CFLRP project.

Social Monitoring Overview

Collaboration



Figure 9. North Central Washington Forest Health Collaborative field trip to Mission Project, Okanogan-Wenatchee National Forest. Photo Credit: Hampton Lumber

Background

The North Central Washington Forest Health Collaborative has one of the most diverse memberships in Washington State and has been an active partner with the Okanogan-Wenatchee National Forest since 2013. The collaborative consists of 24 member organizations including tribal, state, county, and local government, Conservation Districts, conservation organizations, forest products companies and associations, fire adapted communities, and local citizens. The Tapash and North Central Washington Forest Health Collaboratives support work across the Okanogan-Wenatchee National Forest, share membership, and coordinate on forest-wide issues and planning.

Desired Condition

Maintain an active and diverse collaborative membership that is engaged with the forest throughout the life of the CFLRP project.

11. Who is involved in the collaborative and if/how does that change over time?

Indicators: Individuals, organizations, and areas of interest represented in the collaborative over time

CFLRP common monitoring strategy or local? Common

Type of Monitoring? Social Values and Perceptions Monitoring

Data source: North Central Washington Forest Health Collaborative (NCWFHC)

Who collects and analyzes the data: External CFLRP Partner Liaison & NCWFHC Facilitator

Scale: N/A

Methods: Collate and report up-to-date collaborative membership information

Data collection and reporting frequency: Annually

Where is the data stored? Tabular summaries of the indicator will be compiled and submitted as part of annual CFLRP reports (available on the [national CFLRP public facing website](#)). Copies of the annual report will be stored internally in a FS Pinyon Folder for our CFLRP project.

12. How well is CFLRP encouraging an effective and meaningful collaborative approach?

Indicators: Perceptions of whether and to what extent collaborative process is meaningful and effective

CFLRP common monitoring strategy or local? Common

Type of Monitoring? Social Values and Perceptions Monitoring

Data source: SWERI Survey

Who collects and analyzes the data: Southwest Ecological Restoration Institutes (SWERI)

Scale: N/A

Methods: Collaborative structure, health, and performance is evaluated using an assessment administered by the Southwest Ecological Restoration Institutes (SWERI). The assessment includes a core set of questions for all projects and will include several project-specific questions as well. The CFLRP monitoring coordinator and NCWFHC facilitator will work with SWERI to help get the survey to the right people and ensure collaborative members and FS staff complete it.

CLFRPs will work with SWERI to interpret the survey results and SWERI will provide a summary report and reflect on the results including: providing additional context, completed or potential actions in response to assessment results, and/or additional support that would help address challenges, needs, or recommendations from the report.

Data collection and reporting frequency: Every 2-3 years.

Where is the data stored? Data from the online survey will be shared among the SWERI Research Team (at NAU and Colorado State University) through the Colorado Forest Restoration Institute Box directory and our respective institutional Qualtrics accounts until such time that the data is no longer needed. The Box directory is a password-protected and cloud-based directory that is backed up regularly. Raw data will also reside in the research teams institutional Qualtrics accounts. Data will only be accessible to the research team.

All reports, presentations, fact sheets, and academic publications will not include personal identifiable information. Data will be aggregated at the level of the CFLRP project and presented in graphs of quantitative results and summaries of qualitative comments.

Partnership Engagement



Figure 10. Partner-led aquatic restoration project on the Twisp River, Methow Valley Ranger District, Okanogan-Wenatchee National Forest. Photo credit: Gene Shull, 2022

Background

Ownership patterns in the NCW CFLRP landscape require collaborative solutions. For example, 84% of the lands in the Upper Wenatchee sub-basin are owned or managed by federal, state, or county governments and land trusts. To effect meaningful change in the NCW CFLRP area, large land managers, local governments, communities, industry, and stakeholders are working together to identify and implement solutions and leverage different resources to fund projects on and off National Forest system lands. The forest currently has standing GNA agreements with Washington DNR to help with both planning and implementation capacity on forest restoration projects, aquatic partners sponsor projects for salmonid and ESA-listed fish recovery through funding from the Bonneville Power Administration (BPA) and other entities, and the Chelan County Natural Resources Department has been engaged with the forest a conservation finance company, Blue Forest Conservation, to explore the viability of a forest resilience bond on the Upper Wenatchee Pilot Project.

Communities in the NCW CFLRP landscape are among the most threatened by wildfire in the Pacific Northwest. Of 1,005 communities evaluated in Oregon and Washington, five of the most at-risk occur in the NCW CFLRP landscape. The community of Leavenworth was ranked the most vulnerable and the communities of Chelan, Entiat, Twisp, and Winthrop are ranked among the top 25 most vulnerable (Scott et al. 2018). As a result, these communities have organized at multiple scales to learn about, plan for, and act to better manage and respond to risks from wildland fire. We plan to leverage existing social science efforts and research in North Central Washington to better understand the perceived barriers for wildfire

mitigation as well as the strategies and innovations that allow people and institutions to work successfully together across jurisdictional, agency, organizational, and interest boundaries, and across scales and differences in context. Previous outcomes from these projects have included science-based recommendations for investments to improve the wildland fire system, improve community coordination, sustain fire-adapted communities, and conserve the land and harden homes in the Wildland Urban Interface. Reassessment will allow us to understand how additional investments from programs like CFLRP and the Washington State House Bill 1168 have changed outcomes and incentivized cross-boundary solutions at both at the community and landscape level.

Desired Condition

Maintain or increase partner contributions (in-kind time and funding) committed to shared project goals.

Promote cross-boundary defensible space and restoration treatments to increase wildfire preparedness among individuals and communities within the CFLRP project landscape.

13. If and to what extent have CFLRP investments attracted partner investments across the landscapes?

Indicators: Use of direct CFLRP funds; matching funds provided by the agency; contributed funds by partner organizations (both funding and in-kind)

CFLRP common monitoring strategy or local? Common

Type of Monitoring? Validation Monitoring

Data source: FS databases (e.g., NRM, TIM); partners organizations

Who collects and analyzes the data: FS Partnership Coordinator/CFLRP Monitoring Coordinator/External CFLRP Partner Liaison

Scale: CFLRP Project Area

Methods: We will work with Forest Service and non-Forest Service partners to track expenditures and partner match contributions as part of the annual CFLRP report.

Data collection and reporting frequency: Annually

Where is the data stored? Tabular and narrative summaries of the indicators will be compiled and submitted as part of annual CFLRP reports (available on the [national CFLRP public facing website](#)). Copies of the annual report will be stored internally in a FS Pinyon Folder for our CFLRP project.

13A. What partners are engaged in cross-boundary restoration and fire mitigation work? How has this changed over time with the addition of focused efforts and investments on public and state lands?

Indicators:

1. Numbers and types of organizations and practitioners engaged in wildfire and risk management
2. Number and diversity of boundary spanners/bridgers and/or individual coordinators
3. Connectedness of different organizations and actors

CFLRP common monitoring strategy or local? Local

Type of Monitoring? Social Values and Perceptions Monitoring

Data source: Longitudinal surveys including resurvey of [Co-Management of Fire Risk Transmission 2019 survey](#) respondents.

Who collects and analyzes the data: CoMFRT Team, Portland State University/Rocky Mountain Research Station

Scale: Landscape

Methods: To describe the diversity of actors and characterize the wildfire risk management system in NCW, PSU and the CoMFRT team will conduct a survey of practitioners working on wildfire risk management in the region to identify who is part of the wildfire management system, what are their roles, where they work, and how are they connected to each other.

Because the network of practitioners working on wildfire risk is not strictly defined by affiliation, membership in an organization, or representation on a list of managers (called an unbounded network) part of this task will be to develop the population of practitioners who self-identify as working on issues related to wildfire risk management. To do so, the survey first involves key informant interviews and workshops followed by practitioner surveys that are conducted using a snowball sampling approach.

Data collection and reporting frequency: 1-2 years after project inception and 5-7 years later

Where is the data stored? Data collected for this effort will be stored on a restricted network at Portland State University. However, this research qualifies as exempt from Human Subjects review due to the low risk involved, that the researchers survey individuals in their public capacity, and that the identifiable information is public not private. Currently, respondents are told that the researchers will not share contact information but will consider modifying this as 'opt-in' though informed consent. In the interim, summaries of results will be stored locally in our CFLRP Box folder, but raw data will be held by PSU.

13B. What are community perceptions around wildfire risk, and how do community education tools and outreach efforts tailored to those perceptions help partners to plan and implement more effective, strategic, and large-scale cross-boundary projects over time?

Indicators:

5. Number of cross-boundary projects planned by partners
6. Number of cross-boundary planning meetings
7. Increase in number of collaborators our partners work with on a regular basis
8. Increased trust and engagement from community members in landscape restoration projects

CFLRP common monitoring strategy or local? Local

Type of Monitoring? Social Values and Perceptions Monitoring

Data source: Community level risk assessments and social surveys of community and collaborative members

Who collects and analyzes the data: Wildfire Research Team (WiRe); Rocky Mountain Research Station

The WiRē team has substantial experience working with communities to collect social and biophysical parcel-level data and developing useful products and tools. Integration of the data and products into cross boundary collaborations and development of metrics of success will be novel.

Scale: Community

Methods: This project utilizes a co-productive approach that yields social science results that will be used to direct action. A co-productive approach that is built in collaboration ensures that the effort is tailored to attend to critical management questions central to the pursuit of fire-adapted communities and partnerships that support sustainable forest management practices. An essential aspect of co-productive work is maintaining methodological flexibility without compromising scientific integrity.

The WiRē team will start by identifying two study communities that are proximate to cross boundary collaborative efforts within a high risk fireshed. The WiRē Approach is a systematic process that includes two data collection efforts: 1) A rapid wildfire risk assessment based on attributes related to building materials, vegetation near the home, background fuels and topography, as well as access for the fire department to the parcel. 2) Social surveys of the residents of the assessed parcels to investigate homeowners' perceptions of wildfire risk, risk mitigation behaviors, and responses to incentives to mitigate risk. Summarized results are shared with partners to identify areas of most interest for additional analyses. In this project, the results will include a deeper dive into the survey measures related to acceptability of fuels treatment and wildfire risk on nearby public lands. The team will present and discuss results with local cross boundary collaborative efforts.

Data collection and reporting frequency: 1-2 years after project inception and 5-7 years later

Where is the data stored? Data collected from the rapid assessment and household survey are stored on a restricted network with the Rocky Mountain Research Station. Data collected with partners (e.g., local fire districts) is shared with those partners, but the household survey data is de-identified. Summaries of

results will be stored locally in our CFLRP Box folder, but raw data will not be shared outside the WiRē research team.

References

- Altman, B., and B. Bresson. 2017. *Conservation strategy for landbirds of the northern Rocky Mountains of eastern Oregon and Washington*. Version 2.0. Oregon-Washington Partners in Flight, American Bird Conservancy, and U.S. Forest Service/Bureau of Land Management, Boring, OR.
- Fire Effects Information System (FEIS), [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Missoula Fire Sciences Laboratory (Producer). Accessed: 25 March 2023.
- Halstead, K. E., J. D. Alexander, A. S. Hadley, J. L. Stephens, Z. Yang, M. G. Betts. 2019. Using a species-centered approach to predict bird community responses to habitat fragmentation. *Landscape Ecology* 34: 1919-1935.
- Hessburg, P.F., Churchill, D.J., Larson, A.J. et al. (2015) Restoring fire-prone Inland Pacific landscapes: seven core principles. *Landscape Ecology* 30: 1805–1835.
- Northwest Forest Plan Record of Decision (NWFP ROD). (1994) *Northwest Forest Plan Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl*. Washington, DC: U.S. Forest Service and U.S. Bureau of Land Management. https://www.blm.gov/or/plans/surveyandmanage/files/17-1994_nwfp_record_decision.pdf.
- Prichard, S. J., Peterson, D. L., & Jacobson, K. (2010). Fuel treatments reduce the severity of wildfire effects in dry mixed conifer forest, Washington, USA. *Canadian Journal of Forest Research* 40(8): 1615-1626.
- Prichard, S. J., & Kennedy, M. C. (2014). Fuel treatments and landform modify landscape patterns of burn severity in an extreme fire event. *Ecological Applications* 24(3): 571-590.
- Prichard, S. J., Povak, N. A., Kennedy, M. C., & Peterson, D. W. (2020). Fuel treatment effectiveness in the context of landform, vegetation, and large, wind-driven wildfires. *Ecological Applications* 30(5): e02104.
- Scott, J.H., Gilberston-Day, J. and Stratton, R.D. (2018) *Exposure of human communities to wildfire in the Pacific Northwest*. Available at: http://pyrologix.com/wp-content/uploads/2019/11/RiskToCommunities_OR-WA_BriefingPaper.pdf.
- Shirley, S. M., Z. Yang, R. A. Hutchinson, J. D. Alexander, K. McGarigal, and M. G. Betts. 2013. Species distribution modelling for the people: unclassified LandsatTM imagery predicts bird occurrence at fine resolutions. *Diversity and Distributions* 19:855–866.
- USDA Forest Service. (2012) *The Okanogan-Wenatchee National Forest Restoration Strategy: adaptive ecosystem management to restore landscape resiliency*. Portland, OR: USDA FS Pacific Northwest Region.
- US Fish and Wildlife Service. (2011) *Revised Recovery Plan for the Northern Spotted Owl (Strix occidentalis caurina)*. Portland, OR: US Fish and Wildlife Service. 258 pp. Available at: https://www.fws.gov/sites/default/files/documents/NSO_RevisedRP_2011.pdf

Washington Department of Natural Resources (2017). *20-Year Forest Health Strategic Plan: Eastern Washington*. Olympia, WA. 64 pp. Available at:
https://www.dnr.wa.gov/publications/rp_forest_health_20_year_strategic_plan.pdf

Appendix A. Other Questions Considered

Do aquatic restoration projects enhance stream temperatures and cold water refugia?

Over the next several years, the Okanogan-Wenatchee National Forest will be piloting the use of forward-looking infrared (FLIR) sensors deployed using drones to evaluate changes in stream temperatures. In combination with planned fixed wing aircraft flights that will cover larger spatial extents and generate baseline stream temperature data, the drone based FLIR flights are intended to monitor changes in stream temperatures along smaller stream segments before and after treatments where concurrent in-stream temperature sensors have been placed to verify the accuracy of the data. If this proves feasible and effective, the Forest will have the in-house capacity to evaluate stream temperatures, cold water mixing, and cold water refugia over time.

Are active and passive reforestation approaches with the CFLRP boundary meeting the intent of the Replant Act and National Reforestation Strategy?

By 2030, the Okanogan-Wenatchee National Forest will have put forth a strong effort to reforest areas that have resulted from natural disturbances (primarily wildfires). This effort is mandated through the Replant Act and part of the National Reforestation Strategy and applies to disturbance events that occurred from 1987-2022. Methods for reforestation will include active tree planting in areas that are void of adequate seed sources along with assessing landscapes for Natural conifer regeneration where seed sources do exist. Post planting stocking surveys would be conducted to determine the success of those efforts.

How do restoration treatments influence wildfire management operations and decision-making during wildfires?

Washington DNR is working to pilot methods to better understand how treatments influenced fire operations and use incident information including maps and daily briefings along with fire manager interviews to help establish a narrative around the interaction between fuels treatments and wildfire.

Interviews with local fire management personnel with specific knowledge of each interaction would be gathered via the Wildfire Interactions with Treatments Survey (WITS) developed by WADNR and the USFS. The survey consists of a series of questions tailored to collection of qualitative data on the impacts of forest health treatments on fire operations allowing for monitoring the benefits of treatments for fire operations, sharing of success stories of fire and forest management and to understand and communicate the limitations of fire and forest management.

The WITS is being developed to collect information during or after the fire season. Intended respondents are fire staff with specific knowledge of fire behavior and fire operations in the moments leading to, during and after the interaction with the treatment unit during a wildfire incident. Results of survey would ultimately be analyzed by the Forest Health Science Team at WADNR.

Appendix B. Timeline for Data Collection/Reporting

Monitoring Question	Year														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. What is the reduction in fuel hazard based on our treatments?		X	X	X	X	X	X	X	X	X					
1A. How do previous treatments interact with wildfires within the CFLRP project boundary (when they occur)?	X	X	X	X	X	X	X	X	X	X					
2. What is the effect of the treatments on moving the Forest landscape toward a more sustainable condition that includes the scale and intensity of historical disturbances?		X				X				X					
2A. What is the prevalence of insects and disease in project units that are treated as part of the CFLRP?		X	X				X					X			
2B. How well did treatments meet the prescription targets for tree density, composition, and spatial pattern?		X	X												
2C. Were large trees (> 25" DBH) and snags (>12" DBH) retained or created through successive treatments? How much post-harvest mortality or loss of large trees and snags occurs over time (e.g., from windthrow, mechanical damage, etc.)?		X	X				X					X			
3. What are the specific effects of restoration treatments on the habitat of at-risk species and/or the habitat of species of collaborative concern across the CFLR project area?		X				X				X					
3A. How do treatments impact potential distribution, richness, and abundance of avian focal species across the CFLRP project area?			X	X			X					X			
3B. How is Northern Spotted Owl habitat impacted by restoration treatments and fire within the CFLRP footprint?		X				X				X					

Monitoring Question	Year														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
3C. What are the impacts of restoration treatments on the presence of special status (MIS) species such as the White-Headed Woodpecker, Northern Goshawk, Clark's Nutcracker, and other priority species?			X					X					X		
3D. How do habitat restoration projects affect the distribution and abundance of juvenile and adult salmonids (including non-anadromous species such as bull trout, west-slope cutthroat, and resident <i>O. mykiss</i>)?			X	X	X	X	X								
3E. How quickly do focal fish species colonize stream reaches after a fish passage projects?			X	X	X	X	X	X	X	X					
3F. How do aquatic, floodplain, and riparian habitats respond to restoration projects aimed at increasing habitat complexity?			X							X					
4. What is the status and trend of watershed conditions in the CFLR area, with focus on the physical and biological conditions that support key soil, hydrologic and aquatic ecosystem processes?			X					X					X		
4A. How do roads affect hydrologic connectivity and sediment delivery in a sub-watershed pre- and post-treatment?	X	X							X	X					
5. What is the trend in invasive species within the CFLRP project area?		X	X	X	X	X	X	X	X	X					
5A. How do populations of culturally important plant species respond to forest restoration treatments?	X	X							X	X					
6. How has the social and economic context changed, if at all, from the beginning of CFLRP to the end?		X				X				X					
7. How have CFLRP activities supported local jobs and labor income?	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
8. How do sales, contracts, and agreements associated with the CFLRP affect local communities?	X	X	X	X	X	X	X	X	X	X					
9. Did CFLRP maintain or increase the number and/or diversity of wood products that can be processed locally?		X				X				X					

Monitoring Question	Year														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
10. Did CFLRP increase economic utilization of restoration byproducts?		X	X	X	X	X	X	X	X	X					
11. Who is involved in the collaborative and if/how does that change over time?	X	X	X	X	X	X	X	X	X	X					
12. How well is CFLRP encouraging an effective and meaningful collaborative approach?		X		X		X		X		X					
13. If and to what extent have CFLRP investments attracted partner investments across the landscapes?	X	X	X	X	X	X	X	X	X	X					
13A. What partners are engaged in cross-boundary restoration and fire mitigation work? How has this changed over time with the addition of focused efforts and investments on public and state lands?			X						X						
13B. What are community perceptions around wildfire risk, and how do community education tools and outreach efforts tailored to those perceptions help partners to plan and implement more effective, strategic, and large-scale cross-boundary projects over time?			X						X						

Appendix C: Anticipated Funding Needs

TBD