Tapash Collaborative Forest Landscape Restoration Project
Monitoring Plan

INTRODUCTION

The Tapash Sustainable Forest Collaborative formed around a coalition of public, non-profit and tribal land managers organized under a Memorandum of Understanding between four cooperating agencies and an NGO. Established in 2006, The Nature Conservancy, Washington Department of Fish and Wildlife, Washington Department of Natural Resources, the Okanogan-Wenatchee National Forest, and the Yakama Nation, have been working cooperatively to overcome the challenges created by intermixed land ownership and limited resources in central Washington. The groups' organizational structure includes an Executive Board, steering, science, and technical committees, and implementation teams. The members of the collaborative have recognized the need to work together, despite ownership boundaries, to ensure that lands are managed sustainably across the larger landscape.

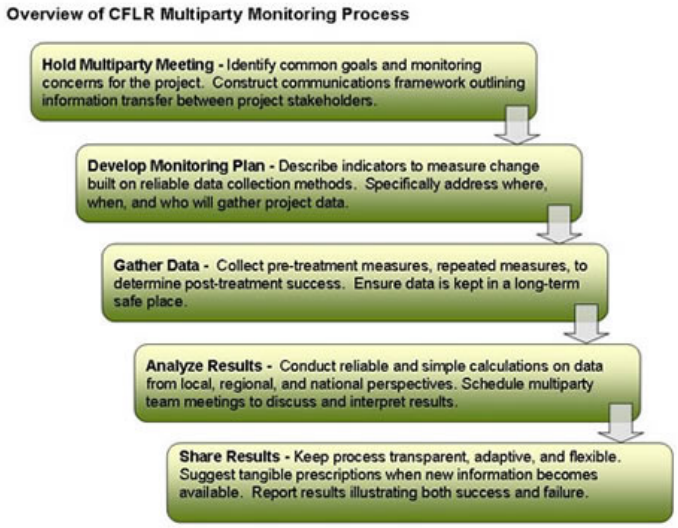
The Tapash Restoration Project was selected for Collaborative Forest Landscape Restoration (CFLR) Program funding in August of 2010 (http://www.fs.fed.us/restoration/CFLRP/2010proposals.shtml). The CFLR program was established by Congress under Title IV of the Omnibus Public Land Management Act of 2009. The purpose of the CFLR program is to encourage the collaborative, science-based ecosystem restoration of priority forest landscapes. The program provides a means to pursue an all hands approach to forest restoration through close coordination with other landowners to encourage collaborative solutions through landscape-scale operations.

The Tapash CFLR project finds its' basis in the Okanogan-Wenatchee National Forest Restoration Strategy. This strategy aims to enhance the resilience and sustainability of forests through treatments that incrementally return the ecosystem to a state that is within a historical range of conditions. A key component of the Forest Restoration Strategy is the implementation of an adaptive management approach that utilizes information gathered through monitoring to validate the appropriateness of these treatment prescriptions and provide insight into necessary adjustments.

GOAL OF THE MONITORING PLAN

Title IV of the Omnibus Public Land Management Act of 2009 mandates the use of multiparty monitoring. Multiparty monitoring is intended to bring people with different views and expertise together to address broad landscape level issues and reduce potential conflict over actions by providing a way for interested groups to discuss, reach agreement, and collaboratively appropriate beneficial management activities. The Act further mandates the

use of multiparty monitoring to monitor, evaluate, provide accountability, and assess the positive or negative ecological, social, and economic effects not less than 15 years after the project implementation commences. The diagram below illustrates the key steps in multiparty development and monitoring process. (From CFLR Program Interim Field Guide (Revision 1.01) – Overview)

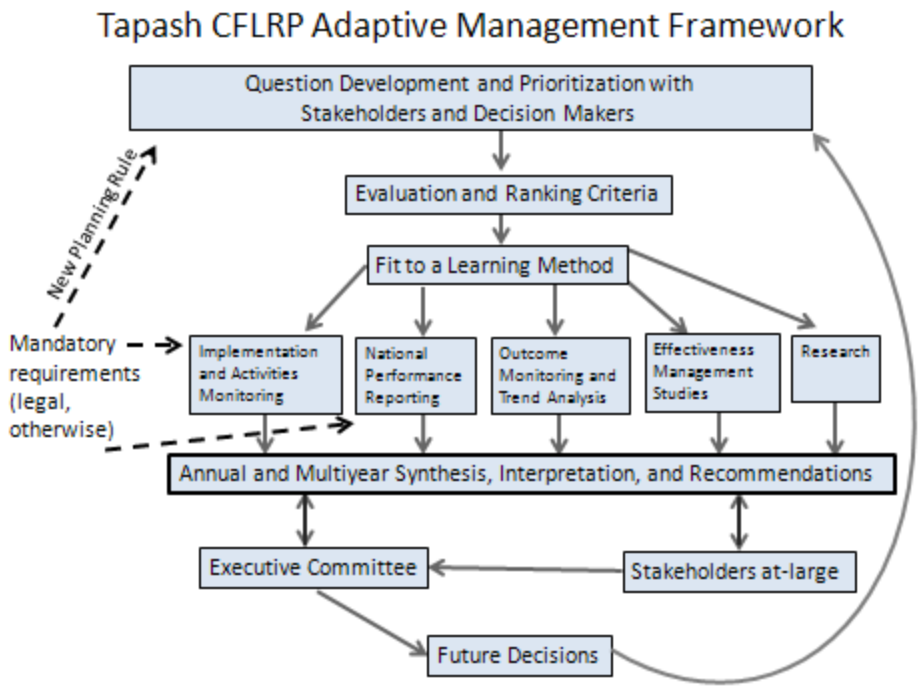


The Tapash Multiparty monitoring group includes representation from the signatory members of the Tapash Sustainable Collaborative as well as other stakeholders who have demonstrated an interest in CFLRP monitoring.

The goal of the Tapash CFLRP Monitoring Plan is to outline a monitoring strategy for this landscape for not less than the next 15 years. The plan will be guided by the multiparty monitoring outlined in Figure 1, above and the Okanogan Wenatchee Forest Restoration Strategy. This plan will outline the information that will be collected (what questions will be asked), the methods, location, timing of data collection, and who will analyze and interpret the data. This plan also outlines how the results will be shared and incorporated into an adaptive management, learning-based framework. Lastly, this monitoring plan will estimate the budget required to implement the monitoring plan as described.

ADAPTIVE MANAGEMENT FRAMEWORK

The Tapash CFLRP multiparty monitoring group has adopted the following framework, illustrated by the diagram below, as a way to organize and manage our overall monitoring and adaptive management process. As specific questions are developed and learning methods assigned, timelines will be specified for outputs associated with each particular monitoring element.



MONITORING GOALS AND OBJECTIVES

As a means to focus our efforts, the team identified a broad suite of monitoring categories to stratify monitoring objectives and guide monitoring question development. We began with the key monitoring items identified in the Tapash CFLRP project proposal and the Okanogan-Wenatchee Forest Restoration Strategy. As well, we gave consideration not only to questions relative to projects that are currently underway, but, also to addressing a larger variety of questions relative to activities/treatments in areas where we are not currently implementing projects. At this time, the team has agreed on the following broad monitoring categories for question development:

Broad Categories for Monitoring Question Development	
Vegetation	Species composition, vegetation structure (including the retention/restoration of old and large trees) and landscape pattern (including all landscape pattern elements; such as, meadows, berry fields, aspen stands, etc.).
Disturbance Regimes	Includes fire and fuels regimes as well as insects, disease, and other disturbance regimes on the landscape.
Wildlife and Aquatic Species and Habitat	Includes ESA-listed and focal species and their habitat.
Physical Processes	Includes hydrologic regimes, floodplain attributes, soils and sediment regimes.
Economics	Supply existing and attract new forest product infrastructure that

Broad Categories for Monitoring Question Development	
	facilitates ecologically based restoration and creates sustainable local employment and community well-being.
Cultural Resource Values	Includes historic and prehistoric heritage resources (archeological properties) defined as physical evidence of past human activity expressed as artifacts and or features on the modern landscape; and treaty rights (the right of access to usual and accustomed fishing stations and the privilege to hunt, gather and graze animals). Would include berry fields, etc.
Social Values	Includes recreational amenities, infra-structure, access, aesthetics, and air quality. This category also includes values associated with collaboration and implementing a collaborative process.

Within each of the broad monitoring categories described above, a monitoring goal statement was developed with specific objectives associated with that category or specific resource area. As with development of the broad categories, the goal statements and objectives were derived from the Tapash CFLRP project proposal and the Okanogan-Wenatchee Forest Restoration Strategy. Because each objective is intended to represent a potential monitoring question, applicable methodologies for measuring progress towards these objectives were also identified.

National Indicators

As a means of further meeting the intent of the Act with regard to monitoring to evaluate, provide accountability, and assess the positive or negative ecological, social, and economic effects of restoration treatments; a set of five national indicators has also been developed. The primary objective of developing a national framework is to provide a means to "roll-up" the data across all of the CFLRP projects to assist in communicating the results of CFLR to Congress and national audiences. This monitoring plan incorporates by reference the guidance for the CFLRP ecological indicator: *Guidance: Tracking and Reporting Ecological Outcomes of the Collaborative Forest Landscape Restoration Act (Transmitted to the field July 24, 2012)*. Desired Conditions and the associated national ecological indicators have been integrated into each of the goals/objective statements for each of the broad categories described above.

Vegetation (Landscape-level)

Goal:
Restore landscape vegetation structure, composition, and pattern such that it falls within the combined HRV and FRV of its ecosubregion.

Objectives:

1) Landscape departure of physiognomic types (PT) relative to HRV and FRV estimates is reduced within the treated landscape area.
2) Landscape departure of cover types (CT) is reduced within the treated landscape area.
3) Landscape departure of structural stage (SS) is reduced within the treated landscape area.
4) Landscape departure of cover and structural class combinations (CTxSS) is reduced within the treated landscape area.
5) Landscape departure of late successional and old forest structure (LSOF) is reduced within the treated landscape area.
6) There is an improvement in the fit of patch sizes of PTs, CTs, SSs, CTxSSs, and LSOF conditions to an inverse-J (lognormal) distribution and the largest patch sizes are approaching those typical of the combined HRV and FRV estimates.
7) Treated patches of PTs, CTs, SCs, CTxSSs, and LSOF conditions in projects have been tailored to the topography.
8) Landscape-scale invasive species severity is reduced by preventing, controlling, and eradicating targeted invasive species.

Measures:
As specified in the Forest Restoration Strategy (2012), departure from the combined HRV and FRV is measured in terms of *seven class metrics*: percentage landscape area (PL), patch density (PD), mean nearest neighbor distance (MNN), aggregation index (AI), mean patch size (MPS), largest patch index (LPI), edge density (ED); and s*even landscape metrics:* Patch Richness (PR), Shannon Diversity Index (SHDI), Hill's Index N1 (N1), Hill's Index N2 (N2), Modified Simpson's Evenness Index (MSIEI), Contagion Index (CONTAG), and Interspersion and Juxtaposition (IJI).

Non-native invasive species are measured by population presence and spatial extent as well as abundance within populated areas.

Vegetation (Stand-level)

Goal:
Restore within stand spatial patterns, and snag, coarse wood, and large/old tree levels.

Objectives:

1) There is an improvement in the number of individual trees, the number and size of tree clumps, and the number, size, and shape of openings within treated stands.
2) There is an improvement in the number snags and amount of CWD within treated stands.
3) Large/old trees within treated stands are retained and there is an improvement in the number of trees with potential to develop large/old characteristics.

Measures:
Within stand spatial patterns are measured using both global and local measures as described in Larson and Churchill (2012) and Churchill et al. (2013). Snag and CWD measured on a per acre basis. Large / old trees may be identified using criteria of Van Pelt (2008) and measured on a per acre basis.

Insects and Diseases

Goal:
Reduce landscape pattern vulnerability to major insect and pathogen disturbance agents such that it falls within the combined HRV and FRV of its ecosubregion.

Objectives:

1) Landscape departure of major bark beetle vulnerability (DFB, MPB, WPB, FE) relative to HRV and FRV estimates is reduced within the treated landscape area.
2) Landscape departure of major dwarf mistletoe vulnerability (DFDM, PPDM, WLDM, LPPDM) relative to HRV and FRV estimates is reduced within the treated landscape area.
3) Landscape departure of major defoliator vulnerability (WSB, DFTM) relative to HRV and FRV estimates is reduced within the treated landscape area.
4) Landscape departure of major root disease vulnerability (AROS, PHWE) relative to HRV and FRV estimates is reduced within of the treated landscape area.

Measures:
As specified in the Forest Restoration Strategy (2012), departure from the combined HRV and FRV is measured in terms of *seven class metrics*: percentage landscape area (PL), patch density (PD), mean nearest neighbor distance (MNN), aggregation index (AI), mean patch size (MPS), largest patch index (LPI), edge density (ED); and s*even landscape metrics:* Patch Richness (PR), Shannon Diversity Index (SHDI), Hill's Index N1 (N1), Hill's Index N2 (N2), Modified Simpson's Evenness Index (MSIEI), Contagion Index (CONTAG), and Interspersion and Juxtaposition (IJI).

Wildfire (Patch-level)

Goal:
Reduce patch-level vulnerability to wildfire such that it falls within the combined HRV and FRV of its ecosubregion.

Objectives:

1) Departure of fuel loading (FUEL), fireline intensity (FLI), flame length (FL), rate of spread (ROS), and risk of crown fire (RCF) relative to HRV and FRV estimates is reduced over at least 30% of the treated landscape area. Departure is estimated for 90th percentile fire weather conditions.

Measures:
As specified in the Forest Restoration Strategy (2012), departure from the combined HRV and FRV is measured in terms of *seven class metrics*: percentage landscape area (PL), patch density (PD), mean nearest neighbor distance (MNN), aggregation index (AI), mean patch size (MPS), largest patch index (LPI), edge density (ED); and s*even landscape metrics:* Patch Richness (PR), Shannon Diversity Index (SHDI), Hill's Index N1 (N1), Hill's Index N2 (N2), Modified Simpson's Evenness Index (MSIEI), Contagion Index (CONTAG), and Interspersion and Juxtaposition (IJI).

Wildfire (Landscape level)

Goal:
Reduce landscape vulnerability to wildfire to minimize the current likelihood of large and uncharacteristic wildfires. Reduce wildfire management costs associated with large and uncharacteristic wildfires.

Objectives:

1) From the landscape analysis of wildfire flow, the top 25-30% of the landscape area in terms of predicted fireline intensity (Intensity), , and node influence (Sending) will be treated to interrupt the flow of large wildfire during rare and extreme events.
2) Treatments will be consistent with the vegetation and insect and disease objectives and measures specified above.
3) Treated patches are tailored to the topography (southern exposures and ridgelines).
4) Expected fire behavior within treated patches changes from crown to surface fire dominated.
5) Increase cost savings resulting from reduced wildfire management costs.
6) Decrease unit cost of implementing ecological restoration treatments overtime

Measures:
Apply the landscape fire index (additive index of Congruence + Intensity + Sending) to evaluated landscapes.
Ensure consistency with vegetation and I & D monitoring measures as above.
Evaluate treatment application in a GIS relative to maps of aspect N and S (degrees True) and of ridges and valleys (WFSL, Brion Salter can give you the scripts for these).
Treated patch has a CT, SS, and fuel loading that will produce surface (rather than crown) fire behavior under 90th percentile wildfire burn conditions. [Hint: These combinations have already been simulated using BEHAVE and CONSUME and are available by reviewing the HRV and FRV reference conditions for the ecosubregion.]

The Risk and Cost Analysis Tool (R-CAT) will be used to measure fire program management cost savings and risk reduction resulting from restoration treatments.

Terrestrial and Aquatic Habitats and Species

Goal 1: Manage habitats to protect ecosystem functions and biodiversity consistent with the historic and sustainable future landscape. Manage habitat using a landscape approach, with a goal towards ecological sustainability.

Objectives:

1) Maintain or improve habitat quality and effectiveness consistent with ecosystem integrity for big game species (elk and deer) to support harvestable populations.
2) Improve or maintain habitat quality and effectiveness for species sensitive to disturbance such as wide-ranging carnivores, ungulates, late-successional species and riparian-associated species (Gaines et al. 2003).
3) Improve or maintain critical habitats for federally listed wildlife species.
4) Habitat quality and effectiveness for focal wildlife species are restored within the range of historic and future reference conditions. Wildlife habitat is sufficient and appropriately arranged on the landscape.
5) Restore complex structural components for birds and mammals relative to HRV and FRV estimates according to Plant Association Groups (PAGs).
6) Unique habitats are protected and improved within the treated landscape area.

Measures:

1) Monitor quality and quantity of deer and elk summer range forage pre and post treatment (5, 10, 15 yrs post).
2) Open road densities remain constant or decrease.
3) The amount and configuration of critical habitat for T&E species concurs with FWS criteria:
   - Manage for NSO habitat as specified in the Federal Register, Revised Critical Habitat for the Northern Spotted Owl (FWS 2012).
4) The amount and configuration of focal species habitat needed would be evaluated at the landscape level specified in the Restoration Strategy (2012).
   - Departure from the combined HRV and FRV is measured in terms of *seven class metrics*: percentage landscape area (PL), patch density (PD), mean nearest neighbor distance (MNN), aggregation index (AI), mean patch size (MPS), largest patch index (LPI), edge density (ED); and s*even landscape metrics:* Patch Richness (PR), Shannon Diversity Index (SHDI), Hill's Index N1 (N1), Hill's Index N2 (N2), Modified Simpson's Evenness Index (MSIEI), Contagion Index (CONTAG), and Interspersion and Juxtaposition (IJI).

5) Snag and log densities, large and old trees numbers as specified in the Restoration Strategy (2012) Table 5 and 7; numbers vary by Plant Association Groups (PAGs); DecAid (Mellen-McLean et al. 2013).

6) Unique habitat as specified in the OKW Forest Plan
    - Conduct pre and post monitoring of meadows. Post monitoring should occur (5, 10 15 years). Invasive plants reduction as specified in the R6 Invasive Plant EIS/OKW Forest Invasive Plant EIS. Hydrological function improved from baseline and size of meadow restored to historic reference condition.
    - Conduct pre and post treatment monitoring to insure unique habitats have been adequately protected and/or restored to historic reference condition.

Goal 2: Restoration treatments will result in increased (or stable) habitat utilization by terrestrial and aquatic species. In some situations a short-term negative effect may be necessary to reach a long-term beneficial effect.

Objectives:

1) Restoration treatments will sustain or increase use by harvestable populations of big game species (deer and elk).
2) Restoration treatments will sustain or increase use by federally listed T&E species according to recovery plans.
3) Restoration treatments will sustain or increase use by R6 sensitive species.

Measures:

Elk populations meet herd objectives as specified in the Yakima and Colockum Elk Herd Plans within a 5-year period. Populations of deer do not decline below 20% of present levels within a 5-year period.

In landscapes where treatments are designed to enhance wildlife habitat, conduct monitoring detection surveys pre and post treatment for the targeted species. Examples: conduct WHWO monitoring detection surveys pre and post treatment (5, 10 yrs post) according to FS Region 6 protocol 2011; conduct NSO surveys pre and post treatment according to FWS NSO protocol survey 2010.

Physical Process

Goal:
Restore the natural flow of water off forested landscapes in terms of quality, timing, and volume.

Objectives:

1) There is a reduction in road or harvest related failure risk within treated landscapes
2) There is a reduction in road related sediment delivery to streams
3) There is a reduction in management caused stream temp increases at key catchment pourpoints
4) There is a reduction in barriers to fish habitat
5) There is an increase in riparian veg cover
6) Peak streamflows in terms of timing and volume are not altered by the transportation system or vegetation management activities.
7) There is a reduction in road or management caused constraints on channels
8) There is an improvement in amount of floodplain that is connected to stream networks.
9) There is an improvement in restoring natural LWD levels to the stream network.

Measures:
The flow of water off forested landscapes can be measured by metrics including: the number of road or harvest caused slope failures, long-term trends in stream temperature, shading of stream channels, percent increase in channel network due to road drainage interception, riparian road density and the number of large woody debris pieces per stream mile.
LWD pieces per stream mile. We also intend to ultimately include the measures from the use of GRAIP and/or other processes that result from further development of the Okanogan Wenatchee Forest Restoration Strategy with respect to integration of the aquatics resource.

Economics

Goal: Make available diverse forest products that promote sustainable local economy (define local?).

Objectives:

1) There are X mmbf annually offered/removed through restoration activities.
2) There are X BDT removed annually through restoration activities.
3) There are X total jobs created/maintained, and X total local jobs created/maintained.
4) There are X $ (Insert value) invested into the landscape through partnerships and in-kind services.

Goal: Improve economic feasibility of forest restoration treatments.

5) Existing funding is leveraged to increase restoration acres.
6) Decreased unit cost of implementing ecological restoration treatments over time.
7) Restoration projects illicit multiple competitive bids.

Measures:

Timber offered/removed is measured as million board feet (mmbf) by size class (small = X, medium = X) and species. Biomass removed is measured as both bone dry tons (BDT) and standing green tons. Jobs are measured as number of those created/maintained both locally (what area) and total and by job quality (define?). TREAT (Treatments for Restoration Economic Analysis Tool) will be used to measure the number of jobs created/maintained and the associated economic impact resulting from restoration treatments. Investments to the landscape contributed through partnerships and in-kind services will be measured in both direct and leveraged funds. Economic feasibility is captured by the number of bids on restoration projects and the number of successful offerings.

Cultural Values (Tribal)

Goal:
To protect or enhance cultural resources and traditional uses.

Objectives:

1) To protect or enhance historic and prehistoric heritage resources (physical evidence of past human activity expressed as artifacts and/or features on the modern landscape; e.g., berry fields).
2) To maintain access to usual and accustomed locations.
3) To maintain the privilege to hunt, gather and graze animals.

Measures:

Protection of historic and prehistoric heritage resources will be measured using…TBD
Enhancement of historic and prehistoric heritage resources will be measured using…TBD
Access to usual and accustomed locations will be measured using…TBD
Maintaining the privilege to hunt, gather and graze animals will be measured using…TBD

Social

Goal:
Protect social values and improve social perception of forest restoration. Work collaboratively with interested stakeholders to find common understanding of, and solutions to, the relevant social issues associated with the landscape.

Objectives:

1) Improve social perception and acceptance of vegetation management activities and prescribed fire.
2) Maintain or improve aesthetic values associated with the viewshed.
3) Improve social perception and acceptance of smoke.
4) There is an X% reduction in non-attainment days to wildfire smoke.
5) Maintain/protect existing recreational opportunities including recreational infrastructure.

Measures:

Social perception will be measured using surveys and questionnaires, interviews, comment forums, resident feedback registers, and response polls. Progress in collaboration will be measured annually in cooperation with the efforts of the National CFLRP Coalition. Maintenance/protection of existing recreational opportunities will be measured using the number of facilities impacted and miles of trail/road closed.

OBJECTIVE/QUESTION PRIORITIZATION

The team also developed criteria to evaluate each proposed objective/question. Evaluation of questions using a common set of criteria allows for a pair-wise comparison of questions, prioritizes questions and ensures that we are addressing the most important questions/objectives in a limited resource environment (there is not sufficient funding to ask all of the proposed questions), guarantees practicality, ensures that questions from all stakeholders are evaluated on an equal basis, and better articulates the questions to be asked/answered. This process, utilizes 'coarse' and 'fine' criteria filters. The coarse filters determines if the question will proceed through the evaluation; the fine filters function as a means to further refine and evaluate each objective/question.

Criteria for Evaluating Potential Monitoring Questions/Objectives (05/15/2013)

Coarse filters (need a yes to continue)

- Does the question fit Tapash priority categories?
- Is the question applicable across multiple PLTAs?
- Can answers to this question influence future management and or public policy?

Fine filters

- Does the question address CFLRP effectiveness?
- What is the necessary level of evidence? Spatial scale, rigor of data
- What is the funding plan?
- Is there a measure/methodology available to effectively and efficiently answer this question?
- Are there opportunities for multi-party/citizen science/public involvement?
- Does the question matter to multiple stakeholders?
- Is this question being addressed through some other process?
- Is there baseline data?

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