Northeast Washington Forest Vision 2020

Collaborative Forest Landscape Restoration Project

Monitoring Plan

September 10, 2013

Summit Pierre Forest Restoration Project

TABLE OF CONTENTS

INTRODUCTION

In 2012, the *Northeast Washington Forest Vision 2020* project (Vision 2020) was selected for funding under the Forest Service High Priority Restoration Program. In 2013, Vision 2020 was assimilated into the Collaborative Forest Landscape Restoration Program (CFLRP) to ensure continued funding. The Vision 2020 proposal makes a compelling case for restoring the landscape to more historic fire regimes by increasing the forest's resilience to natural disturbance, breaking up the homogeneity of the landscape mosaic, thinning overcrowded, suppressed stands, and enhancing the development of fire-resistant late/old forest structure. A key objective of these activities is fewer and smaller wildfires, and reductions in the cost of firefighting and risk of loss of lives and property.

Many of these vegetation-related activities will produce woody biomass and small-diameter logs to offset the costs of restoration. In addition, the restoration work will increase employment and enhance economic development in the communities of rural Northeast Washington.

Over the 8-year lifespan of the project, Vision 2020 will also improve aquatic and upland wildlife habitat through decommissioning unneeded roads, replacing fish-blocking culverts, and other non-vegetative restoration activities.

MULTI-PARTY MONITORING

To maximize the extent to which these objectives are met, the Forest Service directs managers to track the ecological outcomes of CFLRP restoration projects. Throughout the life of Vision 2020, multiparty monitoring will be employed to identify both intended and unintended impacts of project activities, inform changes in project design through an adaptive management process, and increase efficiencies in planning and implementation processes. The monitoring will also serve to inform Congress that the objectives of CFLRP are being met and demonstrate that the program warrants continued funding.

Collaboration is founded on the notion that to be successful, planning and implementation of projects must be based on up-front investment and agreement from stakeholders. Thus, the Vision 2020 monitoring plan was developed from the bottom up. A monitoring cadre was created, consisting of members of the public and Colville National Forest (CNF) staff. Members were selected based on experience and ties to the landscape. The science team represents a diverse mix of specialists and a line officer that will be engaged in both monitoring and implementation for the life of the Vision 2020 project.

The cadre categorized, assessed, prioritized, and merged 127 candidate monitoring questions provided by CNF specialists and stakeholders into the final set of 14 questions addressed in this document. Criteria used in the selection process included:

- relevance to CFLRP requirements and objectives
- objectives and desired outcomes listed in the Vision 2020 proposal
- applicability to national indicators developed by the Forest Service to facilitate reporting to Congress
- the potential to affect a line officer decision

- the extent to which the monitoring project would build upon past and existing efforts
- an estimate of the level of staffing and funding needed to implement the monitoring project.

Throughout the process, meetings and conferences were held with the CNF specialists, representatives of the Rocky Mountain Research Station, and affiliates of the University of Montana and the University of Washington.

ADAPTIVE MANAGEMENT

Monitoring provides essential feedback for the adaptive management process, whereby practitioners learn from successes and failures and take corrective action in future restoration project planning and implementation. Monitoring projects will be conducted through a series of 2-year cycles ending in 2014, 2016, and 2018. Through adaptive management, each cycle of restoration project planning will be guided by the previous cycle of monitoring. Each successive cycle increases the science team's ability to capture ecological variation correlated with implementation of the restoration projects and fine-tune future projects.

The adaptive management process will also be applied to the monitoring component itself. If the results of a monitoring project are not providing clear answers, project design will be improved. If results provide clear answers but new questions have arisen during implementation of restoration projects, in the next 2-year cycle, old questions may be dropped in favor of new questions deemed more important to answer.

TYPES OF MONITORING

Monitoring required for adaptive management depends on project objectives that we may cast as questions. For instance, adequacy of project implementation may take the form of “Did we do what we said we would do” while treatment effectiveness will ask “Did it work?” (Moote 2011). We may also desire to know unintended ecological consequences of our treatments. Procedures can be set up to address known negative and positive effects; however, unknown consequences may require surveillance type monitoring to detect trends.

The Vision 2020 monitoring plan focuses on three types of monitoring listed below. The goal – oriented questions that frame the monitoring are from Hutto and Belote (2013):

- Effectiveness: Did management actions achieve the social, economic or ecological goals and objectives outlined in the prescription?
- Ecological effects: Did management actions result in ecological tradeoffs or unintended ecological consequences?
- Surveillance: Are ecological properties changing some undesirable way through time, or do we perceive an association between a particular land-use activity and a negative indicator?

Effectiveness monitoring requires knowledge of the existing condition in order to compare to a desired outcome, known as a reference condition. A first step for monitoring effectiveness may be describing the existing condition to all parties' satisfaction. A second step establishes agreement on the reference condition. Due to a high level of uncertainty, the Vision 2020 will conduct assessments to establish reference conditions.

MONITORING PROJECT DESIGN

The monitoring is structured to answer questions according to the level of detail needed, termed quality of evidence. Effectiveness monitoring at the landscape level uses spatial data that can be easily updated to report progress. However, questions on the effectiveness of treatments on a project scale require empirical data gathered with on the ground measures.

For the plot-based sampling, the Vision 2020 monitoring will utilize Before-After Control-Impact (BACI) design, which offers a high capability of detecting change while controlling for environmental variation (Hutto and Belote 2013). The BACI concept examines the Before (pre-activity baseline) and After (post-activity) condition of the area, as well as comparing a Control (reference site) with the Impact site (activity site). Before and After sampling will determine how the restoration process changed the site through time from its historical condition. Control and Impact sampling will allow effects of restoration actions to be discerned from natural variability, stochastic events, and underlying trends in the larger area not correlated with project activity– for example, changing weather patterns or cyclical populations of focal wildlife species. A Control site which has identical conditions to the Impact site is not typically available; thus areas near the restoration but not part of the area directly affected by the restoration project may be used as Impact sites.

With the BACI design, results from monitoring of treatment impacts will be available within two years. Returning to these plots in following years will reveal trends of up to seven years by the end of the project term in 2019.

The BACI design will be coupled with a chronosequence analysis of past treatments that were similar to those proposed in Vision 2020. Chronosequence is a "space-for-time" substitution used to examine long-term trends in which systems of different ages are compared to determine the trajectory of a particular metric (such as understory/overstory development), instead of monitoring a single system over time.

LiDAR will be used to provide landscape baseline reference conditions. LiDAR is a remote sensing technology that provides a highly accurate, fine scale map of the forest canopy and ground. This technology is used in forestry to create a digital representation of forest structure, streams, roads, and other characteristics of a forest stand or landscape. Several LiDAR flights have already been conducted on the CNF, and flights of additional areas in the CFLRP project areas are planned.

The science team also intends to document changes with repeat photos that will provide a visual record of changes over time. Photos taken in 2010 at recorded points by the landscape architect give a reference which can be revisited once treatments are completed.

DISSEMINATION OF FINDINGS

Data will be disseminated in annual "briefs" and biennial summary reports. The findings will also be shared with research partners at university and Forest Service research facilities as well as published in papers and conference proceedings. Adaptive management workshops will bring together managers, specialists, and monitoring participants to engage in translating monitoring findings into viable recommendations for future project planning and implementation.

PARTNERSHIPS

One of the tenants of the CFLR program is to partner with outside agencies and groups to accomplish more work. The Vision 2020 leverages the monitoring funding with researchers from FS and universities, local agencies, experts and community groups to accomplish monitoring. The involvement of the Colville Tribe and Washington Department of Fish and Wildlife will increase the level of cooperation across adjacent tribal, state, and federal lands and add a level of transparency to the collaboration. In addition, this cooperation will enable wildlife monitoring that would otherwise be outside each individual agency's ability to conduct.

Wildlife monitoring brings the highest level of match funding; however, the Rocky Mountain Research Station will provide a 50% match to document the effects to water yield. At least 20 percent will be contributed by the University of Washington to monitor the effectiveness of forest restoration. In addition, Conservation Northwest is funding a pilot investigation into forest reference conditions for the East Deer Creek watershed.

Partnering with university and FS research affiliates helps ensure the use of best-available science in date collection and project design, which will in turn help ensure credible results from the monitoring program.

Area school students will also be involved wildlife monitoring, collecting data and even designing management plans for small patches of forest. This partnership will foster these kids' interest in working and playing in the woods.

MONITORING QUESTIONS

1. *How much did fuel project investment defer wildfire costs?*
2. *Did we move departure of stand structure, understory and landscape pattern toward a more sustainable condition?*
3. *Did we alter tree species composition to more resilient stands?*
4. *What type of variable density prescription is suitable for the range of CNF's mixed conifer forest?*
5. *How do you measure restoration success at multiple scales?*
6. *How does the project affect late old successional forest and winter range?*

7. *Do our treatments reduce risk for crown fire and for how long does the effect last?*
8. *Did we maintain or improve water quality, quantity, and watershed function?*
9. *What is the anticipated influence of roads and the road restoration on in-channel conditions and water quality and streamflow?*
10. *How did our historic activities (timber harvest, firewood cutting) affect and how are our existing activities affecting snag numbers and distribution?*
11. *Does the management of nest buffers and post-fledging areas and timing of activity restrictions adequately protect goshawks and keep them from abandoning an area?*
12. *Are our management activities regenerating aspen and other hardwoods at levels that will maintain or spread the clones?*
13. *Do management activities affect big game use of an area, and is the condition and amount of edible vegetation adequate to maintain desired big game populations?*
14. *Did our restoration treatments provide source habitats for focal terrestrial species?*

MONITORING PLAN INFORMATION

The monitoring plan describes annual monitoring action and represents a "living" document. Techniques and methods will be subject to change when more efficient or measurably superior methods are found. The science team will coordinate monitoring and determine updates to methodology. The team will meet quarterly to review results and communicate findings to forest staff, collaborative participants, and researchers. The team will also facilitate biennial workshops to discuss findings and integrate into project prescriptions as appropriate.

Monitoring work entails two steps: first to review, collate, and update existing datasets to establish a baseline reference conditions. Second, collect additional data where needed to assess effectiveness of treatment.

Data collection will be of three areas of interest:

- Vegetation treatment effectiveness
- Water quality
- Wildlife tracking

Forest Service Corporate datasets provide the first level of information. Information will be pulled from corporate datasets and assembled into a central location for the array of monitoring efforts. The datasets include spatial display of plant association group, existing vegetation condition, fire condition class, watersheds condition class, wildlife habitat distribution, management treatment activity and wildfire occurrence. Many of these datasets are used to report on the National Indicators that tracks progress across all the CFLR projects.

Existing condition and reference condition datasets would be refined using a combination of LiDAR generated products and stand plots. Initial investment to characterize the potential stand structure for forests particular to the Vision2020 area would clarify desired conditions. These efforts would enable us to evaluate treatment effectiveness at the stand and watershed level scale.

Each vegetation data plot, using a BACI design, will address multiple questions on treatment effectiveness. Concentration of sampling reduces personnel and time spent. Sampling will be for the eight year project term. After the first two years sampling will be expanded into past harvested areas to investigate fuel treatment longevity. A two year study on bat prey base within the BACI treatment units will coincide spatially with the vegetation plots but rely on different measures.

The BACI design accounts for environmental variation for the primary types of restoration treatment: (1) burning and (2) commercial timber harvest and burning. An untreated control is used to clarify measurement response to account for year to year changes in growing conditions. Figure 1 below illustrates three different treatment types that will be sampled for the Walker project. Data from the BACI design plot sampling would contribute towards answering monitoring questions (1, 2, 3, 4, 7, 10 and 12).

Water quality monitoring builds on ongoing CNF efforts to track compliance with TMDL requirements. To monitor the effects of roads and upland management, a pilot study would identify sediment hotspots and document changes in sediment delivery. The data collection term is two years. Depending on an initial assessment of watershed response, additional data collection may be done at stream sites to document changes in stream morphology throughout the remainder of the project term. Annual results from the Forest Damage Control team will be used to track effectiveness of road closures.

Data collection on the movement of goshawk and deer will evaluate the adequacy of habitat and response to restoration treatments. The data collection requires GPS tracking of individual and populations that will be correlated to habitat variables. The tracking would coincide with monitoring in NEPA projects, although outside of the BACI plot designs. The goshawk sampling is planned for a two year term while the deer tracking would extent to 2019.

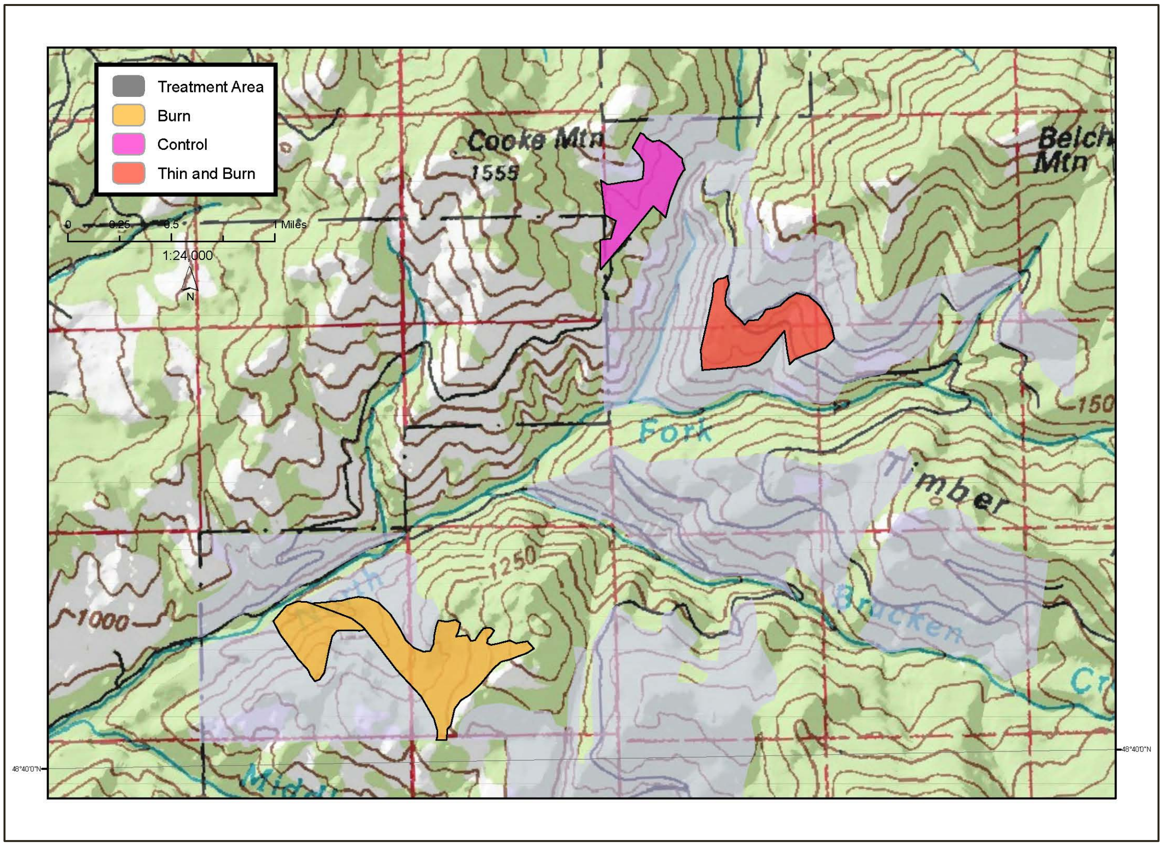

Figure 1. Proposed monitoring within treatment units for Burn (yellow), Thin and Burn (red) and Control within the Walker Fuels Reduction Project.

The next section lists the details on the background, approach, method and analysis for each monitoring question. Table 1 below provides a brief summary as to the what, how and by whom the monitoring will be performed in addition to the location and time period of the monitoring.

Table 1. Questions, objective, indicator, method, timeline, responsibility and location of monitoring.

Monitoring Type	Resource	Objective	Indicator	Method	Timing, Frequency	Responsibility	Location
(1) How much could fuel project investment defer possible wildfire costs?							
Effectiveness, National Indicator	Forest	Estimate fire program management cost savings and risk reductions for the CFLR project area.	Expected suppression costs with and without treatments	Risk and Cost Analysis Tools Package (R-CAT) http://www.fs.fed.us/restoration/documents/cflrp/R-CAT/RCAT_PeerLearning.pdf	FY14	CNF, Nicole Valliant (WWSET), LaWen Hollingsworth (RMRS, Missoula Fire Lab), Keith Stockmann, Krista Gebert (Region 1)	CFLR landscape
(2) Did we move departure of stand structure, understory and landscape pattern toward a more sustainable condition?							
Effectiveness	Forest	Quantify the scale and intensity of current restoration treatments and their effectiveness at moving the forest landscape towards a more sustainable condition	?	In development, can use FRCC for quick estimates	2015, 2019	CNF, Derek Churchill (UW), Rachel Loehman (RMRS, Missoula Fire Lab)	CFLR landscape
Reference	Forest	Refine/ update desired conditions	Amount of departure in acres of existing vegetation cover and structural class compared to historical	Follows Paul Hessburg's protocol using photogrammetry and plots to recreate past forest structure for assessing current departure	2013	Derek Churchill (UW)	East Deer Creek watershed

Monitoring Type	Resource	Objective	Indicator	Method	Timing, Frequency	Responsibility	Location
			using conditions				
Effectiveness	Forest	Monitor effectiveness of stand treatments using empirical data; integrates ecology, silviculture and fire behavior experts to design monitoring plots	Tree growth, species diversity and fire behavior	Monitor species, vegetation structure, and daily temperature and wind speed within control, burn, and thinned units at two projects starting in FY 14. Add two additional projects in FY16 and in FY18. Sampling contingent on funding available. Report findings and update prescriptions and monitoring design at winter workshops (FY14, FY15, FY17, FY19)	Annual: Before and after projects	Rachel Loehman, Jason Clark (RMRS, Missoula Fire Lab), Derek Churchill (UW), Andrew Larson (UM)	Selected NEPA projects within CFLR landscape (Sherman and Walker projects initially)
(3) Did we alter tree species composition to more resilient stands?							
Effectiveness	Forest	Compare post treatment tree species mix with desired conditions. Assess changes to water availability and risk for crown fire	Species composition, productivity, resiliency and risk for crown fire	Monitor species, vegetation structure, and daily temperature and wind speed within control, burn, and thinned units at two projects starting in FY 14. Add two additional projects in FY16 and in FY18. Sampling contingent on funding available. Report findings and update prescriptions and monitoring design at winter workshops (FY14, FY15, FY17, FY19)	Annual: Before and after projects	Rachel Loehman, Jason Clark (RMRS, Missoula Fire Lab), Derek Churchill (UW), Andrew Larson (UM)	Selected NEPA projects within CFLR landscape (Sherman and Walker projects initially)

Monitoring Type	Resource	Objective	Indicator	Method	Timing, Frequency	Responsibility	Location
(4) What type of variable density prescription is suitable for the range of CNF's mixed conifer forest?							
Reference	Forest	Refine desired conditions in dry and mesic mixed-conifer. Assess feasibility using stem mapping.	Basal area, tree density, diameter distribution, height distribution, canopy height, overstory cover	Individual, clump and opening method (Churchill et al 2013).	2013	Derek Churchill (UW), Andrew Larson (UM)	Dry and mesic mixed conifer stands in CFLR project
(5) How do you measure restoration success at multiple scales?							
Reference	Forest	Assess LiDAR data needs to enable integration of ground-based monitoring and landscape-scale monitoring using LiDAR.		Work with CNF to develop protocol using LiDAR products; assess data needs	Fall FY14	Derek Churchill (UW), Andrew Larson (UM)	CFLR landscape
(6) How does the project affect late old successional forest and winter range?							
Effectiveness	Forest	Quantify the scale and intensity of current restoration treatments and their effectiveness at moving the forest landscape towards a more sustainable condition	?	In development, can use FRCC for quick estimates	2015, 2019	CNF, Derek Churchill (UW), Rachel Loehman (RMRS, Missoula Fire Lab)	CFLR landscape

Monitoring Type	Resource	Objective	Indicator	Method	Timing, Frequency	Responsibility	Location
(7) Do our treatments reduce risk for crown fire and for how long does the effect last?							
Effectiveness	Fuels	Monitor effectiveness of treatments to reduce risk for crown fire using empirical data to parameterize models	Risk for crown fire, fuel moisture, wind speed	Monitor stand metrics to model fire behavior in control, burn, and thinned units at two projects starting in FY 14. Add two additional projects in FY16 and in FY18. Sampling contingent on funding available. Report findings and update prescriptions and monitoring design at winter workshops (FY14, FY15, FY17, FY19)	Annual: Before and after projects	Rachel Loehman, Jason Clark (RMRS, Missoula Fire Lab)	Selected NEPA projects within CFLR landscape
Effectiveness	Fuels	Assess length of time that fuel treatments reduce risk for crown fire; improve parameters for R-CAT analysis	Longevity of treatments	Use a chronosequence sampling design that ascertains risk for crown fire in past treatment areas of different ages. Use plot data to derive crown fire risk following FFI protocol (Lutes et al 2009) and outlined in Keane et al (2012).	FY13, 14	CNF, Rachel Loehman, Jason Clark (RMRS, Missoula Fire Lab)	Past harvest treatments within CFLR landscape
Effectiveness	Fuels	Determine sensitivity of current fuel models	Fire behavior outputs	Use plot-based monitoring, meteorological monitoring, and fire behavior modeling (e.g., FlamMap, FOFEM, FuelCalc). Work with CNF staff to parameterize models for Colville NF's specific conditions and resolve conflicts from other methods.	FY14	Rachel Loehman, Jason Clark (RMRS, Missoula Fire Lab)	Landscape

Monitoring Type	Resource	Objective	Indicator	Method	Timing, Frequency	Responsibility	Location
(8) Did we maintain or improve water quality, quantity, and watershed function?							
Reference	Watershed	Identify extent streams respond to upland management; pool findings from previous monitoring	Stream flow response	Landscape watershed assessment	FY13, 14	AB Ecosystems and CNF	CFLR project area
Effectiveness	Watershed	Identify sediment point sources within East Deer Creek Watershed. Evaluate efficacy of method	Sediment	GRAIP http://www.fs.fed.us/GRAIP/	FY14, 15	RMRS, Boise	East Deer Watershed
Effectiveness	Watershed	Identify changes to water quantity associated upland management in East Deer Creek Watershed. Evaluate the efficacy of the model.	Stream flow	WEPP Yield	FY13, 14	Bill Elliott (RMRS, Moscow)	East Deer Watershed
Surveillance	Watershed	Correlate changes in stream morphology with upland management	Stream morphology measures	Stream Morphology at 418 sites. 28 sites up for 5 year re-measure in FY13.	FY14-19	CNF	CFLR project area
Surveillance	Watershed	Comply with TMDL requirements to monitor water quality	Fecal coliform and stream temperature	Fecal coliform at 17 sites and stream temperature at 10 sites. Expected to increase over CFLRP term.	Annual	CNF	CFLR landscape

Monitoring Type	Resource	Objective	Indicator	Method	Timing, Frequency	Responsibility	Location
(9) What is the anticipated influence of roads and the road restoration on in-channel conditions and water quality and streamflow?							
Surveillance, Effectiveness	Watershed	Evaluate the effectiveness of Forest Damage Response Team remediating effects and the performance of those treatments	Level of use at treated sites	Visual inspection by Forest Damage Response Team; incident reports; stream morphology reports	Ongoing	CNF	CFLR project area
(10) How did our historic activities (timber harvest, firewood cutting) affect and how are our existing activities affecting snag numbers and distribution?							
Effectiveness	Wildlife	Determine background snag levels and the effectiveness of current treatments to retain snags	Snag density	Modified fuel sampling protocol from Keane et al 2012 and SnagPRO method from Bate and Wisdom 2008	FY13,14	Rachel Loehman, Jason Clark (RMRS, Missoula Fire Lab); Student Conservation Service	CFLR project area
(11) Does the management of nest buffers and post-fledging areas and timing of activity restrictions adequately protect goshawks and keep them from abandoning an area?							
Ecological effects	Wildlife	Refine understanding of goshawk habitat to clarify buffer distance and when to restrict activities	Goshawk use	Track five goshawk pairs for at least one year prior to, during, and two years after harvest activities and correlate movement with core habitat attributes	FY14-16	CNF, The Student Conservation Assoc., Eastern Washington University,	CFLR project area

Monitoring Type	Resource	Objective	Indicator	Method	Timing, Frequency	Responsibility	Location
						Conservation Northwest, Northwest Wildlife Rehab. Assoc. and Spokane Audubon.	
(12) Are our management activities regenerating aspen and other hardwoods at levels that will maintain or spread the clones?							
Ecological effects	Wildlife	Decipher the differential effects of wildlife and livestock on aspen regeneration after vegetation treatments	Aspen and other hardwood regeneration number and growth	Install paired aspen/hardwood enclosures for control + deer/elk, control + cattle.	FY14-17	CNF	BACI projects
(13) Do management activities affect big game use of an area, and is the condition and amount of edible vegetation adequate to maintain desired big game populations?							
Ecological effects	Wildlife	Examine deer use prior to and after treatment	Deer presence, use	Capture/collar/monitor deer.	FY14-21	CNF, WDFW, Colville Tribe	BACI projects
(14) Did our restoration treatments provide source habitats for focal terrestrial species?							
Effectiveness	Wildlife	Correlate prey findings with bat use	Moth presence and functional prey base, bat presence	Track changes of moth groups and relate to forage potential for bats. Measure moths using light traps during 5 summer nights at 1 year prior to, and years 1, 3 and 5 after treatment. Correlate to bat presence.	FY14, 16, 18	CNF, Student Conservation Association, Bat Conservation International, Jon Shepard	BACI projects

Question #1: How much did fuel project investment defer wildfire costs?

Wildfire arguably is the predominate force determining forest structure. It is well recognized that the current stands do not represent historic stand structure and composition (Agee and Skinner 2005, Hessburg 2005). Restoration prescriptions try to return the stands to what is expected across the Vision2020 landscape while reducing fire hazard near valuable resource or property. The question the team posed was, to what degree does restoration treatments reduce fire on project and landscape scale? The question infers an expectation that treatment is less expensive than wildfire suppression, if successful. The team, however, found little information as to how long the fuel treatments are effective in order to judge the relative economic merits of treatment.

ACTION

Evaluate fire hazard for the existing landscape condition and conditions after treatment at years 2015 and 2019. Estimate cost of for wildfire and compare this to cost of restoration treatments which include fuels manipulations.

Table 2. Objective, indicators, scale and monitoring type for Question #1.

Objective	Indicators	Scale	Monitoring Type
(A) To quantify the effectiveness of restoration treatments on reducing fire growth and behavior at the landscape scale.	Modeled fire growth and behavior.	Landscape	Effectiveness. National Indicator
(B) Estimate fire program management cost savings and risk reductions for the CFLR project area.	Expected suppression costs with and without treatments	Landscape	Effectiveness. National Indicator

METHODOLOGY:

(A) The fire hazard model Fsim will be used to ascertain fire hazard across the Vision 2020 project area. Fsim was developed and used in the Fire Program Analysis of fire hazard across the United States.

(B) The Risk and Cost Analysis Tools Package (R-CAT) will be used to address potential cost and risk reduction at the landscape scale. R-CAT is a modeling tool package methodology developed for the CFLRP projects by the Forest Service to analyze for potential reduction of long-term wildfire management cost (USDA 2010). R-CAT uses a macro-enabled Microsoft Excel workbook (.xlsm) as the interface between user inputs and results from existing fire models to estimate changes in anticipated costs. Results from fire behavior modeling (FSim) are input into the model along with estimates of fire suppression and fuel treatment costs, to determine how treatments might change fire management costs. Initial work on treatment longevity and the adequacy of current fuels mapping would be used to adjust R-CAT parameters (see Question 7).

WHO COLLECTS THE DATA?

CNF and the Missoula Fire Laboratory

WHEN, HOW AND WHO ANALYZES THE DATA AND REPORTS FINDINGS?

During FY13, the CNF worked to establish the current conditions spatial data layers to be transferred to Western Wildland Environmental Threat Assessment Center (WWETAC) for processing. Personnel at WWETAC will run the fire model Fsim. CNF staff worked with the Missoula Fire Laboratory to refine fuels layers prior to submitting fuels layer inputs to WWETAC. The layers were derived initially from LANDFIRE products (2013). A consortium of Region 1 economists, CNF fuels planners, WWETAC and Missoula Fire Laboratory personnel will synthesize the data for final analysis. Initially, the expectation was to conduct the analysis at years 1, 3, 5 and 10. Based on preliminary output from the Deschutes-Ochoco NF, the expected simulation would be at years 5 and 10.

WHERE WILL THE DATA BE STORED?

CNF

Question #2: Did we move departure of stand structure, understory and landscape pattern toward a more sustainable condition?

BACKGROUND:

Forest restoration is a cornerstone of the Vision2020 project. A central goal is to increase the resilience and adaptive capacity of forest ecosystems. This goal is achieved by manipulating across scales—from trees to landscapes—ecosystem composition, structure, and pattern with active management in order to achieve desired conditions and associated functions. The science team sought to measure the degree the Vision 2020 project moved the departure of stand structure, understory vegetation and landscape pattern toward what was historically found. It is recognized, however, that wet conditions prior to 1850 might have favored a forest composition that cannot be achieved with the current climate regime. Thus, reference conditions are a place to start, but current climate forecasts could force strong upward elevation migration of tree species (Dobrowski et al. 2013). Reference conditions should encompass both the historical and future range of variability (Hessburg et al. 2013). Further, the risk of re-introducing fire spreading onto adjacent lands and the limited burn windows restricts the application of fire at levels that historically shaped these forest stands.

APPROACH:

The team engaged research ecologists to help discern if current desired conditions were realistic and whether the current restoration treatments were effective. Even so, final agreement on a particular concept for forest structure is difficult since ecological relationships vary depending on the location and covertype (Keane et al. 2009). Rather than settle on a single dataset for baseline, the Vision2020 is testing different approaches to address the issues of precision and scale.

Researchers from the University of Washington, University of Montana, and the FS Missoula Fire Laboratory (MFL) were brought together to work collaboratively to refine existing ecological concepts for the northeast Washington area. The MFL scientists will refine the existing data models in LANDFIRE model that will be used for departure analysis. The University of Washington (UW) scientists and affiliates will create a finer scale baseline reference condition that relies on photogrammetry but comes with higher cost. The LANDFIRE dataset covers the extent of the Vision2020 area while the more intensive reference condition work will be complete on only the East Deer watershed. The collaborative needs to understand the strength and weaknesses in both approaches as well as the applicability for landscape scale planning. The UW scientists will coordinate with CNF managers and the MFL scientists to evaluate the tradeoffs and test applicability. Reference concepts will be tested at the project level for six projects.

Table 3. Objective, indicators, scale and monitoring type for Question #2.

Objective	Indicators	Scale	Monitoring Type
A) Quantify the scale and intensity of current restoration treatments and their effectiveness at moving the forest landscape towards a more sustainable condition	?	Landscape	Effectiveness, National Indicator
B) Test Paul Hessburg's protocol to refine/ update desired conditions and quantify the scale and intensity of restoration treatments effectiveness at moving the forest landscape towards a sustainable condition	Departure in acres of existing vegetation cover and structural class compared to historical conditions	Project (Orient Watershed)	Baseline
~~C) Test the applicability of existing ecological models~~	~~Stand response (Derek, Rachel help)~~	~~Project~~	~~Effectiveness~~

METHODOLOGY:

A) Existing LANDFIRE data layers will be critiqued and updated to reflect existing conditions. Treatment layers will be updated to compare the progress of treatments at the beginning of the project, mid and end of the CFLR project term. Percent departure would be summarized for the dominant vegetation cover classes.

B) Photo interpretation will establish the level of departed conditions by comparing existing stand structure and pattern to the historical and future range of variation. Protocol follows Hessburg et al. (2013).

~~C) The strengths and weaknesses of the approaches would be presented in the FY14 workshop. Findings from the BACI experiments (see Questions #3 and #4) would be used to validate the current models and refine the departure analysis at the FY15 workshop.~~

WHO COLLECTS THE DATA?

LANDFIRE Data is currently available. Derek Churchill affiliated with Jerry Franklin's laboratory at University of Washington is working on the photo interpretation analysis of the Orient Watershed with the Three Rivers Ranger District.

WHEN, HOW AND WHO ANALYZES THE DATA AND REPORTS FINDINGS?

A) CNF staff will perform the departure analysis at years 5 and 10 of the CFLR project.

B) Derek Churchill will complete and departure analysis by 2014. Data and interpretation is expected throughout FY14, and a report produced for the biennial workshop in 2014 (David – I have no information on this…can you correct)

~~C) Derek Churchill and Andrew Larson will analyze the data and report on findings at the biennial workshops. The workshops will be held Jan 2014 to update existing reference data and then in 2015 following the first year post harvest monitoring. Subsequent workshops would occur in 2017 and 2019 to report findings from each cycle of BACI experiments. (Needs clarification with Derek and Rachel meeting)~~

WHERE WILL THE DATA BE STORED?

Data will be stored initially with University of Washington with copies distributed to the CNF and Region 6 Ecology Program.

Question #3: Did we alter tree species composition to more resilient stands?

BACKGROUND:

This question is a corollary of Question #2 and looks into the adaptive capacity of the forest composition and structure to critique ecological models used in the departure analysis.

APPROACH:

Additional information on site potential would be used to detail the effects our treatments. The information may help clarify stand response observed in the BACI experiments. Current science on climatic patterns and the influence to the water deficit during the growing season is providing a better grasp on the "climatic envelope" of desired forest species (Stephenson 1990, Lutz et al. 2010). The CNF has a unique information base in having a robust soil survey that provides detailed data to compute plant available water. Correlations with stand meteorological data and larger scale climatic mapping should provide insight as to the current footprint of forest species. Churchill et al. (2013) demonstrated the utility of correlating stand distribution with a climate analogue that can be used to refine prescriptions for greater future resilience.

Table 4. Objective, indicators, scale and monitoring type for Question #3.

Objective	Indicators	Scale	Type
Compare post treatment tree species mix with desired conditions. Assess changes to water availability and risk for crown fire	Species composition, productivity, resiliency and risk for crown fire crown fire	Project	Effectiveness

METHODOLOGY:

Will be re-written by Derek, discussed with Rachel and Derek meeting. Stand growth response will be correlated for six planned NEPA projects using the BACI plot sampling. Daily climate data would be gathered using cheap but accurate temperature sensors. The data would be used to assess available water before and after treatment to ascertain productivity and resiliency. (note: will have to explain how we extrapolate moisture)

The use of the BACI protocol enables stronger statistical inference to detect if management is having positive effects. For each selected project, sampling would be done in planned treated (thin + burn), burn only, and a control. Sampling would commence after treatment and then in years following as funding allows.

The stand metrics follow plot protocol in FFI Ecological Monitoring Utilities (Lutes et al 2009, Available[ONLINE] at http://www.frames.gov/partner-sites/ffi/ffi-home/). The climate sensor array follows protocol by Jim Reardon in support of monitoring management effectiveness (Reardon, *personal communication*).

WHO COLLECTS THE DATA?

CNF personnel, Derek Churchill of University of Washington, and Rachel Loehman and Jason Clark of RMRS, Missoula Fire Laboratory.

WHEN, HOW AND WHO ANALYZES THE DATA AND REPORTS FINDINGS?

Derek Churchill and Andrew Larson will correlate vegetation and temperature plot data with attributes for soil, elevation, and insolation to evaluate forest resilience. Findings would be evaluated and reported for the biennial workshops at FY14, FY15, FY17 and FY19.

Findings will be shared with the FS Coeur d'Alene Nursery to compare to existing population distributions of desired forest species. In this way, the project will clarify the reference conditions used to define the level of restoration needed and manage for the adaptive capacity of these particular forests. The monitoring would be part of the BACI design sites with three cycles of feedback throughout the CFLR project term. Field plot measures would be used to assess changes in forest species and structural classes after treatments and to evaluate changes over time.

WHERE WILL THE DATA BE STORED?

CNF and the Region 6 Ecology Program

Question #4: What type of variable density prescription is suitable for the range of CNF's mixed conifer forest?

BACKGROUND:

Question #4 provides data for answering Question #2 by critiquing the mixed conifer ecological models used in the departure analysis.

The mixed conifer forest loosely correlates with mixed severity fire regime forests and thus has a high variability of conditions. This cover type has the highest uncertainty related to desired future conditions (Perry et al. 2011). The aggregation of trees, species composition and forest structure remain difficult to prescribe since this forest type historically was influenced by a mix of lethal and frequent fire that created a heterogeneous environment (Hessburg et al. 2007). Recently, new reference models that capture the patterns of individual trees, clumps and opening – termed ICO - are available for the dry forests on the Blue Mountains in eastern Oregon. However, none exist for the moist forests within our CFLR project area. The dry to moist range of mixed conifer forest is the prevalent forest type within the Vision2020 area.

APPROACH:

The baseline reference condition work will focus on the dry spectrum of the mixed conifer since the cover type has high priority. Derek Churchill of University of Washington and Andrew Larson of University of Montana will work with CNF managers to clarify stand structure and aggregation at the stand scale. The research ecologists will first investigate reference conditions by scouting legacy forest structure within the CFLR project and examine patterns of forest regeneration. An initial workshop during winter FY14 will report on the availability of reference data. Biennial workshops thereafter will summarize current findings and craft alternative proposals for the next project cycle. Continued monitoring would test the effectiveness of treatments over time.

Table 5. Objective, indicators, scale and monitoring type for Question #4.

Objective	Indicators	Scale	Type
Refine desired conditions in dry and mesic mixed-conifer. Assess feasibility using stem mapping.	Basal area, tree density, diameter distribution, height distribution, canopy height, overstory cover	Landscape	Effectiveness

METHODOLOGY:

A coarse field reconnaissance would use plot sampling outlined in (Churchill et al 2013) to establish the feasibility of the Individual, Clump and Opening method.

WHO COLLECTS THE DATA?

Derek Churchill, University of Washington students, and Andrew Larson of University of Montana

WHEN, HOW AND WHO ANALYZES THE DATA AND REPORTS FINDINGS?

The results would be reported at the FY 14 winter workshop. Depending on results, the method may be applied to the BACI project sampling in future years to inform project design. Feedback from these projects could refine the mixed conifer ecological models used in the departure analysis.

WHERE WILL THE DATA BE STORED?

CNF and University of Washington

Question #5: How do you measure restoration success at multiple scales?

BACKGROUND:

Restoration at the project level remains difficult to scale up to the landscape level.

APPROACH:

The CNF desires to work with ecologist Derek Churchill to identify new metrics to assess project effects at the landscape level. A first step is to decide on metrics that would be useful to scale from project to the landscape. Derek will work with the CNF silviculture and ecology staff to identify protocol using LiDAR concurrent with ongoing work on other CFLR projects.

Table 6. Objective, indicators, scale and monitoring type for Question #5.

Objective	Indicators	Scale	Type
Assess LiDAR data needs to enable integration of ground-based monitoring and landscape-scale monitoring.	**?**	**Project, Landscape**	**Effectiveness**

METHODOLOGY:

Professional input.

WHO COLLECTS THE DATA?

CNF

WHEN, HOW AND WHO ANALYZES THE DATA AND REPORTS FINDINGS?

Initial findings of the LiDAR will be used to assess 2014 image purchases. Derek Churchill will work with the CNF staff to identify protocol for measuring restoration success. The Region 6 technical support will help the CNF compute measures.

WHERE WILL THE DATA BE STORED?

CNF and Region 6

Question #6: How does the project affect late old successional forest and winter range?

BACKGROUND

Old growth and winter range were raised as monitoring questions by the collaborative.

APPROACH

This question was not pursued directly for monitoring. Rather, investigation in reference conditions in the dry and mixed conifer cover types would provide information on the successional stages. Better data on varied structural types within these forests will increase our understanding of the potential for late old successional forests. Similarly, the baseline reference conditions will give us a better idea on the extent of openings that could provide winter range habitat.

Question #7: Do our treatments reduce risk for crown fire and for how long does the effect last?

BACKGROUND

The science team placed much emphasis on monitoring fuel treatment effectiveness. To predict effects, fire hazard reduction prescriptions rely on developed models that integrate conditions of fuels, stands and topographic variables. The increasing cost of fuel treatments along with low returns from timber receipts underscores the need for information on return on investment. Further, an increased emphasis on restoration prescriptions that include skips and gaps in the dry to mesic mixed conifer stands do not have a direct correlate in the models. For any given stand, it is also difficult to assess the impact of leaving a heterogeneous mix of slash residual for productivity objectives or retaining shrub and tree regeneration thickets for wildlife habitat.

To understand effects on a landscape several approaches effectively integrate factors that drive wildfire including winds, terrain and stand conditions. However, there is some uncertainty as to how sensitive these models are to fuel treatments and other management activities performed on a finer scale (sub-watershed). It's acknowledged that typical management projects may not be large enough to affect fire behavior.

APPROACH

Given the array of available models and some level of discrepancy between the standard models used, the science team turned to the Rocky Mountain Research Station, Missoula Fire Laboratory, to provide information on the longevity of fuel treatments for the project's forest types and to investigate the effectiveness of current fuel treatments at reducing crown fire risk.

To answer the question of treatment longevity the Fire Laboratory scientists are investigating fuel loadings and stand characteristics in areas treated up to 30 years prior. The work uses a chronosequence approach using information from treated lands at several time periods. The work will gather fuels and vegetation data in representative treatments that can be checked against predictions in the FFE extension of the Forest Vegetation Simulator. A moisture deficit variable will be derived from soils and climatic data as a predictor for fuel treatment longevity for the major forest cover types. Note, for the CNF, the current models borrow algorithms from eastside Cascades and interior Rocky Mountain provinces. Thus, the information will increase the representation of this particular area.

For the planned restoration treatments, the MFL researchers will measure effectiveness using a combination of plot-based monitoring, meteorological monitoring, and fire behavior modeling (e.g., FlamMap, FOFEM, FuelCalc) to compare treatment objectives with on-the-ground outcomes. The monitoring coincides with the ecological data sampling within the BACI projects. Data from effectiveness monitoring and modeling will feed back into adaptive management to assist management on prioritizing treatments.

With the longevity data and plot data in hand, the MFL researchers and CNF fuels planners will address discrepancies between fire behavior predictions based on landscape scale inputs (e.g., LANDFIRE) and predictions made using local scale (e.g., site) data. In other words, the team will identify the topographic and ecological settings under which local conditions are misrepresented by national datasets, allowing us to improve the fire hazard predictions and treatment placement. The new information on treatment longevity and effectiveness should ultimately improve the prioritization of fuels treatments and possibly save money.

Table 7. Objective, indicators, scale and monitoring type for Question #7.

Objective	Indicators	Scale	Type
A) Monitor effectiveness of treatments to reduce risk for crown fire using empirical data to parameterize models	Risk for crown fire, fuel moisture, wind speed	Project	Effectiveness

B) Assess length of time that fuel treatments reduce risk for crown fire; improve parameters for R-CAT analysis	Longevity of treatments	Landscape	Effectiveness
C) Determine sensitivity of current fuel models	Fire behavior outputs	Landscape	Effectiveness

METHODOLOGY:

A) Vegetation and fuels data to assess effectiveness and longevity of current treatments (CFLR treatments) will be collected at BACI plots using a modified FIREMON protocol available in FFI (Lutes et al. 2009). The general design is to have measurements in commercially thinned units and either prescribed burn or fuel reduction units to monitor treatment effectiveness. However, each forest restoration project has unique prescriptions. For FY 13, measurements in six thinning units, three fuels reduction and one natural burn area in addition to no-treat controls will be sampled before treatment and multiple years after treatment. Measurements include basal area, tree density, diameter distribution, crown base height, crown bulk density, understory species composition, tree regeneration, and fuel loadings. These measurements are the inputs for vegetation and fire behavior models. Meteorological monitoring stations in each treatment type will be established to track local and treatment influences on weather. Meteorological measurements include hourly temperature, wind, relative humidity, and soil temperature.

B) Treatment longevity measures the length of time that treatments remain effective (meet objectives), and will be measured through a combination of plot-based monitoring in new and historical treatments, and modeling (FFE-FVS).

C) Discrepancies between fire behavior predictions based on landscape scale inputs (e.g., LANDFIRE) and predictions made using local scale (e.g., site) data gathered in the chronosequence and BACI experimental plots will be assessed. Topographic and ecological settings under which local conditions are misrepresented by national datasets will be identified that allow a better interpretation of fire hazard and treatment placement.

WHO COLLECTS THE DATA?

CNF personnel and Jason Clark from RMRS, Missoula Fire Lab (MFL)

WHEN, HOW AND WHO ANALYZES THE DATA AND REPORTS FINDINGS?

A) Using plot-based measurements, Rachel Loehman and Jason Clark (MFL) will report on structural changes in each unit (basal area, diameter distribution, crown base height, crown bulk density, species composition, and fuel loadings). This data will also provide information necessary to evaluate treatment effects on other high-priority objectives such as potential fire behavior, wildlife habitat, productivity, resilience, etc. Using the weather data, they will report on the effects of the treatments on temperature, wind, relative humidity, productivity, seasonal water deficit and actual evapotransporation – a normalized measure for evapotranspiration. Combining the forest structure, fuels, and weather data as inputs to fire behavior models will allow us to determine treatment effects on potential fire behavior.

B) Rachel Loehman and Jason Clark (MFL) will analyze and report on trends in treatment longevity. Longevity data will be used to determine the development of treated stands over time. Based on effectiveness criteria, they will determine a range of longevity estimates using treatment and forest type. Finally, FFE-FVS will be used to predict treatment longevity and compared to our field measurements of longevity.

C) Rachel Loehman and Jason Clark (MFL) will compare fire behavior model outputs based on landscape level (LANDFIRE) inputs with model outputs using the site level inputs. They will then identify the topographic and ecological settings under which local conditions are misrepresented by national datasets. The researchers will develop a guide for selecting the appropriate models and input data for predicting fire behavior in the project area. Additionally, they will use the plot-based measurements in combination with the meteorology data to determine how treatments affect site weather conditions and potential fire behavior. These results will inform how often model inputs must be updated to reflect fire hazard and fire behavior

WHERE WILL THE DATA BE STORED?

CNF, Region 6 Ecology Program, FS Corporate Databases

Question #8: Did we maintain or improve water quality, quantity, and watershed function?

BACKGROUND

Typically, in the FS, watershed evaluation of management activities infers an empirical relationship to bottomland streams from changes in upslope ground cover. The formulae equate watershed area impacted by timber harvest or other management activities to an equivalent clearcut area in terms of groundcover reduction and then translates the area extent to sediment production. These methods lack a spatial element that may assign lesser or greater impact to an activity or road's location in the valley (i.e. whether in the bottom or atop a ridge). Outside of permanent roads, an activity area is largely considered to be mitigated by vegetation re-growth over 3 to 5 years, with minor improvements extending out 20 to 30 years in most methods.

By contrast, research of sediment inputs to streams has shown that most volume occurs during large low-frequency events at discrete locations near the channel (Miller et al. 2001, Wondzell and King 2003). Sediment rates from mountainous regions has varied widely over recent geologic time (Pleistocene to present), with climate as the likely driver (Kirchner et al. 2001, Meyer et al. 2001). The present, Holocene time, has actually relatively low sediment rates. Most sediment volume during the historic era is delivered to streams during large storms that coincide with catastrophic changes in vegetation cover, predominantly from high severity wildfire (Miller et al. 2003, Wondzell and King 2003). The frequency of such events in any given watershed may be on the order of centuries. Although the active channel of an alluvial stream may reflect a high frequency 1-2 year flow event, the greater mass by far of valley fill is emplaced during very rare events, then worked on a roughly biennial basis into the form most associated with desired conditions. If a channel is severely degraded by livestock trampling, or poor road design to the point that bank erosion has transported from a stream reach much of the finer material, the recovery period could be as long, or more, than the frequency of large sediment pulses, and, at any rate far longer than the assumed mitigation of hill slope treatment area (see Wondzell 2001). Chronic sheet wash of fine sediment most deleterious to fish is largely induced by near channel, well maintained roads (Reid and Dunne 1984, Bilby et al. 1988, Sheridan et al. 2005). These features are usually outside the scope of a project for mitigation purposes (usually they are the principle timber haul route) and not adequately considered in watershed level sediment models typically used to evaluate cumulative effects.

APPROACH

The proposed watershed monitoring for the Vision2020 project would build on current efforts while incorporating new techniques to isolate sediment hotspots and assess management effects to water yield. The desire is to continue to comply with Clean Water Act requirements and ensure the CNF meets forest plan standards for water quality. In addition, the CFLRP Act specifies the need to improve water quality by managing the road and trail system. Impacts of forest management on water quality and quantity are roads (building, maintenance and use), forest vegetation treatment, livestock grazing, and recreation.

Water quality monitoring would continue to ensure water quality specific to TMDLs developed by the state. Within the Vision2020 area, the CNF monitors three sites for fecal coliform and ten sites for stream temperature. The fecal coliform monitoring will be expanded to fourteen sites by the Boulder Grazing EA project in the NE corner of CFLR project area. This monitoring ensures compliance and will increase our understanding of management effects as more sites are added.

To assess the effects of past and ongoing management activities on water quality the science team would use a multi-scaled approach. The monitoring would follow that of the fire hazard assessment whereby initial reference conditions would be established across the Vision 2020 area. Then several techniques would be tested to evaluate their utility respectively as initial pilot studies. Depending on the cost/benefit ratio, the water quality and quantity protocols would be moved forward for future projects. However, the emphasis would start in the northeast CFLR area due to the importance of the municipal watershed for the town of Orient. This location corresponds with the second set of management projects set for monitoring fire hazard reduction effectiveness.

First, a substantial data set of stream monitoring sites will be synthesized to determine the extent streams may respond to upland management and to locate streams and watersheds that have highest sensitivity. Identified sites would be given higher priority for future monitoring. The synthesis establishes a “big picture”, of where upland management could affect valley bottom resources. Second, a low runoff regime and lack of gages in northeast Washington create uncertainty as to management impacts on water yield. A new technique offered by the Rocky Mountain Research Station that offers a finer approximation of local climate, terrain and vegetation attributes would be tested. This effort is a partnership whereby RMRS would split the cost. Third, another new technique by the RMRS that other CFLR projects have proven success is the watershed by watershed identification of “hotspots” for sediment contribution. The process couples intensive field work, roadbed sediment monitoring with a place based empirical model. This suite of efforts would validate our assumptions of potential impacts to water quality and quantity while identifying priority locations for road improvements and stream restoration.

STREAM CHANNEL MEASURES

The CNF has invested heavily in measuring channel geometry and evaluating stream stability. Ultimately, the greatest impacts to streams may prove to be wildfire and extreme weather. Yet repeat measurements over 5 or 10 years, may detect watershed sensitivity to forest management treatment to shore up analysis uncertainty with traditional methods.

418 permanent cross section sites were established over the last five years with the intent to further measure on a 5 year cycle. The cross sections encompass a range of stream orders, distributed across the Vision2020 area.

The CNF stream channel monitoring establishes trend for streams, but does not include changes to riparian vegetation composition and condition. That type of information will be available from the Forest Service’s PACFISH/INFISH Effectiveness Monitoring Program (PIBO) that is funded at the regional level.

The PIBO program’s primary objective is to determine whether priority biological and physical attributes, processes, and functions of riparian and aquatic systems are being degraded, maintained, or restored in the PACFISH/INFISH effectiveness monitoring area (Al-Chokhachy et al. 2011). This monitoring spans Interior Columbia River Basin in eastern Oregon, Washington, northern Idaho and western Montana that includes FS Regions 1, 4, and 6. Thirty-two sites were established in the Vision2020 area starting in 2001. Repeat five year readings were taken twice at 14 sites, and three times at seven sites. The information includes stream morphology, flow and temperature, downed wood, water chemistry, riparian vegetation, and aquatic macro-invertebrates. The baseline condition is a working concept that is evolving as the PIBO program gathers data.

WATER YIELD

Another outstanding, and perhaps legacy concern is the impact of restoration treatments on water quantity. Since the Colville stopped using ECA in 2008, the CNF has started investigating new methods for estimating water yield effects. New research continues to refine our concepts of the potential impact of upland treatments on stream flow. The CNF has experimented with the new approach by working with engineers at the Rocky Mountain Research Station who have developed the Water Erosion Prediction Program (WEPP). Preliminary work was funded to set up a model to estimate impacts for various management activities on water yield for the East Deer Creek sub watershed, a municipal watershed for Orient. It is understood that watersheds have varying levels of contribution depending on topography, aspect, depth of parent material, and amount of precipitation received. This watershed model would be tested to stratify the level of contribution within a given watershed to better understand the interactive effects of management.

Table 8. Objective, indicators, scale and monitoring type for Question #8.

Objective	Indicators	Scale	Type
A) Comply with TMDL requirements to monitor water quality	Fecal coliform and stream temperature	Watershed	Surveillance
B) Identify extent streams respond to upland management; pool findings from previous monitoring	Stream flow response	Landscape	Baseline
C) Identify sediment point sources within East Deer Creek Watershed. Evaluate efficacy of method	Sediment	East Deer	Effectiveness
D) Identify changes to water quantity associated upland management in East Deer Creek Watershed. Evaluate the efficacy of the model.	Streamflow	East Deer	Effectiveness
E) Correlate changes in stream morphology with upland management	Stream morphology measures	Landscape	Surveillance

METHODOLOGY:

A) Three sites would be sampled for fecal coliform and fourteen sampled for stream temperature following protocol outlined in the CNF Laboratory QA/QC's and the CNF standard operating procedures. The number of sites is expected to increase as additional forest and fuels projects are implemented.

B) Landscape assessment: Correlate streamflow measures, channel morphology and terrain attributes to examine stream sensitivity. CNF Stream Morphology and Water Quality measures currently exist at 418 sites. The protocol is described below. PIBO measures of stream morphology and temperature measures exist at 32 sites. PIBO protocol available [ONLINE] at http://www.fs.fed.us/biology/fishecology/emp/ [July 30, 2013]

C) The Geomorphic Road Analysis and Inventory Package GRAIP assessment will collect data during summer FY14 and install long term monitoring plots for road sediment. Sediment plots will be sampled for at least one year. The technique would be tested on the east Deer watershed, the only municipal watershed within the Vision 2020. GRAIP assessment protocol available [ONLINE] at http://www.fs.fed.us/GRAIP/ [July 30, 2013].

D) WEPP Yield: The RMRS will carry out a series of WEPP and complementary groundwater runs to better understand the impacts, if any, of the proposed timber management on water yield in the East Deer watershed, the municipal watershed for Orient. The RMRS will model three subwatersheds before and after treatment to predict the annual water yield and seasonal distribution of runoff for both current and treated conditions, for a total of six runs. If time allows, additional runs will be carried out on other subwatersheds or for different distributions of disturbance.

a. In collaboration with the Colville National Forest, the RMRS will define three subwatersheds (about 1 sq mi each) that are to be treated, noting the dates and the types of treatments.
b. The RMRS will distribute all the proposed treatments among the hillslope polygons, noting the change in vegetation.
c. Runoff data will be measured at the Mica Creek study near Coeur d'Alene, ID, to estimate the impacts of timber removal on water yield. The RMRS will estimate the effects of timber harvest on snow accumulation and water yield from Mica Creek data, and develop relationships among the amount of timber removed, onsite ET, and offsite water yield.
d. Data from the Outlet Creek USGS gauging station near Metaline Falls, WA, will be used to estimate the coefficients for the groundwater linear flow model.
e. Using GeoWEPP, the RMRS will develop WEPP files to describe the proposed fuel treatments, along with coefficients for the ET estimate describing each of the forest conditions.
f. The results from GeoWEPP runs will provide estimates of surface runoff and lateral flow.
g. Base flow from the deep seepage will be predicted by the WEPP model and the groundwater linear flow model.
h. From the results, estimates for daily runoff, average annual water yield, peak flows, and probabilities of low flows will be produced.

E) Stream morphology protocol:

a. Permanent long-term hydrology monitoring sites will be continually added as more projects are conducted within the CFLR area.
b. Sites are selected based on representative reaches and proximity to management activities or sensitive areas.
c. Methodology will follow the Rosgen Stream Morphology protocol (Rosgen 1996).
d. Measurements will include, but not be limited to, sinuosity, particle size distribution, gradient, with/depth measurements, cross-sectional analysis, Bank Erosion Hazard Index, and Pfankuch analysis.
e. The data will be analyzed and stored using the Rivermorph program.
f. The information will provide stream function and stability.
g. Long-term monitoring at the sites will produce a detailed trend analysis.

WHO COLLECTS THE DATA?

A. CNF

B. The CNF would provide past CNF monitoring data. The PIBO staff from the FS Fish & Aquatic Ecology Unit provides PIBO data. Eric Moser and Vince Archer from Above & Beyond Ecosystems would gather additional climate, streamflow and terrain data.
C. Tom Black's crew from the Rocky Mountain Research Station, Boise
D. Bill Elliot's crew from the Rocky Mountain Research Station, Moscow
E. CNF

WHEN, HOW AND WHO ANALYZES THE DATA AND REPORTS FINDINGS?

A) The CNF prepares an annual report of water quality measures to the State of Washington Department of Ecology.
B) Eric Moser will compile data, perform analysis and produce a report by spring FY14.
C) As a means to predict small scale "hotspots" for sediment, a technique was developed that incorporates the ideas of stream functional response – that is how sensitive the stream depends on its setting. The GRAIP builds a locality based dataset that uses monitoring data to predict where the road system adversely impacts water quality (Black et al. 2012). This enables management to focus on specific locations for culvert replacement, make decisions on road closure/decommissioning, and cost/benefit decisions for restoration and road management investment. The road sediment plots enable locally based data to documents sediment generation as it varies by season and storm event, and the connection to traffic. This package has found high acclaim in both Region 1 and 6.
D) RMRS will prepare a report on the estimated effects of forest management on water yield in the East Deer Creek watershed by winter FY14. In addition, the RMRS will lead a hands-on workshop for Colville NF specialists and others interested in estimating water yields from forested watersheds.
E) Jennifer Hickenbottom would produce biennial reports of data findings where sites had at least one period of repeat sampling at five years or more.

WHERE WILL THE DATA BE STORED?

CNF, RMRS

Question #9: What is the anticipated influence of roads and the road restoration on in-channel conditions and water quality and streamflow?

BACKGROUND

One of the primary concerns of forest management is mitigating potential sediment contribution to streams. The use of Best Management Practices (BMP) establishes a level of protection, but the intensity and longevity of effects specific to stream channels, often incurred before use of BMPs, remain difficult to address by mitigating impacts to uplands. Traditional models rely on relationships between canopy cover, and generalized recovery trends that do not account for the entirely different and typically chronic interaction of channels and road runoff or unstable slopes. More recently, the Rocky Mountain Research Station has developed a suite of models that enable finer approximation of potential sediment from forest activities and roads. Still, ongoing work, including ground level monitoring, has demonstrated that small failures in infrastructure can account for disproportionate amount of impacts that is missed by WEPP which only allow sheet wash style of erosion.

APPROACH

The CNF currently identifies and remediates damages by illegal OHV using a Forest Damage Response Team (FDRT) that has been in place for five years. The FDRT responds to damage reports of illegal use and remediates the damage by fencing, reclaiming ruts, replanting and seeding. Immediate attention is necessary because unmitigated sites become hardened features that invite future use. Sites involve one or more of the following: eroding soil, damage to vegetation and meadows, damage to stream banks, impaired water quality, damage to fish habitat, impacts to wildlife habitat and use of the area, spread of noxious weeds, and damage to sensitive plant and wildlife habitat. To further deter continued illegal use, the FDRT communicates these locations to law enforcement via incident reports. The crew is expected to be funded annually.

To date, the CNF monitoring has shown that treatments eliminated use at most sites. In a few cases, the FDRT has returned to fix or extend a fence. A fence installed in the 1990's to deter OHV use through a meadow along the Big Meadow Lake road was found still effective and has no sign of unauthorized use. Another example in the Drummond Creek area shows how work in 2011 curtailed OHV creek crossings and unauthorized trail use. In 2009, one of the few camas meadows on the forest was rutted during the bloom period. The FDRT responded immediately and was able to replant the bulbs. Follow-up surveys found no addition damage since 2009.

The Vision2020 area was a focus area for the Forest Damage Response Team in 2012. The crew surveyed 75% of the CFLR project area and identified 155 impacted sites. Sixty seven sites were remediated by blocking assess with a combination of fences, placing brush on slopes, and planting native plants.

Information collected by the Forest Damage Response Teams serves as monitoring for road closure effectiveness and in general illegal use across the CFLR project. Ninety one closed roads were visited in 2012. Data describes the road closure type, location, effectiveness and documents with a picture. The types of road closures tested include 49 berms, 9 gates, and 33 locations with mapped closure but without a physical barrier. Preliminary results show berms as the most effective (80%), followed by gates (67%). Having no closure device was not an effective means of closure with 85% of the roads showing tire tracks beyond the closed end.

Table 9. Objective, indicators, scale and monitoring type for Question #9.

Objective	Indicators	Scale	Type
Evaluate the effectiveness of rehabilitation treatments stopping illegal use and determine the longevity of treatments	Level of use at treated sites and years in place	Landscape	Effectiveness

METHODOLOGY:

Site visits evaluate conditions using a qualitative rating assessment.

WHO COLLECTS THE DATA?

The Forest Damage Response Team

WHEN, HOW AND WHO ANALYZES THE DATA AND REPORTS FINDINGS?

The Vision 2020 science team intends to use these results to feed back into restoration project design. The annual reports generated by the Forest Damage Response Team would provide valuable information to tailor restoration prescriptions coincident with known levels of OHV use and which types of barriers are most effective. The annual review would feed back into the adaptive management cycle to incorporate into the following years project planning.

WHERE WILL THE DATA BE STORED?

CNF

Question #10: How did our historic activities (timber harvest, firewood cutting) affect and how are our existing activities affecting snag numbers and distribution?

BACKGROUND

Sensitive, threatened and endangered species have top priority in the Vision2020 area. The project area has forest structure that's departed from what is historically viewed in historical photographs. The dry and mixed conifer types in particular have homogenous forest structure that historically had greater heterogeneity. The forest setting and openings provide shelter and food sources for wildlife, although management that benefits one species may be detrimental to another.

Ongoing work has identified key species of concern either legally mandated to manage by the Endangered species Act or by agreement with state agencies. The litigious aspect of maintaining endangered species is covered by regional and research efforts. However, information on the impacts of restoration treatments to specific habitat attributes remains unclear. For example, information may be lacking on the effectiveness of maintaining snags in this managed landscape. The changing approach from timber extraction to ecosystem management leaves a differential array of snags on the landscape.

APPROACH

The distribution of snags with the Vision2020 landscape is poorly understood. The snags are used by various bird species for food and shelter. The proposed monitoring would build and expand on surveys used to determine background snag levels in the CFLR project area. The best available science provided by the FS is DecAid, the decayed wood advisor, developed by R6 Ecologist Kim Mellen and others (Available [ONLINE] @ http://www.fs.fed.us/r6/nr/wildlife/decaid/ [July 5, 2013]). For all species of wildlife that depend on cavities, snags or down wood the DecAid developers conducted a meta-analysis of available literature to determine levels of snags or down wood required by various species. The FS is required to use DecAid to determine effects to species that depend on snags, cavities, and down wood (USDA 1988).

To ensure efficiency, the science team expanded the monitoring to the fuel sampling slated within past harvest units for FY13. The snag monitoring was also added as a variable to the fire hazard monitoring BACI experiments that would occur at three cycles during the life of the CFLR project. The chronosequence surveys will cover a variety of cover types and time steps that can portray the distribution of snags by management type and longevity. The BACI experiments will identify the direct impacts of the restoration treatments on snag retention. By the end of the project, the indirect impacts of the restoration would be known to at least seven years. As with the forest and fire data, annual feedback would be fed into the next year's planning cycle.

Current snag survey efforts would continue since these efforts concentrate along roads and thus determine the influence of firewood access to snag retention. Conservation Northwest or the Student Conservation Association will partner with the FS to complete these surveys.

Table 10. Objective, indicators, scale and monitoring type for Question #10.

Objective	Indicators	Scale	Type
Determine background snag levels and the effectiveness of current treatments to retain snags	Snag density	Landscape	Effectiveness

METHODOLOGY:

The survey protocol is based on the standardized techniques developed by Bate et al. (2008). Once in place, the design can be expanded annually.

Sampling will be conducted to obtain snag and down wood levels by harvest prescription, harvest method, and plant association group. FACTS output coverages show where historical activities have been conducted, their timing intensity, and the harvest methods used (HCC and helicopter, HTH with cut-to-length, etc.). Regional maps display the extent of plant association groups by 30 meter pixel resolution. Sampling in these past harvest areas in a variety of forest types (PAG) would inform future snag management decisions.

Each year, 180 transects will be surveyed. Each transect is 64 feet wide and 800 feet long, generally running 400 feet on either side of a road (except for units yarded by helicopter that do not occur along roads). All snags greater than 10" dbh would be recorded on data sheets, then transferred to a computer.

WHO COLLECTS THE DATA?

Interns from Student Conservation Association will complete the bulk of the surveys. In FY14 and FY15 the project would require a maximum of 120 person-days (2-person crew 60 days each) to survey 180 transects. Snag information will also be collected by Jason Clark of RMRS, Missoula Fire Lab, during the fuel longevity and effectiveness plot sampling for FY14 and FY15.

WHEN, HOW AND WHO ANALYZES THE DATA AND REPORTS FINDINGS?

Each year, Chris Loggers will work with the snag crew members to tabulate and report data. Results would be run through the program SnagPro to determine baseline levels by harvest prescription, yarding method and plant association group. Final data crunching and the final report would be written at the beginning of FY 16.

WHERE WILL THE DATA BE STORED?

CNF

Question #11: Does the management of nest buffers and post-fledging areas, and timing of restrictions, adequately protect goshawks and keep them from abandoning an area?

BACKGROUND

In the past 20 years, goshawks have been petitioned for listing under the ESA, considered a FS R6 sensitive species, and treated as a management indicator species (MIS). In the new draft forest plan they are considered a species of special management concern and an MIS. Much of the available published literature comes from southwest US, in conditions that might not apply well to the east side of the Pacific Northwest.

During analysis of the effects of projects to goshawks, the CNF currently defaults to assumptions that all mapped habitat is occupied. Habitat that is actually occupied should receive far more weight than potential habitat.

APPROACH

Nesting goshawks are scattered throughout the CNF. Ad hoc monitoring over the last 20 years has not answered fundamental questions about how goshawks use the environment during pair bonding, nesting, post-fledging and winter. Systematic monitoring would clarify our understanding on goshawk requirements, including to what extent nests need buffering, how large to create post-harvest fledging areas, and when to restrict or allow activities near nests.

Table 11. Objective, indicators, scale and monitoring type for Question #11.

Objective	Indicators	Scale	Type
Refine understanding of goshawk habitat to clarify buffer distance and when to restrict or allow activities	Goshawk use	Landscape	Ecological

METHODOLOGY:

Population tracking would be correlated with habitat elements. In FY14, five adult pairs will be tracked within the CFLR project area. During FY15, vegetation would be characterized for core habitat attributes and correlated to the goshawk territory. The monitoring would conclude in year 3 with data analysis and reporting. Since the locations of the goshawks may not overlap with the three cycles of BACI monitoring, the goshawk monitoring would be independent of other efforts.

WHO COLLECTS THE DATA?

Partners for the project would include Washington Department of Fish and Wildlife (WDFW), The Student Conservation Association, Conservation Northwest, Northwest Wildlife Rehabilitation Association and Spokane Audubon. Project design and capture will be overseen by WDFW. Bird capture will be directed by WDFW and assisted by members of Conservation NW, the NW Wildlife Rehab Assoc., the Spokane Audubon, and the FS. Birds will be primarily be monitored by volunteers from SCA. Vegetation will be monitored by various groups using remote methods being developed during the CFLR project, backed by on-the-ground vegetation data collection.

WHEN, HOW AND WHO ANALYZES THE DATA AND REPORTS FINDINGS?

WDFW and Chris Loggers will conduct data analysis and report writing during FY16.

WHERE WILL THE DATA BE STORED?

CNF

Question #12: Are our management activities regenerating aspen and other hardwoods at levels that will maintain or spread the clones?

BACKGROUND

Aspen is an important hardwood species for forest restoration activities and wildlife habitat. In many areas in the West, aspen are declining and post-disturbance reproduction is stymied. Causal factors for the decline include disease and grazing pressure from native ungulates and livestock. Pilot studies on the CNF indicate grazing pressure can contribute to decline; worm fencing that excludes livestock correlates to a dramatic increase in aspen regeneration. Away from the large meadows, the CNF lacks data on the degree that grazing – whether livestock or wild ungulate – impacts aspen regeneration.

APPROACH

Ecological effects of grazing, especially by native ungulates, on aspen regeneration within restoration treatments would be monitored beginning in FY14. Monitoring would evaluate the effectiveness of restoration prescriptions and ideally would feed into the next round of project planning. However, it's acknowledged that the lag time for aspen shoots to grow would push results towards the later stages of the CFLR project term. Paired enclosures will be used to track aspen regeneration within recently treated project areas where livestock grazing occurs. The enclosures would have three parts: (1) the control consists of an eight foot enclosure that excludes wild ungulates and livestock, (2) treatment 1 consists of a lower fence that excludes only livestock, and (3) treatment 2 consists of an unfenced area adjacent to the enclosure where all ungulates can browse. Where possible, the enclosures would be placed within the same projects as the BACI treatment areas to "nest" effects determinations. As with the fuel treatments, at least three cycles of project monitoring is expected within the CFLR project term.

Table 12. Objective, indicators, scale and monitoring type for Question #12.

Objective	Indicators	Scale	Type
Decipher the differential effects of wildlife and livestock on aspen regeneration after vegetation treatments	Aspen regeneration number and growth	Landscape	Ecological

METHODOLOGY:

Aspen stems would be counted and classified into size classes within the enclosures and compared to adjacent stands per USDA Forest Service (2004) in FY14-FY17 (3 years). The sites would be selected to represent the different biophysical conditions across the Vision2020 area, though somewhat constrained by requiring recent treatment for installation. Each enclosure measures 24 feet X 36 feet and will consist of 2 parts: an 8 foot tall section to exclude livestock, deer, elk and moose (the control area), and a 40 inch tall enclosure to exclude livestock (treatment 1). The footprint of the 8-foot is 12 feet X 24 feet. The footprint of the 40-inche is 24 feet X 24 feet and shares a one side with the 8 foot. Treatment 2 consists of an unfenced area around the enclosure.

On both segments, within 40 inches of the ground, the enclosure will consist of about-3-inch-diameter X 12-foot horizontal wooden rails anchored to 6 inch vertical posts at about 13-inch vertical spacing (i.e. the 1st horizontal rail would be anchored about 13 inches off the ground, the 2nd about 26 inches off the ground and the 3rd about 40 inches off the ground). On the 8-foot section, the remaining height would consist of either continued wooden railing or cattle panel fencing. Vertical posts could be sunk into the ground to stabilize the structure. Human access to the 8-foot section would be built between the shorter and taller segments.

WHO COLLECTS THE DATA?

CNF

WHEN, HOW AND WHO ANALYZES THE DATA AND REPORTS FINDINGS?

Chris Loggers would oversee the project and analyze the data. Findings would be summarized every two years and reported at the biennial workshops. Kettle Falls School District students will assist with this project.

WHERE WILL THE DATA BE STORED?

CNF

Question #13: Do management activities affect big game use of an area, and is the condition and amount of edible vegetation adequate to maintain desired big game populations?

BACKGROUND

Local communities have strong interest in maintaining favorable habitat for deer and elk. The CNF Forest Management Plan emphasizes deer and elk management on 90% of the winter range (USDA 1988). Both white-tailed and mule deer live in the CFLRP area. Northeast Washington supports Washington's largest white-tailed deer population. The CNF FP emphasizes mule deer management in the CFLRP area. The large scale of the Vision2020 project will create more openings and alter habitat distribution in the now more-homogenous stands. The Colville Tribe and Department of Washington Fish and Wildlife have expressed strong interest to monitor both mule and white-tailed deer species response to the restoration treatments.

The CFLRP treatment area on the Colville National Forest provides year-round habitat for mule deer and white-tailed deer, and the planned thinning and burning is expected to increase the abundance and distribution of forage for deer in more open stands that are similar to those existing in the early – mid-1900s when deer populations were higher (United States Forest Service 2011). Previous research on the effects of thinning and burning treatments in the Pacific Northwest have shown an initial decline in the biomass of understory shrubs and herbaceous vegetation in the first year or two after treatment, but a rapid increase in plant species richness, including exotics (Bailey et al. 1998, Metlen and Fiedler 2006, Wilson and Puettmann 2007, Dodson et al. 2008). Increases in understory cover or biomass were not consistently seen until at least 7-8 years post treatment (McConnell and Smith 1970, Bailey et al. 1998, Alldredge et al. 2001, Lindh and Muir 2004, Wilson and Puettmann 2007) years. Therefore, the first goal of the monitoring would examine the effects of the fuel reduction treatments on the nutritional ecology of mule and white-tailed deer in spring – early fall within 3 project areas within the Colville National Forest CFLRP over the next 6 years. The second goal would be to ascertain the potential different responses from mule deer versus white tailed deer.

APPROACH

The monitoring would begin in earnest during FY14 with GPS tracking devices secured to individuals. The monitoring would be targeted in CFLRP areas where management activities will affect the amount, type and distribution of forage and cover on both summer and winter range. Where possible, the monitoring would coincide with projects selected for the BACI fuels monitoring.

Table 13. Objective, indicators, scale and monitoring type for Question #13.

Objective	Indicators	Scale	Type
Examine deer use after treatment	Deer presence, use	Landscape	Ecological

METHODOLOGY:

Deer capture and collaring will be overseen by WDFW. Deer will be captured using a variety of methods but mainly live-trapping. Animals will be collared using long-lasting GPS collars that provide few (1-4) locations per day but which last for several years. Females will be targeted for capture to avoid issues dealing with collars around the swollen necks of rutting males. About 15 deer/area will be collared. GPS data will be sent to WDFW and FS computers for storage and later analysis. Vegetation data will be collected both on the broad scale and at finer scales. Details will be determined in September 2013 during a WDFW/FS meeting regarding experimental design. Vegetation data collected during CFLRP monitoring will be used if possible. A model for generalized winter ranges on the CFLRP area will be developed using deer location data gathered between mid-late December and late winter.

WHO COLLECTS THE DATA?

Washington Department of Fish and Wildlife will be the primary collector and repository of animal-related data, which is downloaded from a satellite. Vegetation data will be collected by a variety of individuals and groups, and the FS.

WHEN, HOW AND WHO ANALYZES THE DATA AND REPORTS FINDINGS?

WDFW will provide quarterly updates on the project. WDFW will analyze the data and WDFW and Chris Loggers will write the results. Items to analyze and report on will include movement of deer related to harvest activities, use of winter range areas, description of habitat elements related to winter range, generalized locations of winter range areas based on the developed model, use of managed areas post-management, and use of these areas related to vegetation availability.

WHERE WILL THE DATA BE STORED?

CNF, WDFW

Question #14: Did our restoration treatments provide source habitats for focal terrestrial species?

BACKGROUND

Moths are an important component of the diets of Townsend's big-eared bat, white-headed woodpeckers, and flammulated owls, all sensitive species or species of special concern. Since the mid-2000's the CNF has conducted forest-wide nighttime surveys for moths, primarily the noctuid group and primarily in harvested stands. Initial information suggests that the moth suite changes from weaker-flying geometrid moths to stronger-flying noctuid moths after the canopy opens and shrub production increases due to more light reaching the forest floor. However, monitoring to date did not include un-harvested controls and thus lacks inference. Furthermore, there's a lack of understanding as to the extent shifts in moths may impact the above-mentioned predator species.

APPROACH

The monitoring seeks to expand the moth surveys to include un-harvested and harvested areas and to correlate the prey findings with bat use. The monitoring will be placed in drier forest types within the BACI projects beginning in FY14.

Table 14. Objective, indicators, scale and monitoring type for Question #14.

Objective	Indicators	Scale	Type
Correlate prey findings with bat use	Moth presence and functional prey base, bat presence	Landscape	Ecological

METHODOLOGY:

Light traps would be used to sample moths over the course of a night five times during the summer to capture species shift in time. The sampling would be conducted for two summers to capture year to year variability. The project will consist of surveying four locations in a watershed (generally a management project area). Each locations will consist of a past harvest unit and an adjacent unharvested unit. The placement of traps will coincide with the BACI design plot locations where possible. Two two-person crews would set four moth light traps in each forest treatment unit for a total of 16 traps in a management project area, and 32 surveyed during a summer. Traps will be set during 5 sessions over the summer to sample the full suite of moth species (flight periods vary by species, some flying only in early spring and others emerging only in late summer). Traps will be set at night and retrieved in the morning, with the contents of the traps counted and eventually frozen for later identification by Shepard. Each sample session will cover three nights to ensure sampling during a good weather event. IIf available, bat detectors will be placed in each unit to sample the occurrence of bats. Bat acoustic information will be downloaded and run through software to identify species and relative abundance.

WHO COLLECTS THE DATA?

Conservation Northwest or the Student Conservation Association will partner with the FS to complete the surveys by setting out and retrieving the moth traps. The field work would start in early-to-mid May of 2014 and continue through September, then recommence in 2015. Jon Sheppard, a local expert, will partner with the FS to identify moth specimens. Bat Conservation International, WDFW, and the BLM will partner with the FS by lending bat detectors.

WHEN, HOW AND WHO ANALYZES THE DATA AND REPORTS FINDINGS?

Chris Loggers will tabulate results and produce a summary report to inform project design for restoration projects after FY16. Jon Shepard would identify moth specimens during the winter for FY14 and FY15.

WHERE WILL THE DATA BE STORED?

CNF

NATIONAL ECOLOGICAL INDICATORS

Each project is required to develop a set of indicators that have measureable components. The indicators allow the CFLR program to assess ecological outcomes relevant to the individual programs while providing a set of metrics that tier directly to the Omnibus Public Land Management Act of 2009 (Act). Within each outcome is a set of desired conditions that more specifically describe the outcome.

The science team identified desired conditions, indicators, and scoring for the Vision 2020 for each of the ecological outcome measures. Reporting for the National Indicators will be based on monitoring identified in this monitoring plan. Table 15 below indicates how monitoring for the Vision 2020 Monitoring Plan will be used to report on the National Indicators.

Table 15. Crosswalk between National Indicators and the Vision 2020 Monitoring Plan.

National Indicator	Question
Fire Regime Condition	#1. How much did fuel project investment defer wildfire costs?
Fire Regime Condition	#2. Did we move departure of stand structure, understory and landscape pattern toward a more sustainable condition?
Fire Regime Condition	#7. Do our treatments reduce risk for crown fire and for how long does the effect last?
Fish and Wildlife Habitat Condition	#11. Does the management of nest buffers and post-fledging areas adequately protect goshawks and keep them from abandoning an area?
Fish and Wildlife Habitat Condition	#13. Is the condition and amount of edible vegetation on winter range areas adequate to maintain desired populations of big game?
Watershed Condition	#8. Did we maintain or improve water quality, quantity, and watershed function?
Watershed Condition	#9. What is the anticipated influence of roads and the road restoration on in-channel conditions and water quality and streamflow?

ECOLOGICAL OUTCOME 1 – FIRE REGIME RESTORATION

Desired Conditions

The goal of the Vision 2020 project is to re-introduce fire and move the forest towards a more sustainable condition. The desired conditions include:

1. To reduce the potential for crown fire potential near values at risk.
2. To reduce fire suppression costs and to reduce risk through restoration treatments.
3. To move the CFLRP Landscape towards a more sustainable condition.

Methods for Measuring the Desired Condition

1. Projected fire growth and behavior will be measured using fire behavior mapping and analysis program FSim utilizing locally corrected Landfire spatial layers and local data sources. Results will be reported initially for 2014, and then at the five and ten year CFLR program term to quantify treatment effectiveness at the landscape scale.

2. Fire program management cost savings and risk reduction with and without treatments will be measured using the Risk and Cost Analysis Tools Package (R-CAT). Results will be reported initially for 2014, and then at the five and ten year CFLR program term to quantify treatment effectiveness at the landscape scale.

3. Treatment effectiveness across the landscape will be measured using the Fire Regime Condition Class (FRCC) rating system and reported at 2014, and then at the five and ten year

CFLR program term to show the project's effectiveness at moving towards a more sustainable condition at the landscape scale.

ECOLOGICAL OUTCOME 2 – FISH AND WILDLIFE HABITAT CONDITION

Desired Conditions

1. In the past 20 years, goshawks have been petitioned for listing under the ESA, considered a FS R6 sensitive species, and treated as a management indicator species. In the upcoming forest plan they are considered a species of special management concern and a MIS. Much of the available published literature comes from SW US, in conditions that might not apply well to the east side of the Pacific Northwest. The desired condition is improved habitat for goshawks at the stand and landscape scale.

2. Local communities have strong interest in maintaining favorable habitat for deer and elk. The CNF Forest Management Plan emphasizes deer and elk management on 90% of the winter range (USDA 1988). The desired condition is to maintain and improve habitat for deer and elk.

Methods for Measuring the Desired Condition

1. The CNF currently defaults to assuming that all habitat is occupied and lack data to stratify value. Habitat that is actually occupied should receive far more weight than potential habitat, but our current level of requirements does not allow differentiation except where nests have known locations. The monitoring would use population tracking to correlate habitat elements to refine our understanding of goshawk habitat needs. The desired condition will be evaluated by re-running the habitat suitability model at the conclusion of the tracking survey. To account for the effects from forest restoration projects, the model would be run at years 5 and 10 of the CFLR project to evaluate the effectiveness of treatments on maintaining or improving goshawk habitat at the landscape scale.

2. A coordinated tracking study would monitor the impacts of the forest restoration on deer and elk use and habitat requirements. The information would be tabulated and would refine habitat suitability models. The desired condition will be evaluated by re-running the model at years 5 and 10 to gage the effectiveness of the Vision 2020 project to maintain and increase suitable habitat for deer and elk across the landscape.

ECOLOGICAL OUTCOME 3 – WATERSHED CONDITION

Desired Conditions

1. In 2011, the Forest Service is required to assess condition at the 6^{th} field hydrologic unit level (now termed 12^{th}) as outlined in the Watershed Condition Framework (Potyondy and Geier 2011). The protocol is designed to quantify biological and physical watershed conditions. The 6th field watersheds within the Vision 2020 area received ratings of either "fair" or "good" for Forest Service lands. The desired condition is to maintain or improve watershed condition.

2. The impact of upland management on valley bottom channels remains unclear. The Vision 2020 collaborative is working with the Rocky Mountain Research station to test new methods for assessing stream response to upland management. The results will enable a finer approximation of potential influence – negative and positive – of road management along with stream and forest restoration treatments. The desire is to minimize the impact of road sediment sources, which is a core parameter in the Watershed Condition Framework.

Methods for Measuring the Desired Condition

1. The FS requires the national forests to submit the ratings every two years. The Vision 2020 will use these ratings to monitor trends for each of the at the project 6^{th} field watersheds. Trends will be reported at the 5 and 10 year CFLR project term.

2. The GRAIP model (Black et al. 2012) will be used to identify sediment hotspots and assess current conditions in the Deer Creek Watershed, the only municipal watershed within the Vision 2020 area. Once developed, the Vision 2020 will monitor improvements using the GRAIP model at years 5 and 10.

ECOLOGICAL OUTCOME 4 – INVASIVE SPECIES SEVERITY

Desired Conditions

The desired condition is to maintain native or desirable introduced plant communities in a condition that are resistant to invasion by undesirable non-native/invasive plants. Emphasis will be control of existing infestations and eradicate new infestations, according to forest priorities and Early Detection Rapid Response protocol.

Methods for Measuring the Desired Condition

The NRIS Invasive Species Inventory GIS layer will be updated annually with all treatment data. This information will be used to determine the progress in reducing or controlling invasive plants in the Vision 2020 area.

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