Colorado Front Range Collaborative Forest Landscape Restoration Project
Ecological Monitoring Scope and Schedule of Work, 2011-2012
DRAFT – October 2011

Introduction (from Front Range CFLR Proposal, 2010)

The Colorado Front Range Landscape Restoration (FR-CFLR) project is intended to accelerate ongoing restoration treatments that provide long-lasting ecological, social and economic benefit across a 1.5 million-acre landscape covering parts of the Arapaho and Roosevelt and Pike and San Isabel National Forests in Colorado. This project, developed collaboratively by the nationally recognized Front Range Roundtable, will facilitate additional treatment of approximately 32,000 high-priority acres on National Forest System (NFS) lands within the Roundtable's designated 800,000-acre restoration zone and will be enhanced by existing and future treatments on adjacent federal and non-federal lands. A large portion of the 800,000 acre restoration zone is within the wildland urban interface and will be the focus of the 32,000 acres of treatment (Table 1).

Table 1: Acres treated through this proposal

Fiscal Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Non-CFLR Restoration Acres	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Additional Acres with CFLR	1,000	3,400	3,400	3,400	3,400	3,400	3,400	3,400	3,400	3,400
Total Restoration Acres	6,000	8,400	8,400	8,400	8,400	8,400	8,400	8,400	8,400	8,400

More than 70 percent of the forests within this proposal exhibit a high to very high degree of ecological departure from historic norms and are susceptible to uncharacteristic high intensity wildfire and insects and disease. These conditions increasingly threaten human health and well-being, as well as critical ecosystem services throughout the region. Through strategic placement of treatments, the FR-CFLR project plans to restore historic fire regimes, including low intensity wildland fires, with a goal of reducing risks to the ecosystem and communities and lowering suppression costs. Much of the area is deemed critical for protecting communities and municipal watersheds (which supply drinking water to over 75 percent of Colorado's population) from the impacts of catastrophic fire.

Project treatments will be strategically placed to maximize timely implementation and benefit on the ground. The first three years of treatment will focus on areas within the Roundtable's restoration zone where: 1) National Environmental Policy Act (NEPA) review is complete; 2) complementary work has already occurred or is underway and can be leveraged for a larger-scale outcome; 3) both ecological and community protection priorities can be simultaneously addressed; 4) work by non-federal partners on adjacent lands will complement management on federal lands; and/or 5) opportunity exists to create jobs and support local economies.

Opportunities for job creation, business support and development, and meaningful biomass utilization are emphasized in the design and implementation of treatments. The effectiveness of treatments will be monitored through a robust multi-party monitoring protocol designed and implemented in partnership with the Colorado Forest Restoration Institute (CFRI). The monitoring plan can be accessed at: http://warnercnr.colostate.edu/images/pictures/upload/cfri/Roundtable-CFLRP-Monitoring-Plan-062511.pdf

Scope of Work

This Scope of Work defines tasks, lead individuals, and timeframes assumed by the Colorado Forest Restoration Institute for the FR-CFLR ecological monitoring for the period of Fall 2011-Fall 2012. This Scope of Work is tied to the Colorado Forest Restoration Institute's FY2011 work plan project #3a, "Science and Field Support for the Front Range Collaborative Forest Landscape Restoration Project" and Supplemental work plan project #3 under Agreement Modification 2. A separate FR-CFLR Social-Economic Monitoring Scope of Work has been developed.

Four ecological monitoring topics are described in this Scope of Work:

1) Reconstructing historic forest stand structures and fire regimes
2) Clarifying the science basis for desired conditions and range of treatments consistent with restoration and hazard reduction goals
3) Ongoing monitoring of treatment effects on achieving restoration and hazard reduction goals
4) Developing and applying a landscape monitoring framework
5) Coordinating multi-party ecological monitoring across organizations, projects, space and time

1) Reconstructing historic forest stand structures and fire regimes

Leadership people: Paula Fornwalt, Peter Brown, Laurie Huckaby, Mike Battaglia
Overall goals and objectives: Develop quantitative metrics that describe the range of forest structures that historically occurred in the lower montane forests of the Colorado Front Range, so that they can be used both to guide restoration treatment prescriptions and to evaluate the success of treatments at restoring a more historical and sustainable forest structure.
2011-2012 monitoring objectives: Select 3-5 representative lower montane forested sites; collect and analyze field data; and produce summary report of findings. Literature review and synthesis of existing research on historic forest structure, dynamics, and disturbance regimes.
Key questions to be examined:

1) What were the likely ranges of historic forest structures and fire regimes across topographic and vegetation gradients in the lower montane forests?

General approach and measurements: (from July 10, 2011 "Administrative study proposal: reconstructing historical overstory stand structure in the lower montane zone of the Arapaho-Roosevelt National Forest", from RMRS, Paula Fornwalt, lead-PI)

1) Study site selection*:* We will subjectively locate three to five lower montane (~6000 to 8500 feet in elevation) study areas in locations where ARNF restoration treatments are proposed. Within study areas, we will randomly locate three to six 0.25 acre plots. The number of plots per study area will vary with its size and its variability in topographic and vegetation characteristics.
2) Data collection*:* Within each plot, we will measure diameter at breast height (DBH) and record species for all living and dead standing trees taller than 4.5 feet, and we will obtain an increment core or partial cross-section of all living and dead trees >1.5 inch DBH to determine the tree's year of establishment. We will also record all identifiable stumps and fallen trees with roots, by species if possible, and estimate their current diameter near the root collar; a core or cross-section will be taken for dating. Plot attributes such as aspect, slope, elevation, and GPS coordinates, and will also be noted.

3) Analyses*:* First, the age of each tree sampled (live or dead) will be determined by cross-dating. Fire scars will also be cross-dated to develop a fire history for the plot. Then, for four points in time – current, settlement era (~1900), pre-settlement era (~1850), and prior to the 18th century gap (~1750) – we will determine the tree's DBH and age. Existing allometric equations will be used as necessary to convert diameters obtained from cores/sections to DBH outside bark at breast height. The above data will then be used to calculate stand structure metrics (e.g., trees per acre, basal area per acre, diameter distributions, species composition) of each plot for each point in time. These structure metrics will also then be related to potential driving variables such as plot fire history, aspect, and elevation.

People engaged in measuring: RMRS scientists, Peter Brown, CFRI field crews , volunteer crews?
Data management and archiving: To be determined
Plan for communicating findings: Summary report produced by CFRI and presented to Front Range Roundtable and land managers.

2) Clarify science basis for desired conditions and range of treatments consistent with restoration and hazard reduction goals

Leadership people: CFRI research associates, Tony Cheng, Claudia Regan, Jim Thinnes, others on SM Team and Roundtable?
Overall goals and objectives: Develop quantitative metrics and visual aids for defining the desired conditions and range of treatments in lower montane forests of Colorado's Front Range consistent with restoration and hazard reduction goals. Metrics will include ranges of forest structures, and may include understory vegetation and trophic web interactions.
2011-2012 monitoring objectives: Translation of results from historic forest and fire regime reconstructions, compilation and synthesis of ecological research pertaining to lower montane forests, compilation and synthesis of historic documents pertaining to forest structure and fire history, and compilation and comparison of historic and current photographs.
Key questions to be examined:

1) What is the current available scientific information on the range of forest ecosystem structures and processes that likely occurred under historic fire regimes?
2) What is the current available scientific information on the range of forest ecosystem structures and processes that reduce hazards to communities and other important social values?

General approach: Further development and refinement with collaborative team. Initial ideas include:

1) Compile, synthesize, and translate currently available science and evidence on historic structure and fire regimes of lower montane forest systems (CFRI grad student)
2) Utilize results of historic stand reconstructions and fire regime study in project 1).
3) Define range of densities (BA and TPA), species composition, size-class distributions, and fine-scale and coarse-scale spatial heterogeneity at landscape-scale characteristic of historic disturbance regimes and accounting for current social variables (i.e., proximity to communities).
4) Desired condition metrics would form the basis for refining monitoring indicators and measures.
5) Compare and assess wildfire behavior under different restoration and hazard reduction treatment scenarios and timeframes using fire behavior models.

Measurements: Compile information on current forest structure across CFLR project area? (Density, composition, size-class, and spatial heterogeneity – available?)
People engaged in measuring:
Data management and archiving:
Plan for communicating findings:

3) Enhance the effectiveness and efficiency of mechanical treatment implementation

Leadership people: CFRI research associates, Tony Cheng, Claudia Regan, Jim Thinnes, others on SM Team and Roundtable?
Overall goals and objectives: Review, develop, and test the effectiveness and efficiency of different treatment designations pursuant to desired condition metrics. Designations include leave-tree marking, cut-tree marking, designation-by-prescription, and designation-by-description.
2011-2012 monitoring objectives: Review past mechanical treatment designations and develop and pilot test different designations in collaboration with Forest Service field staff and Western Range Reclamation. Possibly define a demonstration pilot area to test different designation through a replicated study process.
Key questions to be examined:

1) What are the differences between different mechanical treatment designations on achieving desired condition metrics and operational efficiency metrics, i.e., time, cost, operability?
2) What designation or combination of designations achieve desired conditions at lowest administrative and operation costs?

General approach: Further development and refinement with collaborative team. Initial ideas include:

1) Review information on past mechanical treatment designations with regard to residual forest structure and administrative and operational costs.
2) Refine marking guidelines and develop designation-by-prescription and by-description pursuant to desired condition metrics defined in task #2.
3) Select a demonstration area to stratify and replicate different designations. Possibly engage Roundtable members and other interested/affected stakeholders to mark trees or write designations.
4) Compare and assess effect of different designations on post-treatment structure and on administrative and operational costs.

Measurements: Quantify pre- and post-treatment forest structure and administrative and operational costs.
People engaged in measuring:
Data management and archiving:
Plan for communicating findings:

4) Monitor and assess treatment effects on achieving restoration and hazard reduction goals

Leadership people: CFRI research associates, timber staff on AR and PSI national forests; Roundtable SM Team members??
Overall goals and objectives:

1) Treatments result in a complex mosaic of forest density, size, and age
2) Treatments result in wildfire behavior more characteristic of historic fire regimes
3) Treatments result in increased productivity of native grasses and forbs, and minimize spread of non-native or noxious weeds.

2011-2012 monitoring objectives

1) Refine what is meant by “complex mosaic of forest density, size, and age.”
2) Assess development of forest structure and spatial patterns if no treatments were conducted
3) Assess development post-treatment forest structure and spatial patterns against desired conditions.

Key questions to be examined

1) Are the locations, types, and scale of CFLR treatments resulting in the desired complex mosaic of forest structures and spatial patterns?
2) Are the locations, types, and scale of CFLR treatments resulting in wildfire behavior and regimes more characteristic of historic fire regimes?
3) Are treatments increased native grass and forb cover, and minimizing or preventing non-native or noxious weeds.

Protocol

1) Spatial scale: treatment areas defined in task orders; 6th-level Hydrologic Unit Code
2) Pre- and post-treatment data gathered through Common Stand Exams, and incorporated in Region 2 Forest Vegetation Simulator to forecast forest structure under no treatment and actual or planned treatments
3) Spatial patterns – use and modify distance measures such as Ripley's K and other spatial pattern analysis techniques
4) Apply understory protocol developed by SRLCC monitoring team.

Measurements

1) Common Stand Exam measures
2) SRLCC team measures

People engaged in measuring:

1) Pre-treatment CSE's conducted by FS timber staff and/or contractors
2) Post-treatment CSEs conducted by CFRI field crews
3) Understory plan measures conducted by SRLCC team and CFRI field crews

Data management and archiving: Pre-treatment CSEs archived in FS field units; post-treatment CSEs and modeling analysis developed and archived by CFRI

Plan for communicating findings: Annual monitoring report published by CFRI and presented to Front Range Roundtable and field units.

5) Landscape monitoring

Leadership people: CFRI, Roundtable SM Team members

Overall goals and objectives: Determine the effect of past, current, and future forest treatments on a small number of landscape-scale indicators of interest. These may include fire propagation and behavior, wildlife species of concern, and/or non-native or noxious weed spread.

2011-2012 monitoring objectives:

1) Identify small number of landscape indicators.
2) Develop data framework for landscape indicators
3) Identify and assess quality of existing data sources to measure landscape indicators
4) Pilot test indicator assessment and modeling.

Key questions to be examined: What is the cumulative effect of past, current, and future forest treatments on landscape-scale processes, such as fire propagation and behavior, wildlife species of concern, and/or non-native or noxious weed spread.

General approach: Convene collaborative team to further develop and refine landscape monitoring approach.

Measurements:

People engaged in measuring:

Data management and archiving:

Plan for communicating findings:

6) Coordinating multi-party ecological monitoring across organizations, projects, space and time

CFRI is not the sole entity implementing aspects of the FR-CFLR ecological monitoring plan.

· Scientists at the Forest Service's Rocky Mountain Research Station and U.S. Geological Survey are monitoring understory plants and wildlife resources funded through the Southern Rockies Landscape Conservation Cooperative.

· Land managers conduct pre- and post-treatment monitoring activities, as well as generate geospatial data and information.

It is beneficial to retain the autonomy of each organization and team, but ensure clear lines of regular communication, share monitoring resources, and coordinate monitoring databases and results reporting.

It is important to determine the degree of formality of coordination necessary. Keep it simple and focus on effectiveness.