Upper South Platte/Hayman Conservation Campaign
Effectiveness Monitoring

Long Term (3 year) Effectiveness Monitoring of Rehabilitation Treatments

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Background Narrative / Introduction

The National Forest Foundation (NFF), Vail Resorts and the U.S.D.A. Forest Service (USFS) are collaborating to complete on-the-ground restoration work in the Upper South Platte watershed as part of the NFF's Upper South Platte/Hayman Conservation Campaign. The project area covers over 115,000 acres, and the majority of the restoration work will be completed in a 45,000 acre area burned by the Hayman Fire. The goal of the restoration effort is to reduce sediment output and increase aquatic habitat and stream channel stability in a number of critical sub-basins within the burn area. These basins, including the West Creek, Horse Creek, Lower Trout and Four Mile watersheds, are still producing a large amount of sediment which is delivered to the South Platte River. Projects will include riparian restoration to help reduce sediment loads, obliteration of decommissioned forest roads and trails, enhancement and relocation of trails away from active stream channels, tree planting to increase reforestation rates, noxious weed eradication, and native plant and wildlife habitat restoration. The goal is to have all restoration work completed by the end of 2012.

Projects within the burned area will be completed by a variety of entities, including the USFS, local nonprofits, youth corps, and contractors. Effectiveness monitoring is required by the NFF for all projects funded under this campaign. The required effectiveness monitoring, however, has short term (< 1 year) timelines and therefore limited value in determining long term project success. Current research in the Hayman burned area being conducted by Robichaud, Wagenbrenner, MacDonald, and others, has shown that long term monitoring (>3 years) is needed to fully assess effectiveness of treatments.

The Rocky Mountain Field Institute, under the guidance of the Pike National Forest Hydrologist, Dana Butler, will implement effectiveness monitoring for selected restoration projects over a period of three years following a project's completion under the campaign. This study plan outlines the set of protocols that will be implemented for effectiveness monitoring for each of the selected types of projects that will be completed during the campaign.

Objectives

The long term effectiveness monitoring will address some key questions such as:

- Are erosion mitigation projects such as decommissioning of roads, placement of ephemeral instream structures, and various revegetation techniques reducing erosion rates or sediment yields within the watershed?
- Are noxious weed management techniques effective at preventing the spread of weeds into unaffected areas or reducing the rate of migration of established weed patches?
- What is the mortality rate of young saplings transplanted within the burned area?
- Is there an observable change in aquatic habitat quality?

Specific objectives of the long term monitoring program include:

1. Establish monitoring protocols for the diverse projects to be completed during the three years of the Upper South Platte/Hayman Conservation Campaign;

2. Provide effectiveness monitoring of each project for three years after project completion to assess each project's affect on watershed health;

3. Develop specific monitoring protocols so that monitoring data can be easily collected by trained volunteers; and

4. Develop a simple data structure so that data collected under the common monitoring protocols can easily be incorporated in a project-scale effectiveness assessment.

Methodolgy

Criteria from David Rosgen's (2006) Rapid Resource Inventory for Sediment and Stability Consequence (RRISSC) methodology is utilized to select projects advanced for monitoring. The selection criteria incorporates connectivity to stream (within 150 feet of an ephemeral, intermittent or perennial stream), slope gradient (>= 30%), soil characteristics, vegetation cover and type, moderate or high burn intensity areas (as a surrogate for bare soils), and road density. A GIS is used to overlay the selection criteria over a base map showing locations of all projects. Those projects falling within the selection criteria for high or very high surface erosion potential and sediment delivery potential are advanced for monitoring. The RRISSC analysis was completed by Pike National Forest Hydrologist, Dana Butler, in conjunction with Wildland Hydrology.

Selected 2010 Projects

First year (2010) projects that met the selection criteria and will have effectiveness monitoring implemented are as follows:

Road or Trail Decommissioning, Closure, Obliteration, or Relocation project type
Eagle Creek- Obliterate 2 miles of trail and revegetate, construct 2 new miles of trail.
Trail Creek- Removal of .5 miles of road prism; create floodplain and revegetate ½ acre.
One Track Mind- Construct 4 miles of new trail.
FR 357.K- Decommission .5 mile of road.
FR 366.AB- Decommission .5 mile of road.

Vegetation Treatment project type
Trout Creek- Rehabilitate old gravel pit near stream; remove sediment, revegetate 1/10 acre of disturbed area, treated for invasive species control.

Ephemeral Channel Stabilization project type
FDR 200B- Obliterate and rehabilitate .7 mile of road within an ephemeral channel.

Monitoring Methods

Monitoring protocols are defined for projects that fall into four general project categories:

1. Road or Trail Decommissioning, Closure, Obliteration, or Relocation
2. Vegetation Treatment
3. Ephemeral Channel Stabilization
4. Instream Restoration and Stabilization

Each of these categories will follow similar monitoring protocols as described below. Within each category, the most appropriate monitoring protocols will be implemented to determine effectiveness of the selected projects.

Road or Trail Decommissioning, Closure, Obliteration, or Relocation

- Restoration of Vegetation. Target 50% vegetative cover

  Prior to initiation of the restoration project, vegetation cover and frequency transects will be established to measure the amount of existing vegetation. The point line transect method will be used within 1m by 1m subplots randomly established within the project area. A minimum of 6 subplots will be established in each project site. This method will provide an accurate estimate of changes in cover for a given area. The plots will be re-measured immediately after the project completion and each year for the three year period to determine if the 50% vegetative cover goal was reached. This method specifically addresses re-vegetation, but this method also may be used if future project objectives include increasing ground cover by other methods (mulching, spreading of slash, addition of rip-rap, etc.).

- Connectivity of road/trail segment to stream network

  Road or trail tread and/or ditches will be inspected to determine if it is directly connected to the stream network via rills, gullies, or sediment plumes. The width, depth, length, and general cross-sectional shape of these features, if present, will be measured. If a large number of features are present within the project area then a subset of the features will be randomly selected for analysis. The survey will be conducted before projects are started, upon completion of each project, and each year for three years thereafter.

- Photo points

  Monumented photo points will be established within each project site. Monuments will consist of rebar or some other semi-permanent locator. The number of photo points will be at least two per site, but may be larger depending on the areal extent of the project site. Each photo point will have the direction and extent of field-of-view documented for simple future repetition. Photo point locations will be recorded using a Trimble GeoXH receiver. Photos will be taken before project work has been started, immediately after project completion, and each year for three years thereafter.

Vegetation Treatment

- Vegetation frequency transects

  These transects will record the areal extent and frequency of occurrence of every species identified in a 40 m transect, following the Daubenmire (ref) method. Twenty sub-plots measuring 20 cm by 50 cm will be recorded in each transect. Transect end-points will be monumented with rebar or some other semi-permanent structure. Two or more transects will be installed in each vegetation treatment site, depending on the area of each site. Transects will be established and measured prior to any vegetation treatment, after the treatment but in the same growing season, and each year for three years thereafter. The yearly repeated measures should occur within 2 weeks of the initial post-treatment measurement so that the same growing stages can be monitored.

- Weed surveys

  100 m transects will be established in each noxious weed treatment area. The occurrence and areal extent of each type of noxious weed (see Colorado state list of noxious weeds) will be recorded. Transects will be established and measured prior to treatment, immediately after and for three subsequent years following project completion.

- Photo points

  Photo points will be included as above, but with smaller field of view, so that vegetation type can be identified.

Ephemeral Channel Stabilization Treatment

- Cross section surveys

  Cross section surveys can quantify local changes in channel morphology such as bank erosion and changes in depth of the channel. Semi-permanent cross sections will be established, monumented, and surveyed in the project reaches. Surveys will be completed with a total station, optical, or laser level. The overall width of the cross section and the distance from the left monument (zero) and the elevation of each change in slope along the cross section will be recorded. All elevations will be relative to an independent semi-permanent monument. Cross section surveys will be conducted before any project work is completed and each year for three years after the completion of the project.

- Longitudinal survey

  Longitudinal surveys can quantify changes in channel profile such as deposition of sediment or incision of nick points. The distance downstream and the elevation relative to a semi-permanent monument of the deepest part of the channel will be measured for each project reach. Longitudinal section surveys will be conducted

before any project work is completed and each year for three years after the completion of the project.

- Pebble count

  Sediment size is an indicator of quality of aquatic habitat and can be used as a coarse surrogate to assess the quantity of sediment transport. Pebble counts will be conducted in each reach of each project. The size of at least 100 pebbles will be measured and recorded. The pebbles will be selected from a bankfull to bankfull zig-zagging transect using methodology by Bevenger and King (ref). The pebble counts will be conducted before any project work has been completed and each year after the completion of the project.

- Riparian vegetative cover transect

  The amount of riparian vegetation is an indicator of riparian health. Vegetative cover will be measured by transects of 1 m by 1m subplots as described above. Cover measurements will be conducted before any treatments are started, after the completion of treatments, and each year for three years thereafter.

- Bank stability survey

  Bank stability is an indicator of riparian health and can be used to identify areas of channel expansion. The Pfankuch-Rosgen Channel Stability Evaluation survey will be conducted for each reach within the project area (ref). This survey attributes a score to 15 different channel characteristics. The survey provides a rapid assessment of given stream reach and allows for a numerical estimation of the reach's overall stability.

- Photo points

  Photos that span the reach of stream where the stabilization project is located will be taken before and immediately after each treatment. Photos spanning the same reach will be repeated each year for three years after completion of the project.

- Structure-specific monitoring

  This method applies to projects that include any in-stream structures, such as check dams, grade stabilizers, in-channel tree felling, or sediment detention basins. The width, depth, length, and slope of the sediment storage capacity above each structure designed to trap sediment will be measured. The channel shape below each structure will be surveyed for scour, and the dimensions of any observed scour will be measured, and the upstream and downstream extents of the scour will be marked on the bank with monuments and a gps. These structures will be surveyed immediately after installation and each year for three years thereafter.

Instream restoration and stabilization

Effectiveness monitoring for instream restoration and stabilization projects is critical to ensure that river restoration is reducing sediment and improving river stability. Effectiveness monitoring for selected projects will follow protocols as set forth in the Watershed Assessment of River Stability and Sediment Supply (WARSSS) manual (Rosgen, 2006). WARSSS outlines effectiveness monitoring, validation monitoring and field methods and procedures for watershed scale restoration projects. Effectiveness monitoring protocols established within WARSSS include:

- Replicate surveys of stream channel cross-sections and longitudinal profiles.
- Annual resurveys of bank pins, bank profiles, and scour chains.
- Annual surveys of bedload and suspended sediment measurements; analysis using the POWERSED model.

The USFS will oversee and implement with RMFI's assistance the monitoring methods outlined in Chapter 6 – (Table 6.1) of the WARSSS manual.

Adapted from Table 6.1

Sediment Source/Process	**Monitoring Procedures**
Streambank Erosion	Bank Profiles (Worksheet 6-2)
	Worksheet 6-3
Sediment Competence/Etrainment	Replicate Annual Survey (Worksheet 6-1)
	Scour Chains (Worksheet 6-4)
	Bedload Sediment Measurement
	Worksheet 6-5 and Worksheet 6-6
Hydraulic Relations/Streamflow	Gage Station Procedure (Worksheet 6-7)
Sediment Supply & Transport Capacity	Replicate Annual Survey (Worksheet 6-1)
	Bedload Sediment Measurement
	Suspended Sediment Measurement
Excess Deposition/Aggradation	Replicate Annual Survey (Worksheet 6-1)
	Compare POWERSED Results with Scour Chain
Channel Incision/Degradation	Replicate Annual Survey (Worksheet 6-1)
	Compare POWERSED Results with Scour Chain
Channel Enlargement	Replicate Annual Survey (Worksheet 6-1)
	Compare Predicted Values to Net Changes in Channel Dimensions (Worksheet 6-8)

Implementation

The Rocky Mountain Field Institute will oversee effectiveness monitoring data collection for all selected project sites that fall under the categories of Road or Trail Decommissioning, Closure, Obliteration, or Relocation, Vegetation Treatment, or Ephemeral Channel Stabilization. The USFS will oversee and implement with RMFI's assistance the monitoring protocols as outlined for Instream Restoration and Stabilization projects (note- no instream restoration or stabilization projects were completed in 2010). Volunteers, student interns, and paid staff under the direction of RMFI will be utilized in data collection. Quality control of collected data will be provided by Dana Butler, Hydrologist, Pike National Forest with assistance by Joe Wagenbrenner, Engineer, Rocky Mountain Research Station. Data will be collected between late April and early November with the timing dependant on monitoring objectives and seasonal accessibility.

Timeframe

Effectiveness monitoring for projects completed in 2010 will be completed by early November, 2010. Additional monitoring will take place on 2010 projects during the 2011 and 2012 field seasons. As new projects are completed in 2011 and 2012, selected projects for monitoring will follow the same three year monitoring timeline as outlined above. Depending on funding, monitoring is anticipated to continue through the summer of 2014. Any instrumentation will be removed at that time.

Application and Dissemination of Research Results

The results of our analysis will be presented at technical conferences throughout the study period. Publication of the results after the first three years of monitoring and at the end of the study is anticipated. The data and results from this study will be combined with those of other, similar studies across the western US and presented in conferences or in publication. Annual briefs of the results will be prepared and presented to National Forest Foundation.

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