Brief updates on MSG Cooperative Instream Monitoring Projects

May 13, 2016

Caspar Creek Watershed Study—Dr. Salli Dymond, USFS PSW

The Caspar Creek Third Experiment Study Plan was approved by the USFS PSW and CAL FIRE on February 17, 2016. The plan was written by Dr. Salli Dymond, USFS PSW post-doctoral Researcher. The overarching goal of the new study is to investigate the effects of stand density reduction on biological, physical, and chemical watershed processes in the South Fork of Caspar Creek. Planning for this experiment began in 2000, with gauges installed in 10 sub-watersheds in 2001, providing 15+ years of pre-treatment streamflow, turbidity, and suspended sediment data. Instead of installing an experiment that uses replicates, a range of treatments will be used, going from 25% reduction in stand density to a 75% reduction. Nine main sub-studies have begun, are in the process of beginning, or are in the process of being developed:

1. *Watershed Resilience and Recovery Study—USFS PSW and CAL FIRE*
2. *Plant-Soil-Water Dynamics Study—USFS PSW (Dr. Salli Dymond)* [document how forest stand density reduction influences hydrologic processes along hillslope transects]
3. *Water Worlds Study—USFS PSW (Dr. Salli Dymond); OSU (Dr. Kevin Bladon); Univ. of Saskatchewan (Dr. Jeff McDonnell)* [improved understanding of how timber harvesting influences the delivery of water from hillslopes to streams and water use of residual trees using stable isotopes]
4. *Bioassessment Study—DFW (Jim Harrington and Dr. Pete Ode)* [determine the effects of contemporary forest practices on macroinvertebrate assemblages and stream nutrients]
5. *Distributed-Hydrology-Soil-Vegetation Model (DHSVM) Study—Cal Poly SLO (Dr. Chris Surfleet)*
6. *Sediment Fingerprinting Study—OSU (Dr. Jeff Hatten*) [document the sources of stream channel sediments using fingerprinting techniques]
7. *Fine Sediment Study—OSU (Dr. Ivan Arismendi*) [contrast fine sediment data from the NF experiment with the 3rd Experiment using two novel statistical techniques]
8. *Road Rehabilitation Study—USFS PSW (Liz Keppeler)* [determine the erosional consequences of legacy road rehabilitation]
9. *Effects of forest stand density reduction on nutrient cycling and nutrient transport—UC Davis (Drs. Randy Dahlgren and Helen Dahlke)* [examine changes in major nutrients and cations/anions across watersheds, hillslopes, riparian zones, and streams]
10. *Caspar Creek Landslide Mapping Study—CGS (Dave Longstreth)* [using LiDAR and other modern georeferenced mapping techniques, CGS will map landslide geomorphology in both the SF and NF of Caspar Creek]

Timber harvesting in the instrumented sub-watersheds will occur in 2018; the matrix area outside of these watersheds will occur in 2017. Some new road construction will be required and will be done in conjunction with the harvesting. The matrix area will be harvested at approximately a 35% stand density reduction. The THP is under development.

Little Creek (Swanton Pacific Ranch)—Dr. Brian Dietterick, Cal Poly State University

A new experiment has been begun in the Little Creek watershed to analyze the spatio-temporal variability of instream community structure within and among varying habitat types along seven stream reaches in the Little Creek watershed. The goal is to develop an assessment method to estimate net ecological benefit of riparian treatments. The result will be a prediction of the ecological benefit that would be associated with implementing a riparian vegetative treatment in North Fork Little Creek watershed. A new CAL FIRE contract with Cal Poly has nearly been finalized to help fund this research.

Specifically, the seven representative study reaches established in Little Creek watershed will aid in understanding relationships between macroinvertebrate community structure and substrate, canopy composition and shading. Macroinvertebrate samples and physical habitat data are collected using the Reachwide Benthos (RWB) procedure described by SWAMP'S Bioassessment protocol. Individual macroinvertebrate specimens are being identified to the family level. Sampling events occur every Spring, Summer, and Fall. The Spring 2016 sampling event will take place June 4th - June 7th. Upcoming tasks include hiring lab assistants to process macroinvertebrate samples, meeting with Dr. John Walker of the Cal Poly Statistics Department to format the project's database, and participating in the poster session at the Society for Freshwater Sciences Annual Meeting in Sacramento on May 23rd.

Railroad Gulch BMP Evaluation Study Update—Nick Harrison, HRC

This study is designed to evaluate the effectiveness of Humboldt Redwood Company's aquatic HCP, the California Forest Practice Rules, and Elk River Watershed Analysis-derived prescriptions in minimizing sediment delivery to watercourses in response to timber harvest activities through the integration of compliance and effectiveness monitoring. A paired watershed format is being used to evaluate sediment loading from road surfaces, watercourse crossings, landslides, Class I channel incision and bank erosion, and tributary channel head-cutting. The study compares the West Branch (1.48 km^2, 365 ac) and the East Branch (1.28 km^2, 314 ac) of Railroad Gulch, a tributary to the Lower South Fork Elk River in Eureka, CA. Forty seven percent of the East Branch will be logged in the summer of 2016 with 80 acres of single tree selection, 45 acres of group selection, and 24 no-cut acres left as buffer strips along Class I and II watercourses. New seasonal road was constructed in the summer of 2015, and existing roadways reopened. No timber operations will occur within the West Branch, which will serve as the study control.

Data have been collected pertinent to the evaluations listed above since 2014 and data collection will continue through 2019. Starting in this month and throughout the summer, road surveys, hillslope and in-stream landslide inventories, cross-sectional surveys, pebble counts, and channel head inspections will be conducted. Analysis is currently underway on data collected during WY 2016. A progress report dated May 10, 2016 covers study objectives, design, and preliminary results from water years 2014 and 2015. Future reports will be submitted annually and will cover results from the previous water year. Dr. Andrew Stubblefield (HSU), PI, provided a presentation on the study at the BOF EMC meeting held on May 16th in Redding, and he will provide a paper on the project at the Coast Redwood

Forest Symposium which will take place in September. CAL FIRE is helping fund this study through a contract with Dr. Stubblefield.

South Fork Wages Creek Cooperative Instream Monitoring Project—Pete Cafferata, CAL FIRE

Background data have been collected for water years 2005 through 2015 in the South Fork Wages Creek, with annual data summaries produced. Due to timber stand age and other factors, the project has not yet had a THP implemented to test the effectiveness of the Forest Practice Rules. In January 2015, Hawthorne Timber Company lands in western Mendocino County, including the South Fork Wages Creek watershed, were sold to Lyme Redwood Forest Company, LLC. Lyme Redwood determined that they would no longer be able to fully fund and complete this THP effectiveness scale monitoring project as originally structured due to their limited funding available for research. CAL FIRE has developed a sole source contract with Lyme Redwood to continue the project and fund the study for data collection through 2020; it is currently in the contract review process.

The overall objective of this monitoring project is to evaluate the relative importance of sediment generated by THP activities, compared to legacy sources and background rates within the South Fork Wages Creek watershed. A before and after control study has been designed and implemented. Turbidity and streamflow monitoring stations have been established at three locations in the watershed. A THP to implement an updated road system in the South Fork Wages Creek watershed was completed in 2014, followed by one over winter period for data collection to document sediment from roads versus timber harvesting.

Due to the ownership change, no monitoring took place in water year 2016 (winter of 2015-2016). This contract, if approved, will enable monitoring to take place in water years 2017 (beginning in October 2016) through water year 2020 (June 2020). A THP will be submitted in 2016 and harvesting will occur during the summer of 2017, ensuring that there will be three years of post-treatment monitoring data collected. The THP will propose logging in the non-control watershed area of the South Fork of Wages Creek. After harvesting is conducted in 2017, suspended sediment and turbidity data will allow conclusions to be drawn regarding the effectiveness of current management practices implemented as part of California's Forest Practice Rules in protecting water quality.

Little River (Humboldt County)—Dr. Lee MacDonald, CSU, and Matt House, GDRCo

Dr. Lee MacDonald, Colorado State University, has undertaken a project with Green Diamond Resource Company (GDRCo) titled "Quantifying Cumulative Watershed Effects Over Time in Two Little River Watersheds, Humboldt County, Northwestern California." The overall goal of the study is to qualitatively and, to the extent possible, quantitatively characterize the relative magnitude and effects of natural and management-related sediment inputs over three different time scales for two ~3,700 (15 km^2) acre sub-watersheds in the 26,000 acre (105 km^2) Little River drainage located north of Arcata. These two watersheds have been selected in part because (1) they are 100% owned by GDRCo; (2) timber harvest records date back to the early 1900s and aerial photos to the early 1940s; (3) a USGS gaging station has operated at the mouth of the Little River watershed since October 1955; (4) they have had relatively high harvest rates by cable and ground-based clearcuts over the last 15-20 years; (5) they have at least ten years of

stream gaging, aquatic habitat, and fisheries data; and (6) their comparatively small size will allow a relatively comprehensive aerial photo and sediment source analysis. To assess the relative impact of natural, legacy, and current sediment sources we are assessing sediment inputs over three time scales: the millennial time scale using 10Beryllium (^{10}Be); the 100+ year time scale using timber harvest records and aerial photos; and the 10-20 year time scale using process-based sediment source studies and the gaging station data.

In terms of work accomplished and planned, ^{10}Be samples were collected at the watershed and sub-watershed scale in May 2015, and the results are expected over the next few months. The historic timber harvest maps have been digitized, and the LiDAR data for the watersheds have been used to delineate the railroad network used for the early logging. The aerial photos also have been analyzed to provide a nearly complete record of timber harvest over time, and the next step is to quantify the skid trail densities from representative harvest units over the different logging cycles. The aerial photos also will be used to identify the number, size, and likely cause of landslides over time, and these data will be combined with the existing landslide inventory to estimate landslide volumes and delivery. A road inventory has been conducted to quantify current road-stream connectivity, and these values will be compared to previous inventories to estimate the changes in road sediment production and delivery over time. Most of the gaging station, aquatic habitat, and fisheries data are already compiled. Deep-seated earthflows are not common, so it should be relatively straightforward to map these from the LiDAR data and then try and estimate the volume being delivered by a combination of remote sensing and field measurements. Streambank landslides have been inventoried, but streambank erosion surveys have not yet been conducted.

The expectation is that most of the historic data should be available by late summer 2016. Once all the historic data have been compiled, we can then begin the process of estimating relative sediment inputs over time from each of the major natural and management-related sources (deep-seated earthflows, soil creep, streambank erosion, railroads, roads, harvest units, and landslides). Data analysis will extend through summer 2017, and the results should be written up for publication in late 2017. We expect that the data compiled for these two watersheds can be extrapolated in a relative sense to other watersheds to provide a more rapid index of legacy effects over time, and possibly in an absolute sense to geologically-similar watersheds. CAL FIRE is helping fund this study.

Judd Creek Cooperative Instream Monitoring Project—Dr. Cajun James, SPI

All field work and data analysis for the first phase of the Judd Creek Watershed Study has been completed. Ten years of water quality data collection, sediment budget, and particulate organic matter (POM) work have been completed. Continuous monitoring is ongoing in Judd Creek.

A final report and peer reviewed paper will be finished in the latter part of 2016. The Judd Creek data will be included with data from eight other watersheds where sediment budgets, turbidity monitoring, and POM analysis have been completed. All of these watersheds had active timber operations occur over the last two decades. Results of this work show water quality conditions over the last two decades where logging has occurred under the California Forest Practice Rules.