Monitoring Study Group Meeting Minutes

June 13, 2012
Judd Creek Experimental Watershed
Red Bluff, California

The following people attended the MSG meeting: George Gentry (BOF—MSG Chair), Dr. Lee MacDonald (CSU), Dr. Michael Wopat (CGS), Dennis Hall (CAL FIRE), Brook Darley (CAL FIRE), Stacy Stanish (DFG), Bill Short (CGS), Ed Struffenegger (CLFA), Bruce Beck (CAL FIRE), Gabe Schultz (CAL FIRE), Shane Cunningham (CAL FIRE), Mike Tadlock (CTM), Ted James (SPI), Dr. Cajun James (SPI), Mike Mitzel (SPI), Steve DeBonis (SPI), Matt Boone (CVRWQCB), Drew Coe (CVRWQCB), Angela Wilson (CVRWQCB), Adam Wyman (CAL FIRE), Chuck Schoendienst (CAL FIRE), Duane Shintaku (CAL FIRE), Mike Miles (BOF), Dave Manthone (HRC), Maggie Robinson (NCRWQCB), Rich Klug (Roseburg Resources), Andrew Yarusso (DFG), Dr. Helge Eng (CAL FIRE), Clay Brandow (CAL FIRE), Don Lindsay (CGS), Davis Crane (student), Herb Baldwin (SPI), Scott Carnegie (WM Beaty and Associates), Gabriel Sosa (CSU), Dr. Tuğrul Varol (Bartin Univ. (Turkey)/CSU), Mike Laing (NCCFFF), and Pete Cafferata (CAL FIRE).

Background Information

The purpose of this MSG field meeting was to view and discuss the Judd Creek Cooperative Instream Monitoring Project, including observation of field instrumentation, logging units, reforestation sites, road and crossing improvement work, and hillslope sediment monitoring sites. The Judd Creek study is a cooperative project between Sierra Pacific Industries (SPI) and the California Department of Forestry and Fire Protection (CAL FIRE), which was formalized in a Memorandum of Understanding (MOU) signed by both entities in 2005. As stated in that document, the primary goal of the project is to determine the impacts of clearcut silvicultural treatment, road construction, and road rehabilitation work associated with a single Timber Harvesting Plan (THP) on water quality (i.e., a THP-scale effectiveness monitoring project). A companion THP-scale effectiveness monitoring project is located in South Fork Wages Creek in western Mendocino County (Campbell Timberland Management and CAL FIRE).[1] The Judd Creek study plan written in 2004 is posted at the following website: http://www.bof.fire.ca.gov/board_committees/monitoring_study_group/msg_archived_documents/msg_archived_documents_/judd_creek_final_prospectus_msg_maps.pdf.
The meeting consisted of six stops, which are described below.

Stop 1. Little Giant Mill Road Fuel Break

The purpose of this stop was to describe the fuel break work being undertaken to reduce the risk of catastrophic wildfire in the watershed, as well as to introduce the Judd Creek cooperative monitoring project and supply background information regarding the study. Adam Wyman, CAL FIRE, explained that 4.5 miles of fuel break have been built from Highway 36 with federal grant funds, coordinated through the very active Tehama County Fire Safe Council (Figure 1). SPI is a major cooperator in the fuel break construction and there is an eventual goal of 15 miles. Field work is accomplished with crews from the nearby Ishi Conservation Camp. Fuel breaks are 300 feet wide (150 ft on each side of the road).

[1] Additional BOF/CAL FIRE cooperative instream monitoring projects include: Caspar Creek watershed study (USFS PSW and CAL FIRE), Little Creek watershed study (Cal Poly SLO/Swanton Pacific Ranch, CAL FIRE, and others), and the Garcia Cooperative Instream Monitoring Project (MCRCD and CAL FIRE—through 2006).

Slash is burned in piles, with trees cut up to 10 inches in diameter. SPI has supplemented this work, removing some merchantable trees larger than 10 inches as part of THPs, and also providing fuel break maintenance.

Drs. Cajun James and Lee MacDonald introduced the Judd Creek project. The basin was first logged beginning in the 1880's, with no harvesting occurring from 1917 to the 1950's. Dr. James provided a history of watershed research in this area, stating that her early studies were undertaken in Millseat Creek, and then later in the Judd Creek basin at the Southern Exposure research site as part of her Ph.D. work at UC Berkeley. The BOF granted experimental status to Judd Creek to allow canopy levels to be reduced below standard Forest Practice Rule (FPR) requirements to test impacts on water temperature and riparian microclimate. This site expanded into the Judd Creek cooperative instream monitoring project in 2004 with the BOF and CAL FIRE, and the Engebretsen THP (2-04-084-TEH) was developed with 41 clearcut units (each ~20 ac) to test the effectiveness of the FPRs. The study watershed has a drainage area (DA) of 4,344 ac (the planning watershed DA is 6,388 ac). Five monitoring stations record flow, turbidity, suspended sediment concentration (SSC), water temperature, and other parameters to document potential timber operations impacts. Past work includes a detailed sediment budget and a large wood inventory in the watershed, both completed by Dr. Lee Benda and Associates. Dr. Benda determined that the largest sediment sources over a long time frame are post-fire erosion and bank erosion.

Dr. MacDonald briefly summarized the Engebretsen THP history, with all the road work completed in 2007 and the clearcut units harvested in 2009 (Figure 2). The units were then mechanically ripped to alleviate soil compaction and planted with conifer seedlings. He became associated with the study in 2011 and added a hillslope monitoring component to document sediment source areas from disturbed areas (harvest units, roads, skid trails, and landings) and explain turbidity/SSC levels observed at the monitoring stations. Ten harvest units were evaluated, along with 43 landings, all WLPZs below harvest units, and a stratified random survey of 14.5 miles of roads. Thirty sediment fences were installed to document road sediment production rates, which will then be compared to estimates from models such as WEPP and SEDMODL2. The sediment fences have yet to emptied and the material weighed after the winter of 2011-2012.

Stop 2. Engebretsen THP Harvest Unit 327

At this stop, Dr. Michael Wopat, CGS, and Dr. MacDonald briefly summarized the geology and soils of the Judd Creek watershed (Figure 3). Approximately two-thirds of the basin has Cohasset clay loam soils formed from the Tuscan Formation (volcanic).[2] The remainder is primarily composed of the Salminas soil series, developed from basaltic igneous parent material (andesite). Slopes range from 0 to 35%. Elevations range from 3,180 ft to 5,520 ft and the watershed is within the rain-on-snow zone. The January 1997 flood event had a major impact in the basin (~40-60 year return interval event in the nearby Mill and Deer Creek basins).

Dr. MacDonald explained that transects were installed on 10 of the steeper Engebretsen THP clearcut units to document ground cover and erosion features. No rills (defined as 5 cm deep and 10 m long) were observed in any of the units, largely due to mechanical ripping on contours and the high infiltration capacities of the soils. Average bare soil from the transects was approximately 10%, with litter covering almost half of the units (the remainder was

[2] These are older volcanic flows than are found in the Battle Creek watershed to the north.

covered by live vegetation, wood, and rock). Very little evidence of sediment delivery to watercourse channels was observed, similar to published work conducted in the Sierra Nevada (Litschert and MacDonald 2009) and the results reported by the Battle Creek Interagency Task Force in 2011.

The group then examined a landing used for Unit 327 that had been chip mulched. Trees were whole-tree harvested and skidded to landings, where they were delimbed and cut to length. Slash was chipped and loaded onto chip trucks, with residual chips scattered on most of the landings (31 of 44). Dr. MacDonald explained that past fire research has shown that when 65-70% or more of the soil is exposed, erosion problems are much more likely to occur. Of the 44 landings evaluated, three rills were documented and large differences in erosion between chipped and unchipped landings were not evident. Eight drainage features (rills or sediment plumes) were observed draining from landings, but the longest was only 23.5 m and none of these were connected to streams. Finally at this site, one of the 30 sediment fences was observed (Figure 4). Current sediment loading at this sediment fence was estimated to be 70-80 lbs, with actual documentation of dry weight to occur this summer. Sediment fences are relatively inexpensive to construct and provide quantitative documentation of sediment yields from small, well defined, drainage basins. Sediment fences are increasingly being used to quantify road and hillslope erosion rates in the western United States, the Caribbean, and other countries.

Stop 3. Upper Judd Creek Crossing No. 29 Ford/Road Abandonment

At the upper end of the Judd Creek watershed, the group observed a site where a 40 inch corrugated metal pipe (CMP) was pulled as part of the THP road work completed in 2007. Steve DeBonis, SPI, explained that this pipe had been overtopped in January 1997 and the site would have required a very large culvert to accommodate the 100 yr flood. Instead, ~80 cubic yards of fill was removed and a rock ford crossing was installed (Figure 5). In total, 1.3 miles of riparian road was abandoned as part of this THP and two main crossings were removed and replaced with fords. At this location, Judd Creek is a Class II watercourse that does not flow in the summer. While a bridge or a pipe arch could have been installed, Mr. DeBonis explained that a rock ford crossing made sense here due to: (1) the flow regime present, (2) the crossing topography, and (3) the lack of required maintenance.

Stop 4. Engebretsen THP Harvest Unit 340 (Vista/Lunch)

This stop provided a vista for lunch, as well as an opportunity for Dr. MacDonald to explain data collected to date from the road inventory work that has taken place in the Judd Creek watershed (Figure 6). In general, past studies have shown that road gradient (slope) times segment drainage area (A) provides a good prediction of road surface erosion. Sediment fence data, when available, will be tested against predictions from the WEPP and SEDMODL2 models. The majority of the Judd Creek roads are seasonal roads that are not surfaced, with a road density of approximately 7 mi/mi^2. The road survey was conducted as a stratified random sample of seasonal and permanent roads, and then stratified into roads that were less than 200 feet away from a watercourse or more than 200 feet away from a watercourse. The permanent roads were more intensively sampled because they were much fewer in number, while the roads within 200 feet of a watercourse were more intensively sampled due to their greater likelihood of being connected to a stream. Detailed surveys were also conducted for all of the new roads and all of the closed (abandoned) roads to determine the net effect on road sediment production and delivery. The data from the road segments draining into sediment fences are being compared to data from the detailed road inventory work (e.g., segment width, length, gradient, bare soil, etc.) to determine how representative the sediment fence data are to the overall population. Seasonal roads within 200 ft of the channel were found to be approximately 20% hydrologically connected, while those greater than 200 feet from the channel were only about 5% connected (for an overall fairly low connectivity). The preliminary results of the road survey indicate that only about 7 percent of the length of the new roads was connected to a stream as compared to about 28 percent for the closed roads.

Stop 5. Lower Judd Creek Crossing No. 2 Ford

Steve DeBonis explained that two 48 inch CMPs were removed from this site in the lower part of Judd Creek. A rock ford crossing was then installed as part of the THP (Figure 7). Approximately 500 cubic yards of fill was removed to construct gentle approaches to the crossing site. Judd Creek is a Class I watercourse at this crossing and flows year round. Mr. DeBonis explained that this road segment is not part of the main SPI haul route and that the company does not drive log trucks through this crossing. If it were needed for truck traffic, a temporary crossing (pipe or bridge) could easily be installed. No maintenance has been required in the five years since the rock ford crossing was installed. A vented ford may be another alternative for this site, provided that adequate fish passage could be provided.

Stop 6. Southern Exposure Montana Flume, Monitoring Station

The final stop was to the lowest unit harvested under the Southern Exposure THP in 2000 and 2001. First the group visited the lowest of the five Montana flumes installed along Judd Creek in 2005 to more accurately measure flows at or near the water quality monitoring stations (Figure 8).[3] Dr. James showed the various types of instruments used at the monitoring station located a few hundred feet upstream from the Montana flume site, including the YSI multi-sensor Sonde and ISCO pump sampler, as well as canopy measurement tools.

Dr. James and Ted James explained the harvesting sequence used for the experimental design developed to examine canopy removal effects on water temperature and riparian microclimate in 2000/2001 (Figures 9 and 10). Buffer strips with widths of 175 ft were thinned to 50% overstory canopy, then 100 ft strips were thinned to 50% overstory canopy, followed by 50 ft widths thinned to 50% overstory canopy, and finally lowered to 0 ft with only merchantable timber removed, with the impacts studied at each stage. A few large trees were left along the bank for bank stability and wood recruitment. Fifty percent overstory canopy equated to approximately 80-85% angular canopy density. Buffer strips were found to either maintain stable water temperature patterns or minimize increases in daily maximum temperatures (less than 2°C), although the merchantable clearcut to the edge of the bank had 2.4°C increases**.** Greater cooling was observed in the controls below the units with the greatest heating. Monthly maximum water temperatures did not exceed 21.1°C before or after harvest and yearly average water temperature did not exceed 18.2°C before or after harvest. Canopy cover was shown to be increasing in recent years as vegetation grows back (Figure 11).

In terms of sediment and turbidity, mean hourly data has revealed occasional turbidity spikes up to 500-600 NTUs. Analysis of the data, however, shows that turbidity values of over 25 NTUs do not last for long time periods (generally 2-6 hrs). Preliminary data analyses show

[3] Mr. Rand Eads, RiverMetrics, assisted with the design and installation of the Montana flumes.

that only 7 days out of 10 yrs had >24 hrs with turbidity values >25 NTU. The highest turbidity values are generally reported immediately below Turner Meadow (a large inholding within the Judd Creek basin). Preliminary annual suspended sediment yields were displayed for water years 2001-2012. Data ranged from <1 to ~7.5 tonnes/km^2 and there was no clear signal from roading work in completed 2007 or timber harvesting undertaken in 2009. Higher sediment yields appear to be much more strongly related to annual precipitation values. Dr. MacDonald and Dr. James are planning to present the results of this study at the AGU Fall Meeting in San Francisco in December, and submit a manuscript for publication in a peer-reviewed journal in late 2012 or early 2013.

Next Monitoring Study Group Meeting Date

The next MSG meeting date was tentatively planned for September 2012, with the location to be determined. When a definite date, venue, and agenda are available, this information will be emailed to the MSG contact list.

Figure 1. Fuel break constructed along Little Giant Mill Road.

Figure 2. Dr. Lee MacDonald provides background information on the Judd Creek watershed. Also shown are Bruce Beck, Dr. Cajun James, and Ted James.

Figure 3. Dr. Lee MacDonald shows a map of Judd Creek and summarizes soil data for the Judd Creek watershed, while standing in Engebretsen clearcut no. 327. Also shown are Ted James and Dr. Cajun James.

Figure 4. Dr. Lee MacDonald explains the design and construction of a sediment fence constructed on a steep skid trail leading from Engebretsen THP unit no. 327 to the landing used in 2009.

Figure 5. The rock ford crossing constructed when a 40 inch CMP was removed from upper Judd Creek.

Figure 6. Dr. Lee MacDonald explains road inventory data collected from the Judd Creek watershed.

Figure 7. The lower Judd Creek watershed rock ford crossing constructed when two 48 inch CMPs were removed from this site.

Figure 8. The lower Judd Creek Montana flume installed for accurately measuring stream discharge near the water quality monitoring station located a few hundred feet upstream.

Figure 9. Dr. Cajun James and Ted James explain the original Southern Exposure research project and THP that documented impacts of varying levels of buffer strip removal on water temperature and riparian microclimate.

Figure 10. The group assembled at the Montana flume site.

Figure 11. Southern Exposure THP unit logged in 2001.