Project Number: EMC-2017-003 - August 2, 2017
Project Name: Intensive Road Effectiveness Monitoring for the Caspar Creek Third Experiment

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1. Background and Justification:

This project proposes to conduct intensive field monitoring to rigorously quantify sediment discharge from a range of hydrologically connected road segments that have been treated to minimize "significant sediment discharge." Sediment discharge and flow from treated connected road segments (i.e., the remaining portion of the road network that could not be fully disconnected but have been treated for erosion control) will be measured. Frequent sampling over time and space will provide data on "significant sediment discharges," as defined by the California Forest Practice Rules (FPRs).

The project specifically relates to 14 CCR § 923 (943, 963) and Technical Rule Addendum #5 of the FPRs. It also relates to EMC Critical Question/Priority, Section 2.3, Theme 3 of the Effectiveness Monitoring Committee (EMC) Strategic Plan. Specifically, are the FPRs and associated regulations effective in:

(a) reducing or minimizing management-related generation of sediment and delivery to watercourse channels.
(b) reducing generation and sediment delivery to watercourse channels when timber operations implement the Road Rules 2013 measures.

This project will complement EMC-2015-004 (Road Rules--Effectiveness of reducing hydrologic disconnection and road surface erosion), which is a broad, regional scale assessment of road hydrologic connectivity and erosion potential before-and-after road rule implementation to assess the effectiveness in achieving rule-mandated hydrologic disconnection and reduction of "significant sediment discharges." Combined, these two projects provide a strategy to evaluate road performance on non-federal forestlands regulated by the California Forest Practice Act and Rules. This new process-based evaluation of the effectiveness of the Road Rules is vital for fully assessing the overall performance of the California Forest Practice Rules.

2. Objective(s) and Scope:

The objectives of the Intensive Road Effectiveness Monitoring Project are to:

- Determine the watershed scale effectiveness of the road-related Forest Practice Rules in preventing significant sediment discharges and runoff increases that might adversely impact water quality.
- Collect road segment runoff and suspended sediment information to calibrate Distributed Hydrology Soil Vegetation Model (DHSVM).

While this project is nested within the Third Caspar Creek experiment, the multiscale process-based understanding of road-to-watercourse interactions derived from this study can provide useful insight for all Forest Practice Districts.

3. General Approach

We propose to conduct this research-level monitoring study in South Fork Caspar Creek as part of the Third Experiment. Using a nested sampling approach in this heavily instrumented watershed will provide a link between discharge and sediment concentration from road segments (i.e., the road sediment signal) and water quality conditions in the downstream direction. The nested biological portion of the third experiment (i.e., BMI and fish monitoring) can inform us about possible beneficial use impairment, allowing us the potential to explicitly link road performance to water quality requirements. Additionally, the road erosion field data will be coupled with the DHSVM simulations already funded for the Third Experiment (Surfleet et al., 2011).[1] This study will support DHSVM simulations and improve model performance. DHSVM modeling combined with road storm sediment relationships will quantify surface erosion at road discharge points.

A pilot project is proposed for the winter of 2017/18 to define a more precise methodology. The options for road sediment data collection include (1) grab samples at outlet of road flumes (Figure 1), (2) grab samples above and below watercourse crossings, (3) utilizing a catchment device in conjunction with the road flume (e.g. silt fence, silt sock, other), (4) pumping sampler at a flume, or possibly (5) turbidity threshold sampling (TTS) at the flume. The selected method(s) will be implemented more broadly during the winter of 2018/19 in the South Fork.

[1] Evaluation of Hydrologic and Water Quality Changes Associated with Differing Silvicultural Treatments, Road Practices, and Riparian Buffer Strip Design Implemented under the California Forest Practice Rules using the Distributed Hydrology Soil Vegetation Model (DHSVM) at the Caspar Creek Experimental Watersheds). CAL FIRE contract with Cal Poly State University.

Figure 1. A circular flume with stage recorder to capture continuous runoff. Grab samples can be collected to generate a sediment rating curve. Photo provided by Dr. Chris Surfleet, Cal Poly-SLO.

Questions to be answered by this project may include:

- What is the road segment and road network scale contribution to sediment load at various watershed scales?
- What is the road segment and road network scale contribution to storm runoff volume, runoff timing and runoff peaks at various watershed scales?
- Using DHSVM, what are the hydrogeomorphic effects of the road network under different road densities, road locations, and under different road treatment scenarios (e.g., high versus low hydrologic connectivity)?

4. Proposal Collaborators

Collaborators include: Dr. Christopher Surfleet, Cal Poly State University, San Luis Obispo ; Pete Cafferata, Drew Coe, Will Olsen, and Lynn Webb, CAL FIRE; Dr. Joe Wagenbrenner and Liz Keppeler, US Forest Service Pacific Southwest Research Station.

5. Timeline

Data collection will begin in December of 2017, with data collection ending in the spring of 2019. Results of the study will be written as a report and/or manuscript by December 31, 2019.

6. Existing or Needed Funding:

EMC monies are requested to fund the salary and benefits for a CAL FIRE Forestry Aide for 13 months over two winter seasons (i.e., Water Years 2017-2018 and 2018-2019). Approximate cost for salary and benefits will be $52,000 over two years (approximately $4,000/month with benefits). Depending upon the results of the initial pilot, and expected $20,000 will be needed for additional sampling equipment (e.g., ISCO samplers and lab costs for sediment analysis. Total approximate cost will be $72,000.

7. References

Storck, P., Bowling, L., Wetherbee, P. and Lettenmaier, D., 1998. Application of a GIS-based distributed hydrology model for prediction of forest harvest effects on peak stream flow in the Pacific Northwest. *Hydrological Processes*, *12*(6), pp.889-904.

Surfleet, C.G., Skaugset III, A.E. and Meadows, M.W., 2011. Road runoff and sediment sampling for determining road sediment yield at the watershed scale. *Canadian journal of forest research*, *41*(10), pp.1970-1980.