Project Number: EMC-2017-xxx
Project Name: Effects of Forest Stand Density Reduction on Nutrient Cycling and Nutrient Transport at the Caspar Creek Experimental Watershed

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Background and Justification: Forest management strategies, and forest harvesting in particular, are often implicated as having adverse effects on nutrient cycling, sediment transport and hydrological processes in forested watersheds. This study will examine changes in major nutrients across sub-watersheds harvested with varying levels of stand density reduction in the South Fork of Caspar Creek. A range of treatments will be used, going from 25% reduction to a 75% reduction. Six research watersheds will be harvested in 2018 at a rate of 25, 35, 45, 55, 65, and 75% reduction in leaf area, while two watersheds will be established as long-term controls. The overarching objective of the third experiment is to quantify the influence of multi-aged sylvicultural systems on physical, chemical, and biological watershed processes. This experiment in the Caspar Creek watershed will result in a systematic understanding of the connection between forest canopy removal and watershed processes that can be used to develop sound management practices in similar Coast Range watersheds in the future. For an overview of the Third Experiment, see the PowerPoint presentation provided to the EMC in February 2016 by Dr. Salli Dymond:
http://www.bof.fire.ca.gov/board_committees/effectiveness_monitoring_committee_/feb_2016_emc/emc_4.0_presentation_by_salli_dymond_casper_creek_02_24_16.pdf

This project is part of suite of sub-studies collectively known as the Third Experiment at Caspar Creek. The other sub-studies include the watershed resilience and recovery study, plant-soil-water dynamics study, Water Worlds study, bioassessment study, DHSVM (Distributed Hydrology Soil Vegetation Model) study, sediment fingerprinting study, fine sediment study, road rehabilitation study, and landslide mapping study. This work complements what is being learned through implementation of several of these sub-studies in the South Fork, including the plant-soil-water dynamics, the Water Worlds, sediment fingerprinting, and bioassessment studies (all currently funded). The response of biogeochemical processes to disturbance may also provide useful information when evaluating the impacts of emerging land uses, such as cannabis cultivation.

Objective(s) and Scope:

Specifically, the goal of this research is to examine how forest harvesting affects ecohydrological/ biogeochemical processes and nutrient cycling within the South Fork of Caspar Creek. The proposed nutrient research will investigate the following objectives:

1) Determine the effect of stand density reduction on stream water and soil water solute concentrations and nutrient cycling during storm flow and baseflow conditions prior to and post-harvest in the South Fork Caspar Creek watershed. [note that pre-logging water samples are currently being analyzed at UC Davis]

2) Compare nutrient export between harvested and reference sub-watersheds in the South Fork watershed.

3) Investigate the effect of forest canopy removal (i.e., the change in leaf-area-index as a result of different levels of stand density reduction) on ecohydrological and biogeochemical processes to better understand how light is influencing water and nutrient budgets.

FPRs and regulations: 14 CCR § 916.9 (936.9, 956.9)(a)(7)(b); TRA#2

EMC Critical Question or Priority: See Section 2.3, Theme 1
Are the FPRs and associated regulations effective in …
(d) retaining of conifer and deciduous species to maintain or restore riparian shade, maintaining or restoring water temperature, and maintaining or restoring primary productivity?
(e) maintaining or restoring input of organic matter to maintain or restore primary productivity as measured by macroinvertebrate assemblages?

Study linkages to (d) and (e): Numerous references in the literature describe the relationship between primary productivity and nutrient cycling, and the effects of nutrient cycling on long-term forest productivity (Johnson et al. 1982). The literatures provides evidence that nutrient leaching into forested streams can impact algal growth and macroinvertebrate assemblages.

Collaborators: UC Davis, CAL FIRE, US Forest Service Pacific Southwest Research Station

Existing or Needed Funding: EMC funding requested. Partial funding received from the Save the Redwoods League (sufficient for one year of the study).

Timeline and Fiscal year (s): Pre-project data are currently being collected (baseline data prior to timber harvesting); field work is being conducted by the USFS PSW, laboratory work is being conducted and funded by UC Davis.
Project funding required for years 2017-2020 (amount TBD).

Submitted by Pete Cafferata, 02/28/17