The Final Newsletter from the SNAMP Water Science Team - Volume 8, Number 5, September 2015

This newsletter shares the results of 8 years, 2008 – 2013, of water research by the Sierra Nevada Adaptive Management Project on the effects of fuel treatments /forest thinnings on water quantity and quality at two project sites in the Sierra; Last Chance in the Tahoe National Forest and Sugar Pine in the Sierra National Forest.

the Sierra Nevada *Adaptive Management* newsletter

Water Team Measurements

The SNAMP Water Team took water quantity and quality measurements in 4 small forested watersheds before and after fuels reduction projects, called SPLATs, short for strategically placed landscape area treatments. They then used that data to model the changes those treatments created in the forest and its water system. Changes in forest structure were determined by differences in Leaf Area Index (LAI), overstory canopy cover, and understory shrub cover. These changes were further compared, with the help of the SNAMP fire modeling team, to the effects of a wildfire on the water supply within the forest; a growing concern in California.

The Regional Hydro-Ecological Simulation System (RHESSys) model used was calibrated using observations of climate, snow, soil moisture, and stream discharge for three pre-treatment years (2010-2012), which encompassed wet, average, and dry precipitation conditions. The successful headwater calibrations were then upscaled to the larger fireshed scale, based on hydrologic similarities between catchments, to look at water in the Sierra from a larger perspective.

Water Quantity Results

Fuel Treatment Effects at 2 sites	Changes in Leaf Area Index (LAI) (measured)	Changes in water runoff (modeled)	Changes in vegetation from fire (modeled)	Changes in vegetation with SPLATs + fire (modeled)	Changes in runoff from fire alone (modeled)	Changes in runoff with SPLATs + fire (modeled)
Last Chance	-8%	+12%	-50%	-38%	+67%	+55%
Sugar Pine	-8%	+3%	-43%	-39%	+15%	+13%

Vegetation modeling showed that after 10 years, the regrowth of plants decreased runoff to pre-treatment levels. Though high-intensity fires result in greater vegetation reductions and

increased runoff, these results did not specifically address water quality issues related to wildfires caused by soil erosion into the stream channel, hydrophobic soils, and elevated snowmelt rates.

The difference in the two study area responses can largely be attributed to the differences in average precipitation rates during the study period, 78.3 in/yr in Last Chance and 51.3 in/yr in Sugar Pine. Changes in vegetation at Sugar Pine had minimal effect on annual evapotranspiration (ET) rates, suggesting the forest is more water-limited than at Last Chance, where changes in ET were more closely linked to forest density.

Water Quality Results

Pre and post project water quality measurements were made to assess whether treatments could affect aquatic life and downstream water resources. These headwater streams lack sources for chemical pollutants, so sediment was the main water quality parameter of concern. Water quality measurements included temperature, conductivity, turbidity, and dissolved oxygen recorded at 15-minute intervals using continuous recording sensors from water year (WY) 2010 to 2013 in all four watersheds (a treated and untreated at each site). Additional grab samples were collected and analyzed on a bi-weekly to bi-monthly basis for major ion and stable isotope chemistry. Movement of channel bed material was measured at 15-min. intervals using load cell pressure sensors during water years 2012 to 2014.

Water chemistry sonde in creek near fuel treatments in Sugar Pine, CA.

Water chemistry and turbidity data show a drought signal for WY 2012 and 2013. **All water chemistry parameters were found to be within healthy ranges for aquatic life with the exception of dissolved oxygen values during dry years** when stream flow was intermittent. Water temperature, conductivity, and major ion concentrations were higher in the 2012 concurrent- and 2013 post-treatment water years however, these were dry years and these **patterns are typical of drought conditions**. The observed timing of turbidity versus peak discharge indicates that **sediment came from localized in-channel sources**. Data also indicate periods of accumulation and depletion were tied to high and low flows. Channel bed movement data implies that it acted as temporary storage for sediment, but that it remained stable over time.

Rebuilding Duncan Peak meteorological tower following the American Fire.

Conclusions

The Water Team concluded that the fuels reduction treatments as implemented at both sites were not intensive enough to show an increase in discharge during a low precipitation year and thus no detectable effect on turbidity was seen. For more information on this water chapter and those of the other 5 teams, please see: http://snamp.cnr.berkeley.edu/snamp-final-report/.

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