

4.32) The Effects of Prescribed Burning on Stream Water Chemistry at Different Spatial and Temporal Scales

-Andi Heard and Dr. John Stednick, Colorado State University, Fort Collins, CO

INTRODUCTION

This research will investigate the effects of prescribed burning on stream water chemistry at different spatial and temporal scales in the East Fork of the Kaweah River in Sequoia National Park, California. Pre- and post fire concentrations of sulfate, nitrate, orthophosphate, chloride, calcium, magnesium, potassium, and sodium will be analyzed and pH, specific conductivity, alkalinity and temperature will be measured. To investigate the potential effects of prescribed fire at different scales these constituents will be measured in large (i.e. 20,000 ha) and small (i.e. 100 ha) catchments treated with prescribed fire over the past several years. This study will test the hypothesis that changes in stream water chemistry as a result of prescribed burning will be the same at different spatial and temporal scales.

Federal agencies are using prescribed burning as a tool to reduce fuel loads and restore ecological integrity in forests. In order to establish objectives for prescribed fire programs and methods to monitor if these objectives are met, a better understanding of the effects of fire and fire exclusion on forested watersheds is needed (Dissmeyer 2000). This study will provide a further understanding of how prescribed burning may be affecting stream water chemistry in Sequoia National Park. The results of this study will be useful in determining what water quality parameters may be included in a monitoring program and the most effective scale at which these parameters may be monitored.

OBJECTIVES

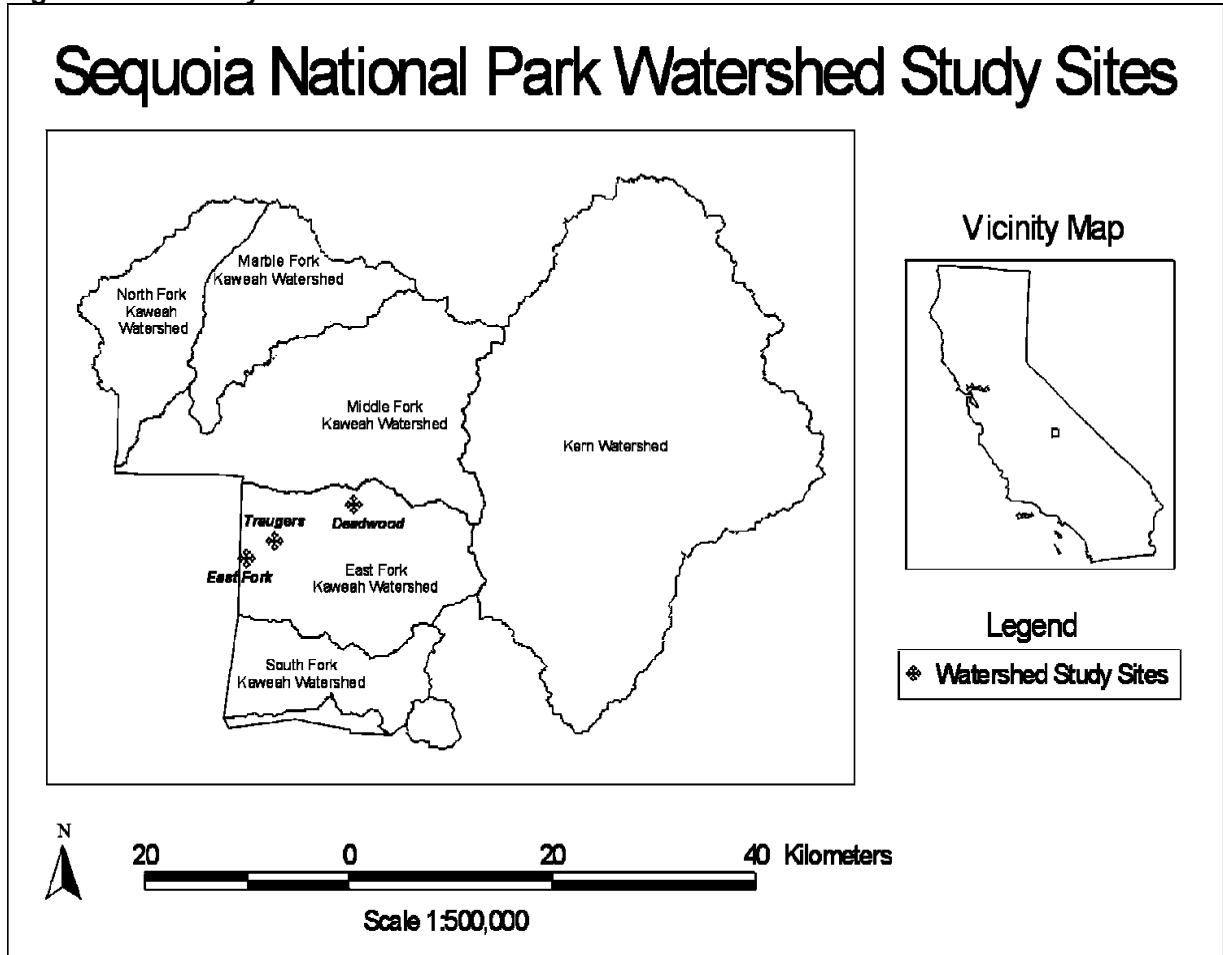
There are three study objectives. The first objective is to quantify any change in the precipitation-runoff relationship following the fire. The second objective is to quantify any change in solute concentrations and export. The third objective is to determine if the water quality responses of each constituent at different spatial scales are statistically different.

STUDY SITES

The research will be conducted in the East Fork of the Kaweah River in Sequoia National Park in conjunction with the Mineral King Risk Reduction Project. In an effort to look at the effects prescribed fire has at the landscape-scale versus in a small first order watershed, sampling will be conducted at three sites: East Fork of the Kaweah River (20,000 ha catchment), Trauger's Creek (106 ha catchment) and Deadwood Creek (100 ha catchment). Trauger's Creek is a transition zone between the chaparral-hardwood zone and the mixed conifer zone and the elevation ranges from 1390 m to 1970 m. Deadwood Creek is in a sequoia mixed-conifer zone and the elevation ranges from 1985 m to 2660 m (Caprio 1999) (Figure 4.32-1).

Prescribed burning in the East Fork has been occurring since 1995. Deadwood Creek was partially burned in December of 1999. Trauger's and Deadwood are scheduled to be burned in the summer or fall of 2001. Hydrology and water chemistry data have been collected at the three sites since 1996.

Figure 4.32-1: Study sites



modified from Caprio 1999)

SUMMARY OF METHODS

Stream water stage will be continuously measured using Global Water dataloggers and pressure transducers at Trauger's and Deadwood Creek. A stage-discharge rating curve has already been established for both sites. Southern California Edison measures discharge data for the East Fork Kaweah River.

Daily precipitation amounts for the East Fork drainage are available from the National Park Service and Army Corps. of Engineers.

Stream water grab samples for chemical analysis will be collected at all three sites. The sampling schedule will be dependent on changes in the hydrographs and the timing of the prescribed fires. Routine sampling will occur at least twice a month for each site. In order to capture the stream chemistry at different stages of the hydrograph, additional samples will be collected during storm events and periods of snowmelt runoff.

Temperature and conductivity will be measured in the field at the time of sampling. Specific conductivity, pH and alkalinity will be measured at the Ash Mountain Water Lab in Sequoia National Park. Samples will be filtered in the lab with a 0.45 μ membrane. The samples will be shipped to the US

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Forest Service Rocky Mountain Experiment Station in Fort Collins, Colorado for analysis of sulfate, nitrate, orthophosphate, chloride, calcium, magnesium, potassium and sodium.

The total monthly and annual export of the constituents will be determined for each site. This will be accomplished by calculating volume weighted means (VWM) for each constituent.

The total export and mean solute concentrations will be compared between the East Fork, Trauger's and Deadwood Creek in order to determine if the magnitude of the post-fire response for sulfate, nitrate, orthophosphate, chloride, calcium, magnesium, potassium, sodium, pH, conductivity, temperature and alkalinity are the same at different spatial and temporal scales.

PROJECT TIMELINE

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Season	Year	Phase
Winter	2001	Begin intensive winter and post-burn water sampling
Summer/Fall	2001	Trauger's and Deadwood Creek scheduled to be burned
		Less intensive sampling and complete pre-burn analysis
Winter	2002	Intensive winter and post-burn sampling period
Spring	2002	Continue intensive post-burn sampling period through snowmelt
Summer/Fall	2002	Analyze data, complete thesis and submit an article for publication

REFERENCES

Caprio, A.C. 1999 Annual Fire Report on Research, Monitoring, and Inventory. National Park Service, Three Rivers, CA.

Dissmeyer, G.E. 2000. Drinking water from forests and grasslands: a synthesis of the scientific literature. Gen. Tech. Report SRS-39, U.S. Department of Agriculture: Forest Service.