

## Project Overview: Kings River Experimental Watersheds

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Yosemite toad with tracking device.



Meadow at Bull Creek site.



Stream invertebrate which are the larvae of adult insects.

### Years of Treatments

Site	Pre-treatment Period	Treatment	Year of Treatment	Post-treatment Period Start
Providence	WY2003-WY2012	Thin	Summer 2012	WY2013
		Burn	Pending Spring 2016	None
Bull	WY 2004 - WY2012	Thin	Summer 2012	WY2013
		Burn	Fall 2013	WY2014

A water year (WY) correlates with a 12-month time period and starts on Oct. 1 and ends Sept. 30. Pre-treatment data collection started in WY2003 in Providence watersheds and the following water year in the Bull watersheds. The pre-treatment phase ended in Summer 2012 when the mechanical thinning treatment phase began at both sites. Thus, post-treatment data for the thin-only treatment watersheds began in WY2013. Burn treatments at Bull were completed in Fall 2013 with post-treatment data collection starting in WY2014. Due to hot and dry weather conditions in 2014 and 2015, the Providence burn treatment was delayed.

### Additional Information

For further information about the project please visit KREW on the Web at:

<http://www.fs.fed.us/psw/topics/water/kingsriver>

Additionally, streamflow and precipitation data for KREW can be found online at:

<http://www.fsl.orst.edu/climhy/>

National Science Foundation, Southern Sierra Critical Zone Observatory:

<https://snri.ucmerced.edu/CZO>

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### Collaboration and Funding

Research collaboration with Southern California Edison, University of California, U.S. Geological Survey in Sacramento, University of Nevada at Reno, and Colorado State University at Fort Collins.

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United States Department of Agriculture  
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## Why the Research is Important

Ecosystems are composed of living and nonliving things that are dependent upon each other to survive. The quality of aquatic, riparian (near-stream area), and meadow ecosystems is directly related to the conditions of nearby uplands in their watershed. A watershed is an area of land where precipitation drains off and collects into a particular place, like a stream, river, or lake. Scientists studying the Sierra Nevada report that these ecosystems are the most altered habitats due to dams and diversions, overgrazing, roads, logging, and physical alteration that occurred in prior decades. However, the Sierra Nevada lacked a long-term experimental watershed study to help inform future land management. Work began on the Kings River Experimental Watersheds (KREW) in 2000 with data collection starting in October 2002. The study was designed to (1) characterize the variability in watershed attributes to understand processes and health of headwater streams and forest watersheds; (2) evaluate forest restoration treatments—mechanical tree thinning and understory prescribed fire; and (3) address effects of a changing climate on the ecosystem. KREW is the only long-term ecosystem experiment evaluating forest restoration effects at the watershed scale in the Sierra Nevada.



Stream at Bull Creek site.

## Questions from Forest Managers



Timber harvest.

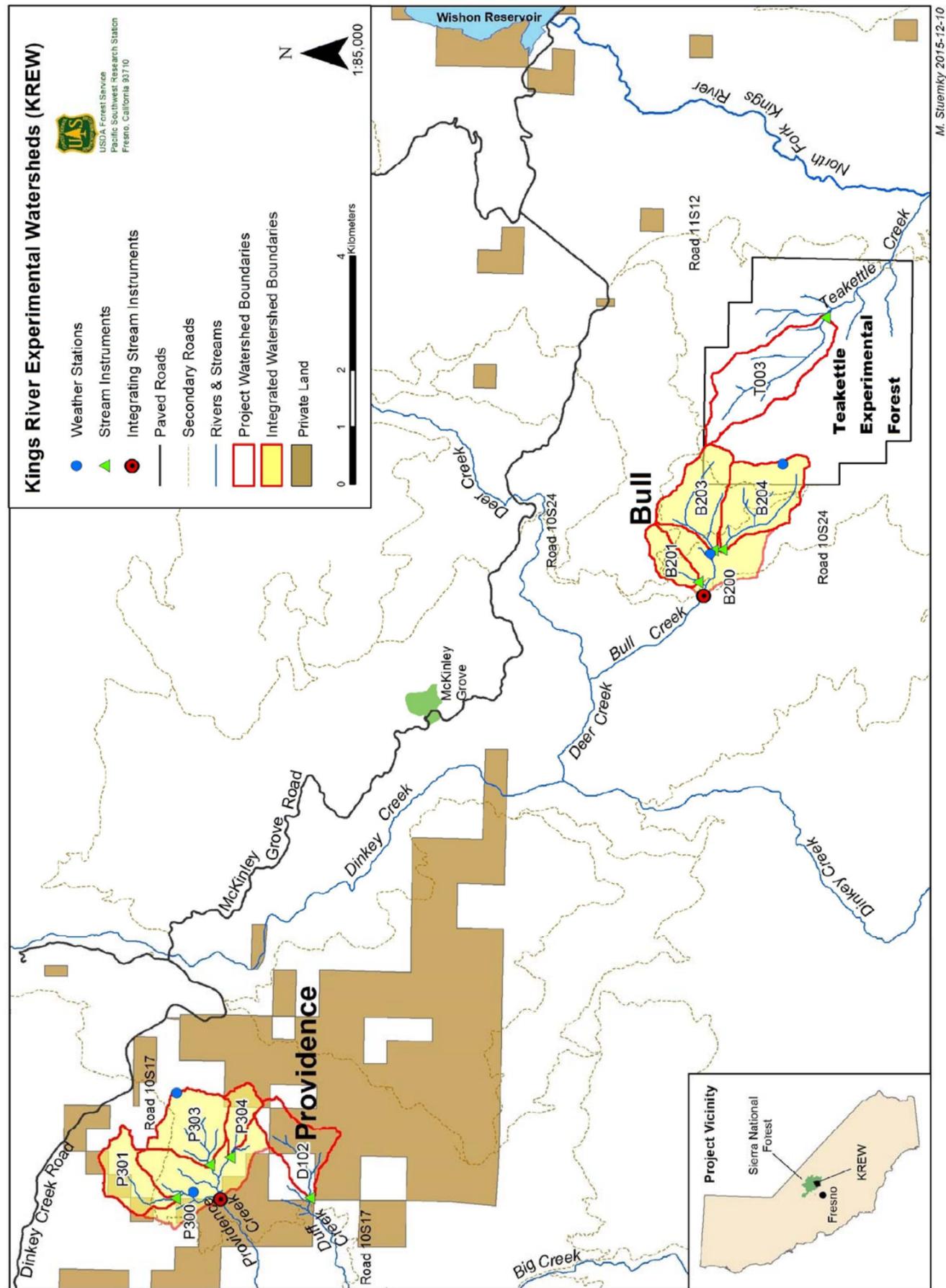
- What is the effect of thinning and fire/fuel reduction treatments on the riparian and stream physical, chemical, and biological conditions?
- Does the use of prescribed fire increase or decrease the rate of soil erosion (long-term versus short-term) and affect soil health and productivity?
- How adequate and effective are current stream buffers (areas on both sides of a stream with restricted uses) at protecting aquatic ecosystems from water quality issues due to land management activities?

## KREW's Goals

- Measure the range of values for selected characteristics of stream ecosystems and their associated watersheds.
- Provide an instrumented research site to evaluate stresses on forests from air pollution and climate change and to support computer modeling for future predictions.
- Evaluate the effects of both ecological restoration (prescribed fire and mechanical thinning) and commercial harvest activities.
- Maintain a patchwork of vegetation types and ages that mimic the historical distribution of vegetation resulting from frequent, low-intensity fires common before European settlement of the West.



Prescribed fire.



M. Stuenkel 2015-12-10

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**Location**

The KREW is located in the Sierra National Forest, east of Shaver Lake, California. The study area is on the headwaters of the Kings River that drains into the Central Valley. Eight watersheds are located on two research sites that are equipped with instruments to monitor ecosystem changes after forest treatments (Table 1); the Providence Creek site is located in mixed-conifer forest from 1,500-2,120 m (4,920-6,950 ft.) elevation, and the Bull Creek site is located in red fir/mixed-conifer with an elevation of 2,050-2,480 m (6,720-8,150 ft.). The Providence Creek site includes land owned and managed by Southern California Edison. Each watershed ranges in size from 120 to 550 acres (48 to 220 ha); a size that can be consistently treated. The Pacific Southwest Research Station works with the Sierra National Forest and Southern California Edison to carry out both data collection and forest restoration treatments.



Stream invertebrate sampling during spring.

Watersheds	Watershed Area	Treatment Type
Providence site is 991 acres (401 ha)		
P301	245.13 acres (99.2 ha)	Thin & Burn
P303	326.92 acres (132.30 ha)	Burn
P304	120.34 acres (48.70 ha)	Control
D102	298.50 acres (120.80 ha)	Thin
Bull site is 1,436 acres (581 ha)		
B201	130.97 acres (53.0 ha)	Thin
B203	341.99 acres (138.40 ha)	Burn
B204	412.42 acres (166.90 ha)	Thin & Burn
T003	550.30 acres (222.70 ha)	Control

Table 1: Watersheds and Management Treatments

**Methods**

Each of the eight experimental watersheds received one of four management treatments: no treatment (control watershed); a watershed that received an understory prescribed burn; a watershed that was mechanically thinned (trees 30 inches in diameter or smaller were removed); and a watershed that was both burned and thinned. The two sites have three experimental watersheds that join together at integrating stream stations that collect data on cumulative effects of the treatments (see map: yellow representing the integrating stream area and red circles representing stations).

Before the treatments began, pre-treatment data were gathered for 10 years (Table 2). The purpose of the pre-treatment phase was to document the variability in headwater conditions listed below. These measurements are compared to post-treatment measurements to determine if conditions are the same, better, or impaired. Post-treatment data will be gathered for at least five years to evaluate change. Currently, scientists are still in the treatment phase and are evaluating the integrated condition of the streams and their associated watersheds (i.e., physical, chemical, and biological characteristics).

- Physical measurements include: upland erosion, turbidity (suspended sediment), stream temperature, streamflow, channel characteristics, and weather conditions.
- Chemical measurements for stream water, shallow soil water, precipitation, and snow-melt include: nitrate, ammonium, and phosphate (primary biological nutrients); chloride, sulfate, calcium, magnesium, potassium, sodium, pH (measurement of acidity), and electrical conductivity or the general measurement of dissolved solids in water.
- Biological measurements include: stream invertebrates (like dragonfly and mayfly larvae), algae, and riparian and upland vegetation (herbs, shrubs, and trees). Yosemite toads are also being studied at the Bull Creek site.



Tower with weather instruments at Bull Creek site.

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