

Water Quality on California Rangelands

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Annual rangelands occupy three million hectares in California, and represent the landscape where California's urban-wild land-agricultural interface is most pronounced. Grazing and prescribed fire are critical vegetation management tools allowing managers to maintain economically feasible agricultural enterprises, reduce fuel loads, improve wildlife habitat and manage weed infestations. However, the watershed-scale impacts of grazing and prescribed fire on watershed processes are not known. To address these issues, we have developed a project that has two primary goals:

1. Use a paired watershed design to determine the watershed-scale effects of fire and grazing intensity on water quality, hydrology, nutrient cycling and plant community dynamics on annual rangelands.
2. Use the experimental watersheds as field classrooms for extension education and university classroom education.

The study simultaneously examines sediment, nutrients and microbial pathogens, the primary water quality concerns on California's rangelands. We are completing the pre-treatment calibration phase on four watersheds each at sites in the Sierra Nevada foothills and Coast Ranges. The following treatments will be examined:

- i. non-managed reference,
- ii. grazed to 800-1000 kg/ha residual vegetative dry matter (RDM),
- iii. grazed to 300-500 kg/ha RDM, and
- iv. moderate intensity prescribed fire.

We find that stream water concentrations of nutrients, sediments and pathogens vary dramatically at the storm-event, seasonal and annual time steps. During storm events, sediment and pathogen concentrations increase while nitrate concentrations decrease. Nutrient concentrations also display a distinct seasonal pattern with the highest concentrations at the start of the water year. This pattern results from a temporal decoupling of the nitrogen cycle that occurs in the Mediterranean climate due to distinct wet and dry seasons. There is also considerable variability in the magnitude of constituents exported from watersheds on an annual time step. An 18-yr record at one of our watersheds shows that nitrogen and suspended sediment loadings vary by more than an order of magnitude (total N = 0.2 to 4.0 kg/ha/yr; suspended sediments = 25 to 465 kg/ha/yr). Loadings appear to be related more to total runoff, seasonal distribution of the rainfall, and rainfall intensities than differences in rangeland management practices.