

Immediate Postfire Effects on Soil Nutrient Availability and Seed Bank Composition in Sagebrush Steppe Invaded by Annual Grasses

INTRODUCTION

This project examined the immediate postfire effects of fire on soil nutrient availability, seed bank composition, above ground community composition and invasive grass productivity in low-nutrient ecosystems currently dominated or threatened by invasive annual grasses in western North America. The research approach included both field and laboratory experiments. The field sites were in mixed conifer forests of the Sierra Nevada mountains and sagebrush steppe of the western Great Basin (mountain big sagebrush/pinon-juniper) and the western Colorado Plateau (basin big sagebrush/ponderosa pine). This fact sheet specifically describes the sagebrush steppe field experiments.

STUDY DESIGN AND IMPLEMENTATION

The Great Basin study site is in the Mono Basin, just north of Lee Vining, CA at a sagebrush/pinon ecotone. Predominant vegetation at the site includes mature mountain big sagebrush (up to 2m tall) (*Artemisia tridentata ssp. vaseyana*), perennial grasses (*Elymus cinereus*, *Achnatherum hymenoides*, *Hesperostipa comata*) and various forbs. Cheatgrass (*Bromus tectorum*) is present at the site and is especially dense near Hwy 395.

Fire treatments were applied randomly to 5 x 5 m plots for a total of 40 burned and 40 unburned controls during April 2004. Each plot was burned individually and allowed to extinguish naturally. Temperatures below, above and at the soil surface were recorded before, during and after the fire using Chromel alumel thermocouples. Soils were collected immediately pre- and postfire and microhabitat noted, to investigate immediate soil nutrient and seed bank changes beneath the shrub canopy, at the dripline and in the interspace.

Fuel load was visually estimated on all plots and related to quantitative models developed via double sampling of herbaceous and shrub vegetation. Fuel continuity and moisture were also measured quantitatively. Flame length and rate of spread were recorded during each fire. Fire severity was described using NPS FMH standards and evaluated using the same metric as vegetation cover, which allowed us to evaluate relationships

Progress Report:

- April 2004 Great Basin fire in collaboration with BLM Fire Management, Bishop Field Office.
- September 2004 Colorado Plateau fire in collaboration with NPS Fire Management, Lake Mead NRA
- Winter 2004 Pre and post-fire soil seed bank are assayed: seed density and richness
- Winter 2004 Soil nutrient analysis for the two burns conducted at the University of Denver biogeochemistry lab: Labile p, geochemical p, biological p, total P, exchangeable N, total carbon and nitrogen analysis
- June / July 2005 Vegetation surveys
- Summer / Fall 2005 Statistical analysis, presentation of results, final report and project completion.

among cover, biomass, temperature, and burn severity.

The Colorado plateau study site is located on the Shivwits Plateau, near the north rim of the Grand Canyon, AZ in a sagebrush/ponderosa pine ecotone. Predominant vegetation at the site includes basin big sagebrush (*Artemisia tridentata ssp. tridentata*), Ponderosa pine (*Pinus ponderosa*) rubber rabbitbrush (*Chrysothamnus nauseosus*), perennial grasses (*Elymus elymoides*, *Bouteloua gracilis*) and various forbs. Cheatgrass was extremely dense the year of the burn.

Fire was applied as a large scale burn; all plots were burned together, not in individual 5 x 5 m plots as at the Great Basin site. Designing the prescription in this manner created fire behavior more similar to wildfire, and provided excellent data that directly related immediate post fire effects of fire temperature and duration, fuel load, weather, vegetation community structure and soil nutrient availability at this site. All pre-fire and post-fire data, and data during fire, were collected in the same manner as the Great Basin experimental burn.

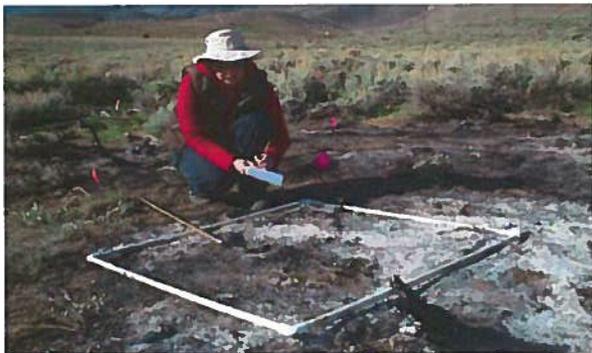
GREAT BASIN RX FIRE, APRIL 2004



Prefire fuel load estimates for herbaceous and shrub cover. Prefire vegetation surveys for annuals and perennials allow us to evaluate immediate post fire plant community changes.



Shrub intershrub mosaic in sagebrush steppe resulted in much variation of soil heating and duration across the site. Temperature data and soil nutrient samples were collected so that we can directly relate changes in soil nutrients and soil seed bank to peak temperature and duration of soil heating.



Burn severity was measured using NPS FMH standards. Measurements were recorded using the same unit as vegetation cover in order to directly relate severity with fuel load and plant composition.

COLORADO PLATEAU RX FIRE, SEPT 2004



Prescribed Fire in Basin Big Sagebrush/ Ponderosa Pine Forest



Active fire behavior



Post fire landscape. White patches indicate areas with complete consumption, while brown patches indicate areas that remain unburned. The changes in color clearly demonstrate the mosaic pattern of fire effects in this sagebrush steppe site.

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