# Prescribed Fire Effects on Soil Hydraulics and Infiltration Properties in a Dry Conifer Forest of the Eastern Cascades, Oregon

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## Background

### Wildfires in the West

With the increasing frequency of wildfire and the costs associated with managing severely burned landscapes, strategies are needed to increase landscape and community resilience impacted by legacy management and a changing climate. As a management tool, prescribed fire is commonly used to mimic the beneficial and ecologically significant effects of wildfire while also controlling the extent and magnitude of impact. In determining when and where such treatments are applied, knowledge of the potential impacts to soils and hydrology of the ecosystem is critical – particularly in sensitive systems.

### Post-fire Soil Hydraulics

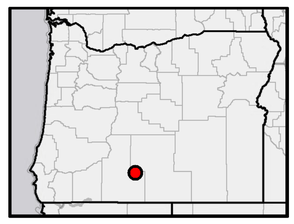
After severe wildfire, soil hydraulic properties including organic matter content, porosity, water holding capacity, infiltration rate, and water repellency, are commonly changed. These changes often induce a series of cascading effects relating to surface waters and total water availability. These include increases in erosion, runoff, debris flows and mass land movement events, and potential decreases in plant available water.

**To gauge the benefit of prescribed fire compared to wildfire, we need to know fire effects on soil hydraulic properties these changes vary across climate gradients and biogeographic regions.**

## Key Points

- ❑ Wildfire can degrade hydrological systems needed for both human and ecological use
- ❑ Prescribed fire may increase resiliency, but impacts may vary across biogeographic regions

## Study Region – Sycan Marsh Preserve



The Sycan Marsh Preserve in South-Central Oregon covers over 12,000 hectares of wetland marsh and dry coniferous forest. The upland watersheds are dominated by Ponderosa pine (*Pinus ponderosa*) and lodgepole pine (*Pinus contorta*), mixed with bitterbrush (*Purshia tridentata*) and greenleaf manzanita (*Arctostaphylos patula*). The Nature Conservancy of Oregon manages this property for ecological benefit and as a collaborative research and learning playground for engaging land managers and the public. Prescribed burn treatments were applied to a series of varying density forest stands at Sycan during Fall 2019

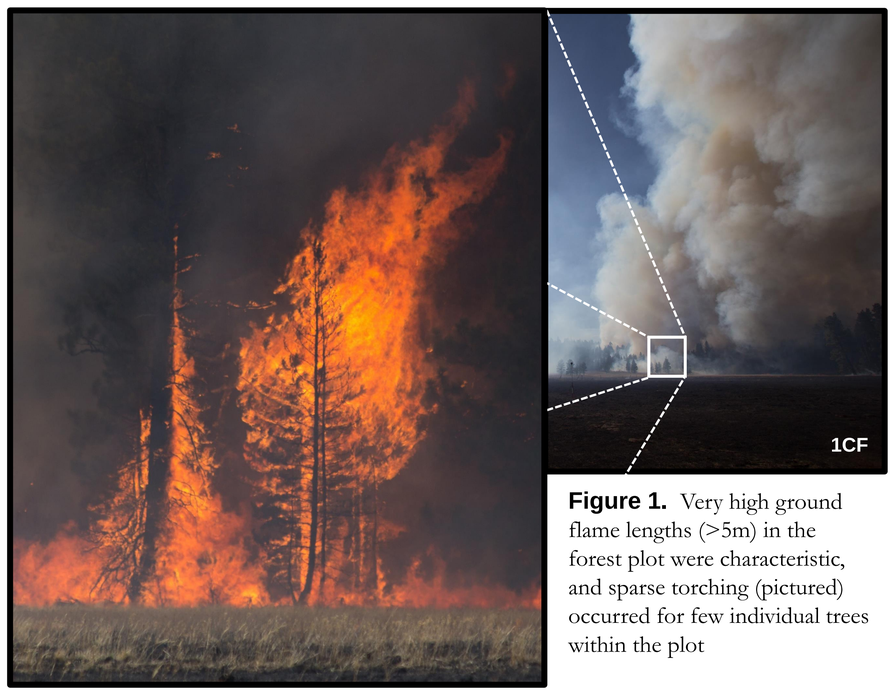



**Figure 1.** Very high ground flame lengths (>5m) in the forest plot were characteristic, and sparse torching (pictured) occurred for few individual trees within the plot


**Figure 2.** Pre and Post burn landscape at the 1CF forest plot. Continuous fuels at this plot caused total consumption of coarse fuels and uniform charring of the duff layer. Duff consumption was ~50% of the total thickness.

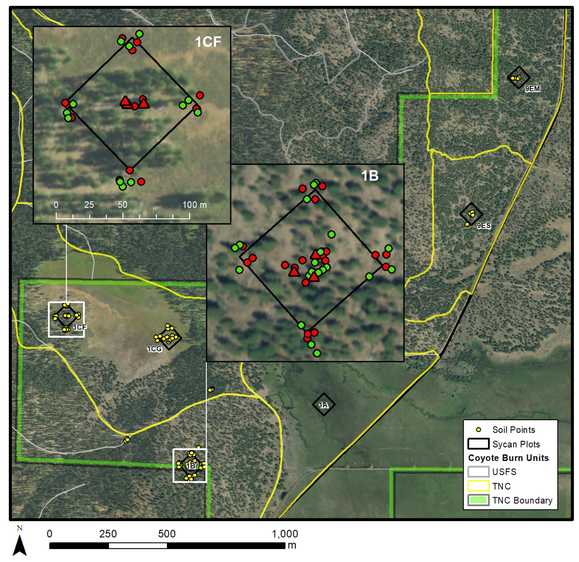



**Figure 3.** Plot locations and burn boundaries at the Sycan Marsh. A set of three thermocouples were placed at the center of a plot with corresponding soil and hydraulic samples. Four external points were placed 50 m from the central point

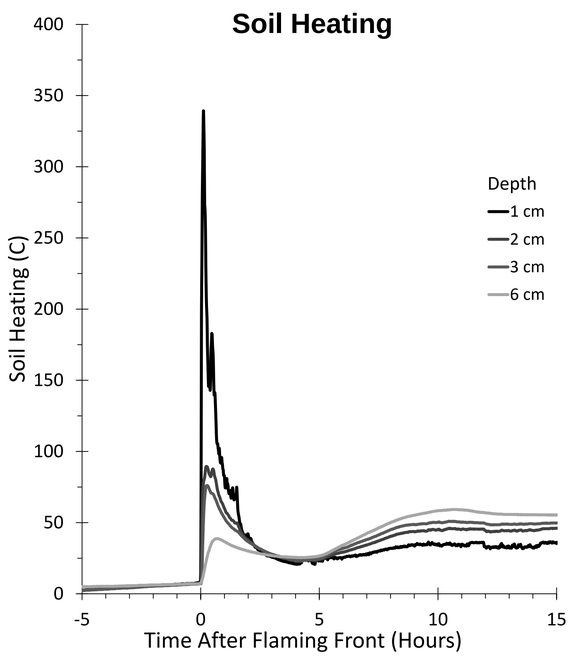



**Figure 4.** Sub-surface soil heating at differing depths during the prescribed fire.

## Methods

### Prescribed Burn

All burn units were treated between 07 October 2019 and 11 October 2019. The burning patterns were prescribed to meet both research goals and ecological effects targets. This includes thorough consumption of ground fuels, snag recruitment, and thinning of younger tree saplings. Along with general reduction of fuels.

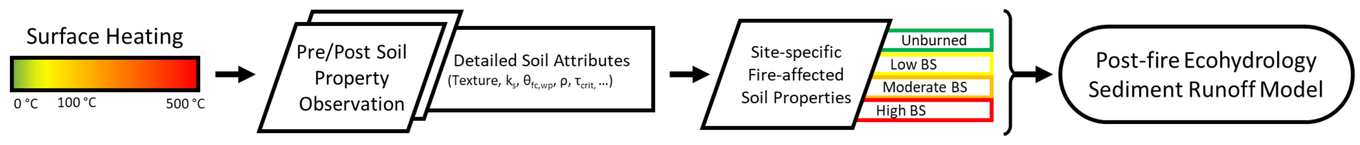
### Field Measurements

Soil heating was continuously measured between 1-6 cm depth using below-ground thermocouple probes. Infiltration and water repellency metrics were collected along with samples for bulk density and porosity.

### Lab Soil Hydraulics

At each soil sampling point, soil cores were collected for laboratory infiltration tests, which will compare various infiltration and sorptivity metrics in a controlled environment. Other water retention metrics will be observed which can inform process models for ecohydrological impact and surface water runoff and erosion impacts.

**Figure 5.** *(Right)* - Conceptual model of future analysis to drive post-fire models using observed and modeled effects of fire on soil hydraulic properties using spatial soil properties

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