Translating SPLATs from a theoretical to a real world landscape: The implications of fuel management strategies for Sagehen Creek Basin, Tahoe National Forest

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Introduction

Nearly a century of fire suppression in the Sierra Nevada has had the unintended consequence of placing millions of hectares of forest at risk of catastrophic fire. Modifying wildland fire behavior across landscapes in the Sierran National Forests has been identified as a management priority. The preferred response is to apply strategic fuel treatments at the landscape level, yet there is little guidance for the implementation of this strategy. One concept currently being researched for its effectiveness at modifying fire behavior to reduce fire hazard is strategically placed area treatments (SPLAT). Sagehen Creek Basin in the Tahoe National Forest provides a representative landscape, where the accumulation of forest fuels has created a severe risk of catastrophic wildfire. The primary goal of this administrative study is: To evaluate the effectiveness of strategically placed area treatments (SPLAT) in reducing fire hazard at Sagehen Creek Basin. The fire behavior models Farsite and FlamMap are being used to evaluate the effectiveness of these treatments and to simulate alternative fuel management designs. The performances of these designs would be evaluated in terms of slowing fire spread and reducing fire intensity. Field-parameterized versions of these models are being created using geo-referenced field plots, where fire-relevant attributes of the vegetation and the surface fuels were measured; LiDAR acquired topographical data, and long term weather and forest change data for the area. The hope is that the specific lessons learned during this intensive study of one landscape will help guide planning for other management units in the Tahoe National Forest and other forests in the Sierra Nevada. The presence of Sagehen Creek Field Station provides vital infrastructure support to extend these results to both professional managers and the interested public.

Methods

Location

Sagehen Creek Field Station lies in California, roughly 10 miles north of Truckee, and approximately 20 miles north of Lake Tahoe. The Creek is about 8 miles long, extending eastward from near the crest of the Sierra to Stampede Reservoir on the Little Truckee River. Three entities work together to manage the Sagehen Creek watershed: UC-Berkeley, the Tahoe National Forest and the U.S. Forest Service's Pacific Southwest Research Station. Since 1951, UC-Berkeley has had a special use permit that covers about 450 acres, and includes a mile and a half of Sagehen Creek. The year round Station facilities are at an elevation of 6,380 feet on the east slope of the northern Sierra Nevada, The roughly 8,000 acre Sagehen Creek watershed includes yellow pine, mixed conifer, and red fir forests, brush fields, scattered mountain

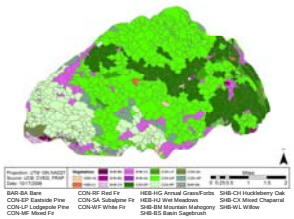
meadows and fens. Deep snow is typical of the winter season, and dry, warm weather is typical of the summer period. Sagehen Creek Field Station also serves as the hub of the Central Sierra Field Research Stations, a network of five field stations administered by UC-Berkeley that together represent 20,000 acres of high altitude montane forests. These research areas together offer a unique opportunity to study a transect of natural systems that crosses the Sierra crest. The new Sagehen Centennial Experimental Forest encompasses the entire 8,000-acre watershed and is part of the Tahoe National Forest. From a scientific viewpoint this gives it another advantage because, unlike many other research areas, it is not an ecological island. Rather it is embedded within a much larger natural area, which means that ecological processes and wildlife populations function in a relatively undisturbed manner.

Data Collection

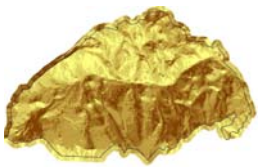
Field data for this project was collected from 523 systematically random plots located over the entire watershed. Sample plot size is 500 square meters in area and approximately 1% of the watershed was sampled. Data collected includes: species, dbh, total height, crown height, and vigor for all trees over 5cm in diameter. Downed woody material was sampled using Brown's (1971) planar intercept method. Shrubs were also sampled by species, height and length. Topography, slope, aspect and canopy cover data was collected using Lidar (Light Detection and Ranging) technology. Dual pass Lidar collects data by utilizing the first return (canopy) and second return (ground) of the radar to create one meter resolution DEM's and canopy cover maps.

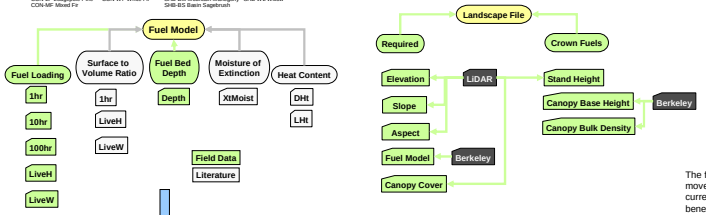
Analysis

Vegetation Map and Fuel Model Generation

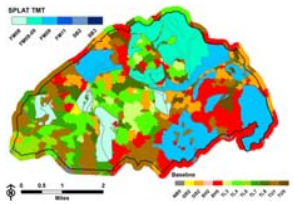


LIDAR DEM and Landscape Configuration

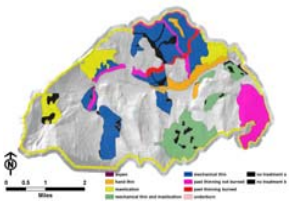




Fuel models with SPLATS



Final SPLAT design

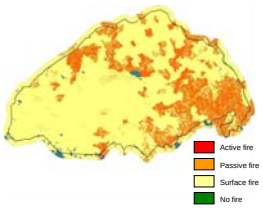


The fire hazard was assessed by using the FlamMap model. FlamMap burns the entire area at once and produces a map showing fire hazards by our three chosen fire behavior criteria. The model used 97th percentile weather data for August 30th to calculate fuel moisture conditioning. A 20 foot wind speed of 16 miles per hour from the southwest was used for wind. Two runs of the model were done representing the current conditions and post SPLAT response.

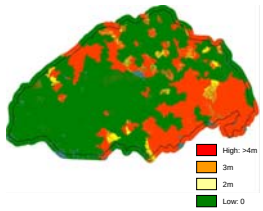
The fire behavior model Farsite was used to predict fire movement and intensity. Two fires were ignited under current conditions and the same two to demonstrate the benefit of implementing the SPLAT strategy. The two runs were run with the same weather and wind inputs and allowed to burn for 48 hours. The first represents a fire started at the campground in the basin and the second a fire starting outside the basin and moving in from the southwest.

Current fire hazard using FlamMap

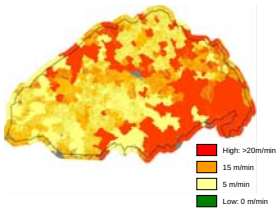
Crown fire activity



Flame length

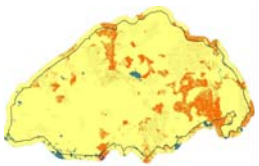


Rate of spread



FlamMap predicted hazard reduction using SPLAT design

Crown fire activity



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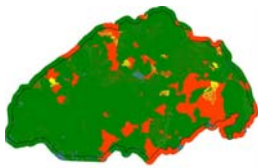
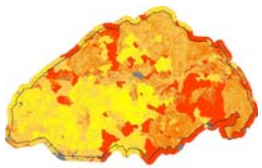
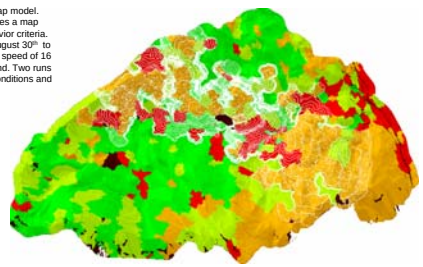
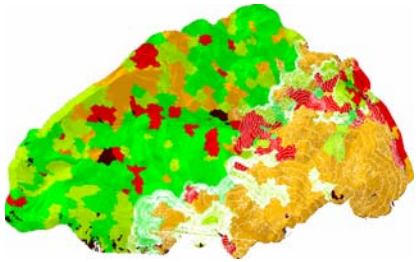


Rate of spread

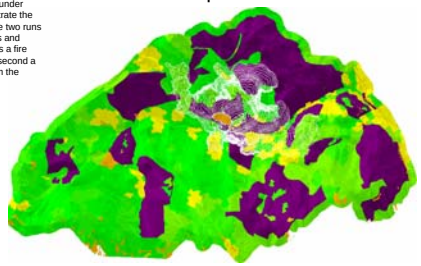


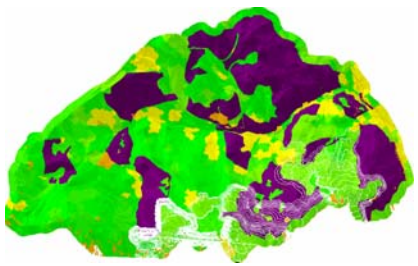
Current fire intensity using Farsite





Farsite predicted reduction in intensity using SPLAT design





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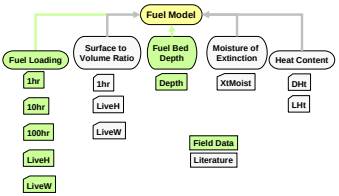
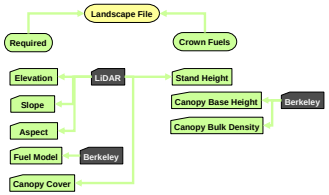

Fuel Model
Fuel Loading
1hr
10hr
100hr
LiveH
LiveW
Surface to Volume Ratio
1hr
LiveH
LiveW
Fuel Bed Depth
Depth
Moisture of Extinction
XtMoist
Heat Content
DHt
LHt
Field Data
Literature


Landscape File
Required
Crown Fuels
Elevation
Slope
Aspect
Fuel Model
Canopy Cover
LiDAR
Berkeley
Stand Height
Canopy Base Height
Canopy Bulk Density
Berkeley


FLAMMAP 3.0
Fire Sciences Lab


FARSITE