David Little Livestock Range Management Endowment

AT THE UNIVERSITY OF IDAHO

2013 Project Progress Report:

Distribution of fuel components in sagebrush steppe – implications for the impact of livestock grazing on wildfire spread.

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ACCOMPLISHMENTS:

Objectives

The objectives for this project were to collect the necessary field data for parameterizing the physics-based Wildland-Urban Interface Fire Dynamics Simulator (WFDS) to more accurately predict the effects of livestock grazing on fire spread in sagebrush steppe. Specific objectives were to:

1) Characterize the spatial distribution of shrubs, herbaceous vegetation, and fuel in size classes.
2) Document how the distribution of plant and fuel components change in grazed and ungrazed pastures to better understand how livestock grazing impacts fire spread.

Field Sampling

A field crew was employed for necessary field data collection for this project. Four field technicians instructed by the project PIs collected data through the summer, May 25 – August 12, across southern Idaho ecological sites. To characterize fuels cross a variety of ecological sites (Table 1) ranging from Wyoming sagebrush (*Artemisia tridentata* ssp. *wyomingensis*; 7-13 inches precipitation) to mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*; 13-16 inches precipitation) we selected field sites across this precipitation gradient. We sampled in the southwestern Idaho at the Birds of Prey and on the Owyhee Plateau; and in eastern Idaho at the US Sheep Experiment Station near Dubois, ID. The majority of the samples were collected in Wyoming sagebrush because the concerns of the flammable annual grass cheatgrass (*Bromus tectorum*) invasion and an increased fire frequency is most prominent in this plant community.

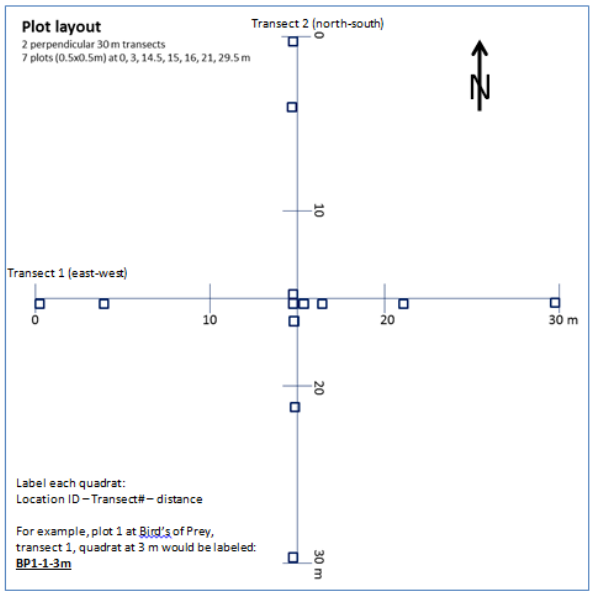

Figure 1. *Plot design for fuels sampling in sagebrush steppe.*

At each sampling location we established a plot where two 30 m transect tapes were laid out in a perpendicular pattern (Figure 1). Shrubs were sampled along the transects according to the line intercept method. Quadrats (50x50 cm) were placed along the transect at 0, 3, 14.5, 15, 16, 21, and 29.5 m. Within the quadrats we sampled biomass of fuels by type: litter, herbaceous, woody fuels in three size classes (0-0.25 inches, 0.25-1 inches, and 1-3 inches). Shrubs that fell within the quadrats were also sampled and divided into the three woody fuel classes. To address Objective 2, a comparison of grazed and ungrazed pastures, we established transects in areas grazed during the winter season and also

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within exclosures that had not been grazed for several decades. Comparison of grazed and ungrazed pastures was only done at Birds of Prey.

Table 1. *Location, ecological site and number of plots sampled during the field season 2013.*

Location	Ecological site	Time period sampled	Plots sampled
Birds of Prey (grazed and ungrazed pastures)	Artrw/Achy/Pose Loamy 7-10" 550 lb/ac normal production	May-June	18
Twin Falls, Mtn Home, Owyhee Area	Artrw/Pssp/Stth Loamy 10-13" |750 lb/ac normal production	July	15
Dubois	Artrva/Artrtri/Feid Loamy 13-16" 1100 lb/ac normal production	Late July - August	3

Fuel types by category and quadrat were weighed in the field and then combined by transect. The combined samples were dried at 60° C and weight to compute dried biomass by fuel type and quadrat. All biomass was dried for a minimum of 24 hours except larger woody samples that were dried for 4 days. At the time of submitting this report, all lab samples have been processed and entered into Excel spreadsheets.

Data analysis

We plan to model our data analysis after Keane et al. (2012). The spatial variability of the fuel components will be quantified using a semivariogram (Bellehumeur and Legendre 1998) which describes the spatial autocorrelation and spatial distribution of measured components. Following the analysis of the field data and semivariograms we will model fire spread and sustainability of the fire at a variety of environmental conditions including fuel moisture, wind, and livestock stocking rates in WFVS. The effect of grazing on grass height will be estimated using the relationships developed by Kingery et al. (1992); and the spatial distribution of herbaceous material between interspaces and under shrubs will be estimated according to France et al. (2008).

Collaboration

We have engaged two collaborators via this project:

1) Nancy Glenn Associate Professor in Remote Sensing at Boise State University.
2) Anne Halford, Rangeland Ecologist at the Bureau of Land Management, Boise Idaho. There are opportunities for further collaboration on comparing fuels in grazed and ungrazed areas. Ms. Halford was particularly interested in our data collection on the Birds of Prey area where we collected data on vegetation composition and fuels in winter grazed and long-term ungrazed areas.

PROJECTIONS:

The information resulting from this research will be used in at least four ways:

- Spatial distribution of fuels provides necessary input data to physics based fire behavior models such as the Wildland-Urban Interface Fire Dynamics Simulator (WFDS; Mell et al. 2007). We intend to continue collaboration with Dr. Mell (US Forest Service, Seattle WA) and Dr, Hoffman (Colorado State University) to model fire rate of spread and fuel consumption using this novel tool. Using these novel modeling techniques,

we intend to demonstrate how livestock grazing alters fire behavior (rate of spread and persistence of the fire) under a variety of utilization levels and weather scenarios.
- We will collaborate with Dr. Glenn at Boise State University to research the potential for Terrestrial Light Detection and Ranging (LiDAR) technology and Airborne LiDAR to estimate biomass of herbaceous and shrubby vegetation in sagebrush dominated rangelands.
- We will continue to research the effects of livestock on fuels in sagebrush steppe. A new Little Endowment Grant will be submitted in 2014 titled Distribution of Fuel Components in Sagebrush Steppe- targeted grazing applied to reduce wildfire spread. Collaborators on this proposal are Dr. Scott Jensen (University of Idaho Owyhee County Extension) and graduate research assistant Christopher Schachtschneider.
- The data collected will be submitted to the LANDFIRE (www.landfire.gov) project as ground reference data for updating US-wide vegetation and fuels maps.

PUBLICATIONS:

The work performed under this funding agreement has not yet been published. We are expecting two publications from this project:

1) Jameson Rigg, a senior in Environmental Science, is analyzing collected data as part of his Senior Thesis, which is conducted over one year and will be completed in May 2014. The goal of Jameson's senior thesis is to compile and analyze the data obtained via this project in a format similar to Keane et al. (2012). Keane et al. (2012) quantified the distribution and relevant spatial scale for fuel components in mixed coniferous forests; we plan to do the same for Wyoming sagebrush fuel types using the data collected via this project.
2) In collaboration with Nancy Glenn and her graduate students we intend to produce a journal article on the utility of using Terrestrial Light Detection and Ranging (LiDAR) to estimate biomass of herbaceous and shrubby vegetation in sagebrush dominated rangelands. Our field data is currently being summarized and will be sent to Dr. Glenn's group by the beginning of the spring semester 2014.

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