

Evaluating Fuel Treatment Effects on Surface Fuels in Dry Ponderosa Pine Forests



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- Fuels treatments have inconsistent effects on fuel patch size
- There is a scale mismatch between measurement practices and the inherent variability of fuels
- Measurements must be taken at much smaller distances to capture all variation

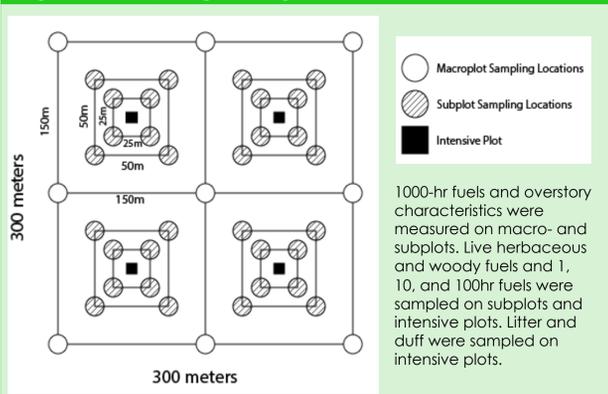
Goals

- Quantify the spatial variability of surface fuels in dry ponderosa forests of the Front Range of the southern Rocky Mountains
- Compare variability in treated and untreated stands

Background

Recent research has shown the important influence of **fine-scale fuel variability** on **wildfire behavior and effects**. However, wildland surface fuels have traditionally been measured and mapped at resolutions consistent with satellite imagery or stand-level averages. This ignores the **intrinsic patterns of fuel loading** and limits the application of fuel inventories to creating fuel maps for predicting fire behavior and effects.

Fig. 1: Sampling Design



Sampling Methods

Surface fuels were inventoried within a **nested plot design** through a combination of the photoload technique (Keane and Dickinson 2007) and sample collection (Figures 1 and 2) on four treated and untreated sites across Colorado and New Mexico (Figure 3).

Data Analysis

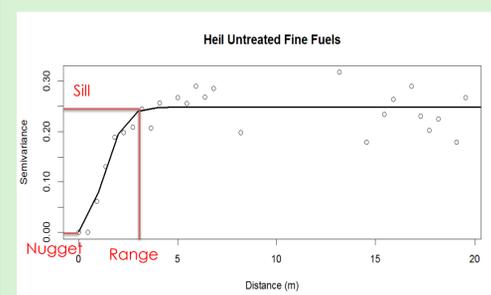
Fuel patch size (range) and variability between patches (sill) were analyzed for the 1, 10, 100-hr and fine fuel (litter+1-hr fuels) classes using **Gaussian variograms** (Figure 4) and the resulting ranges and sills were qualitatively compared for analysis.

Fig. 2: Photoload



1-m frame used for 1-hr, 10-hr, and 100-hr fuel loading estimates using the photoload technique

Fig. 4: Elements of a Variogram



Results

- The treatment **effect on litter, 1-hr, and 10-hr fuel classes was greater** than the effect on larger fuel classes
- Almost all fuel classes had **patch sizes (range) less than 6x6 m** (Figure 6)
- There was **no consistent effect of treatment** on patch size or variance (Figure 7)
- Variance between patches (sill) had a wide range **regardless of treatment type**

Fig. 6: Histogram of all Range Values

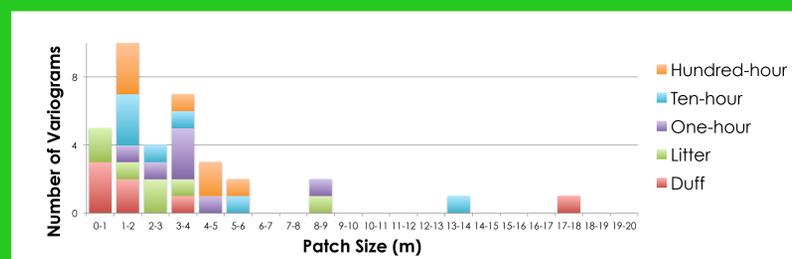
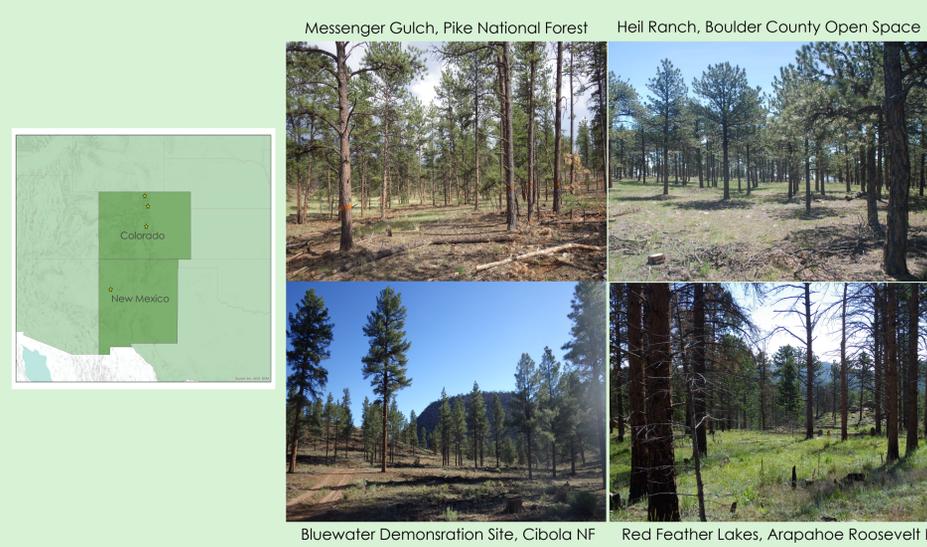


Fig. 3: Study Sites and Treated Plot Photos

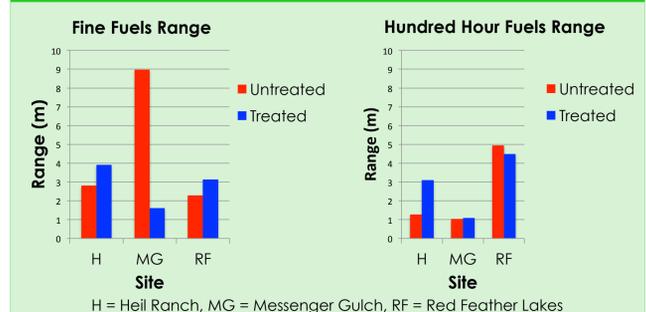


Discussion

Preliminary results suggest that:

- there is **no standard set of values** that describe the variability of surface fuels in dry zone ponderosa pine systems
- Current practice **may not capture all variability** in surface fuels before or after treatment.

Fig. 7: Selected Patch Size Comparisons



Our Future Research Directions

Pending further data collection, this study will investigate:

- stand-level** drivers of variability in surface fuels
- effects by **treatment type**– thin only vs. thin and burn

Recommendations for Further Study

We suggest that future studies:

- predict and measure fire effects and fire behavior **at the fuel patch scale**.
- determine a more accurate but time-efficient method to inventory fuels
- Improve understanding of associations between fine-scale fuel distribution and fire behavior using 3 dimensional physics-based models

References

Keane, R.E. and L.J. Dickinson. 2007. Development and evaluation of the photoload sampling technique. USDA Forest Service, Research Paper RMRS-RP-61 CD. 29 p.
 Keane, R.E., K. Gray, V. Bacciu, and S. Leirfallom. 2012. Spatial scaling of wildland fuels for six forest and rangeland ecosystems of the northern Rocky Mountains, USA. *Landscape Ecology* 27: 1213-1234.

Acknowledgements

Funding for this project was provided in part by Joint Fire Science Program (JFSP) project 13-1-04-53, funds provided by the Rocky Mountain Research Station, Forest Service, U.S. Department of Agriculture and the National Fire Plan and through McIntire-Stennis funding.
 We would also like to thank William Grimsley, Lawrence Huseman, Donn Slusher, Andrew Spencer, and Justin Ziegler for their help with data collection and input.

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