Understory vegetation recovery following wildfire in the Southern Rocky Mountains

Kate Weimer[1,2], Camille Stevens-Rumann[1,2], Marin Chambers[2]

[1] Department of Forest and Rangeland Stewardship, Warner College of Natural Resources, Colorado State University, Fort Collins CO
[2] Colorado Forest Restoration Institute, Department of Forest and Rangeland Stewardship, Colorado State University, Fort Collins CO

Introduction

- 2020 was a record-breaking fire season across Colorado, USA.
- Wildfire size and frequency are likely to continue growing, so understanding post-fire vegetation dynamics will be critical for future management[1].
- **How does understory vegetation in burned areas vary across forest types and across burn severities?**
- We performed vegetation surveys in 108 plots through 4 forest types and across a gradient of burn severities.
- Data collected one year post-fire gives us a starting point to monitor long-term patterns in post-fire vegetation regeneration and recovery.

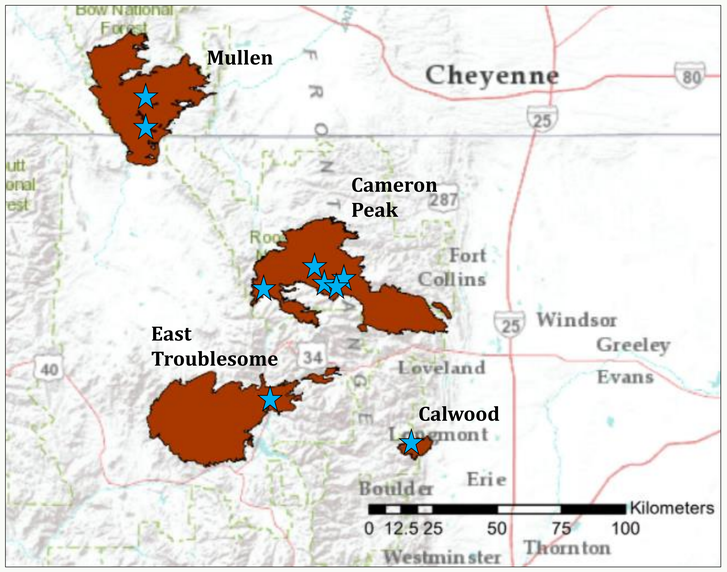

Figure 1: Map showing perimeters of the 2020 Mullen, Cameron Peak, East Troublesome, and Calwood Fires in Colorado and Wyoming, USA. Blue stars represent site locations.

Figure 2: Plants seen in burned areas. From right, *Lilium philadelphicum*, *Frageria virginiana*, resprouting *Arctostaphylos uva-ursi*

Acknowledgements

Special thanks to CFRI/CSU staff and field crew:

Allison Rhea
Helen Flynn
Monserrat Rodriguez-Rivera
Tyler Carlson
Michael McNorvell
Calvin McCartney
Rachel Hatfield
Gabriela Szyniec

Figure 3: Example of low/moderate severity burn area. Forest type is ponderosa pine, photo from the 2020 Cameron Peak Fire.

Figure 4: Example of high severity burn area. Forest type is ponderosa pine, photo from the Cameron Peak Fire.

Figure 5: Example of low/moderate severity burn area. Forest type is subalpine fir and Engelmann spruce. Photo from the 2020 Cameron Peak Fire, near Joe Wright Reservoir.

Figure 6: Example of high severity burn area. Forest type is subalpine fir and Engelmann spruce. Photo from the 2020 East Troublesome Fire.

Methods

Sampling design:
- Paired plot design in high severity and low/moderate severity post-fire burn areas.
- Plots placed in 4 forest types: subalpine, lodgepole, mixed conifer, and ponderosa
- Four fires sampled: Mullen, Cameron Peak, East Troublesome, and Calwood

Measurements:
- Aspect, slope, elevation, and fuel model
- Along transects:
  - Line point intercept for vegetative and ground cover
  - Densitometer at 1 ft intervals on N-S transect
  - Litter and duff depths measured at 12 points per plot
- In full plot (0.1 acre):
  - Survey of vascular plant presence in 0.1 acre plot
  - Mature trees and snags
- In subplots (0.01 acre):
  - Seedlings and saplings measured in three 0.01 subplots
  - Coarse fuels measured in 0.01 acre subplot
  - -Fine fuels measured by visually estimated photoloads in 1 m2 quadrats

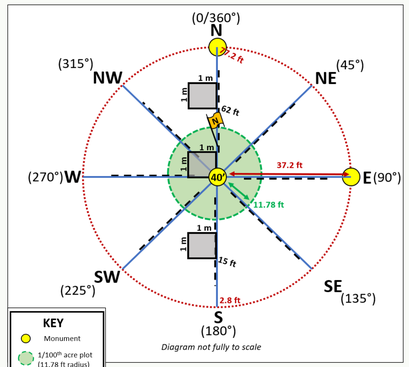

Figure 7: Plot layout based on CFRI "Mothership" monitoring protocol.

References

[1] Abatzoglou, John T., et al. "Increasing Synchronous Fire Danger in Forests of the Western United States." Geophysical Research Letters, vol. 48, no. 2, 2021, https://doi.org/10.1029/2020gl091377.

[2] Fornwalt, Paula J., and Merrill R. Kaufmann. 2014. "Understorey Plant Community Dynamics Following a Large, Mixed Severity Wildfire in a Pinus Ponderosa-Pseudotsuga Menziesii Forest, Colorado, USA." Journal of Vegetation Science 25 (3): 805–18. https://doi.org/10.1111/jvs.12128.

[3] Reilly, M. J., M. C. Wimberly, and C. L. Newell. 2006. "Wildfire Effects on Plant Species Richness at Multiple Spatial Scales in Forest Communities of the Southern Appalachians." Journal of Ecology 94 (1): 118–30. https://doi.org/10.1111/j.1365-2745.2005.01055.x.

Discussion

- Greater richness and cover in low/moderate severity burn areas compared to high is expected in the first year following fire
- Vegetation recovering in high severity burn areas across forest types was dominated by re-sprouting shrubs and often a few forbs like *Chamerion angustifolium* and *Dracocephalum parviflorum*.
- In low/moderate severity burn areas, vegetation across forest types was dominated by perennial forbs and shrubs that had survived or sprouted after the fire.
- We expect that richness and percent cover in high severity burn areas will increase rapidly and possibly surpass the richness and cover of low/moderate severity burn areas within a few years. [2, 3]

Future directions:
- We plan to classify data further by native/introduced status, life span, and by biogeographic affinity or life history traits such as regeneration strategy.
- We also plan to further investigate the effects of ground cover on cover, richness, and species composition. All plots will be revisited and remeasured in 2022.

Results and Conclusions

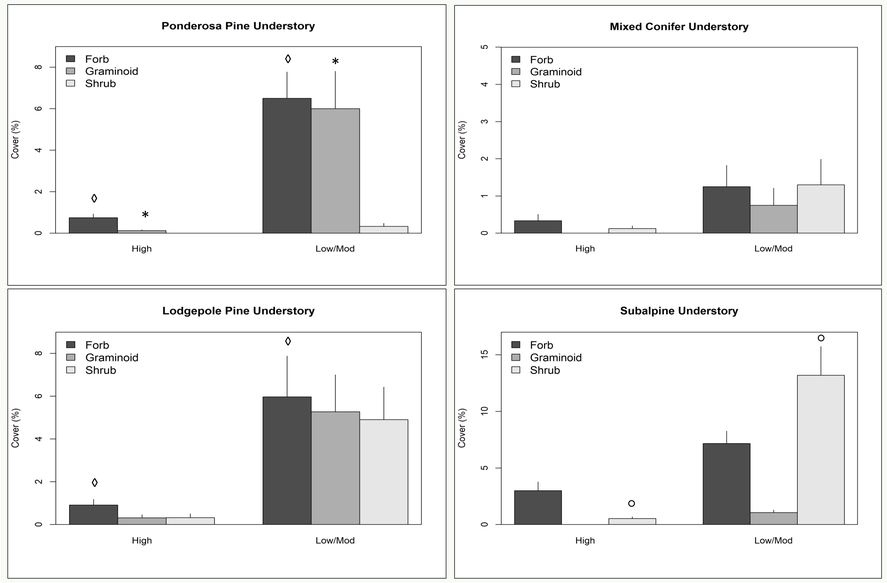

Figure 8: Percent cover of understory functional groups by fire severity class and forest type. The percent cover of understory vegetation was consistently higher in low/moderate burn areas than in high severity ones. Same symbols indicate significant difference with $\alpha = 0.05$. Forbs accounted for the majority of cover in every forest type and burn severity, except for low/moderate severity subalpine sites, where the shrub *Vaccinium scoparium* was the most common species.

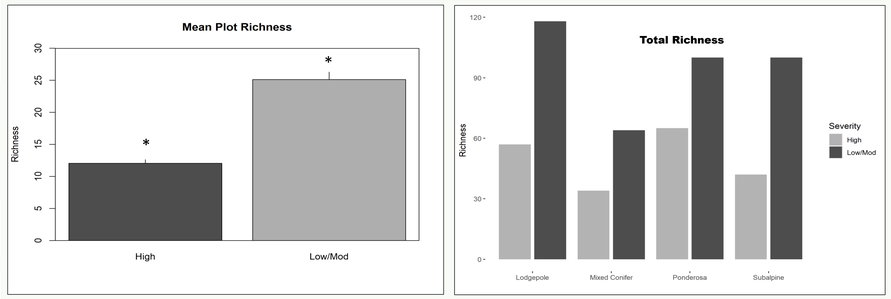

Figure 9: Understory richness by fire severity class and forest type. Understory richness was consistently greater in low/moderate severity plots than in high severity. Mean plot richness was 12.1 in high severity burn areas and mean plot richness was 25.1 in low/moderate severity. Asterisks indicate significant difference with $\alpha = 0.05$. Total richness was highest in low/moderate severity lodgepole pine. Sample sizes are not equal across forest types. In this figure, lodgepole n = 36, mixed conifer n = 12, ponderosa n = 24, and subalpine n = 34.