

Exploring resilience in piñon-juniper woodlands:

Insights from three Colorado fires

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Introduction

- Post-fire piñon pine (*Pinus edulis*) and juniper (*Juniperus monosperma*) (PJ) regeneration is challenging due to:
 - Elimination of seeds
 - Decreased cone production from surviving trees due to drought¹
 - Competition from opportunistic non-native grasses and understory plants²
 - Declines in key associated bird species³
 - Increasingly harsh climate conditions⁴
- In some areas, forests are converting to grasslands or shrublands post-fire due to limited conifer regeneration⁵
- We rarely study burn footprints 25+ years post-fire, and in these slow successional systems this is likely the time frame when one may start to discern conversion

Methods

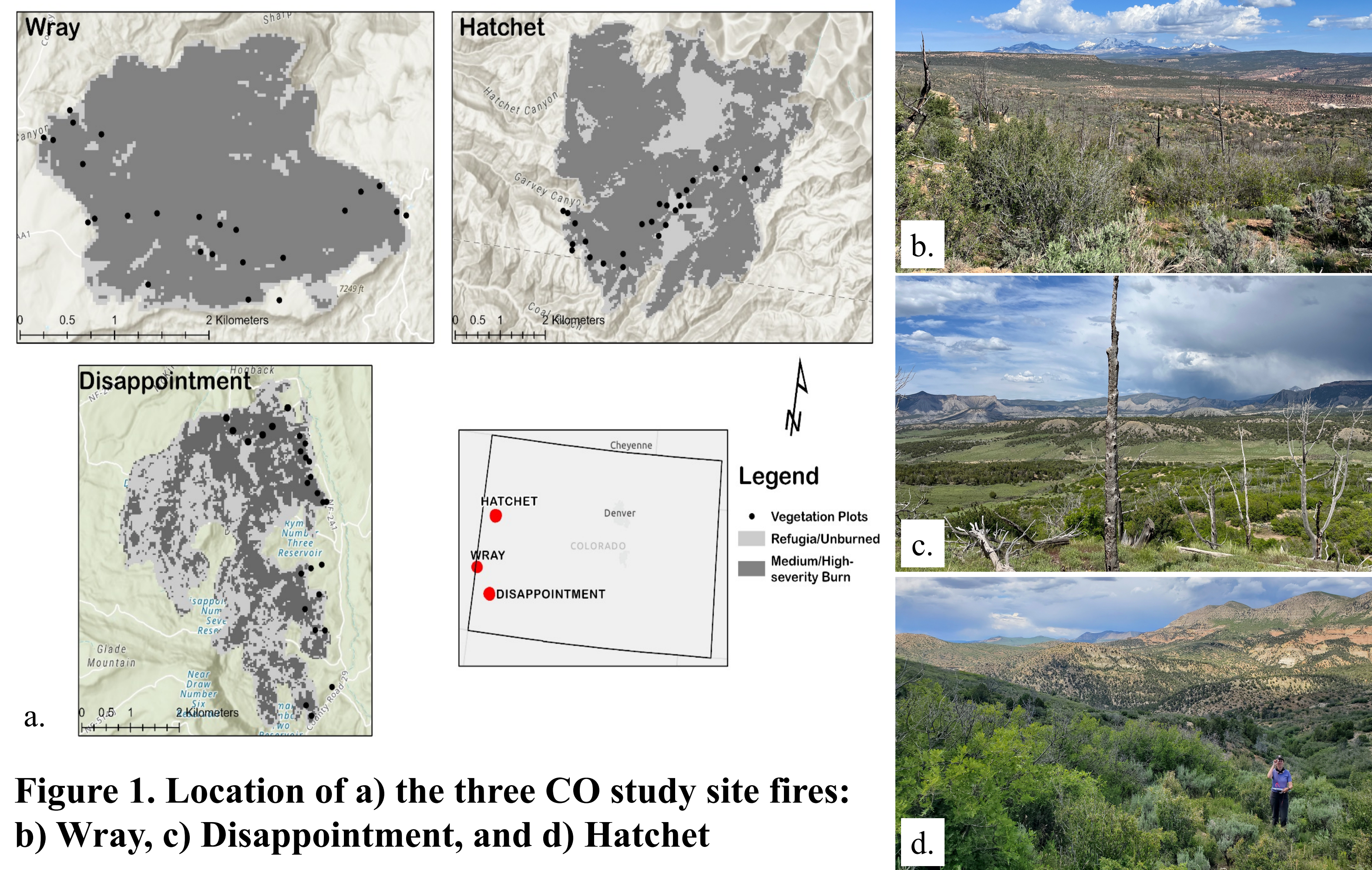


Figure 1. Location of a) the three CO study site fires: b) Wray, c) Disappointment, and d) Hatchet

Objectives

1. Identify PJ seedling regeneration and seedling microsite conditions
2. Determine correlation between seedling presence and associated vegetation

Sampling Design

- 25 plots per fire
- 10 edge
- 10 interior
- 5 unburned controls

Measurements

- Seedling species and microsite conditions
- Line point intercept (LPI) vegetation cover measurements



Results

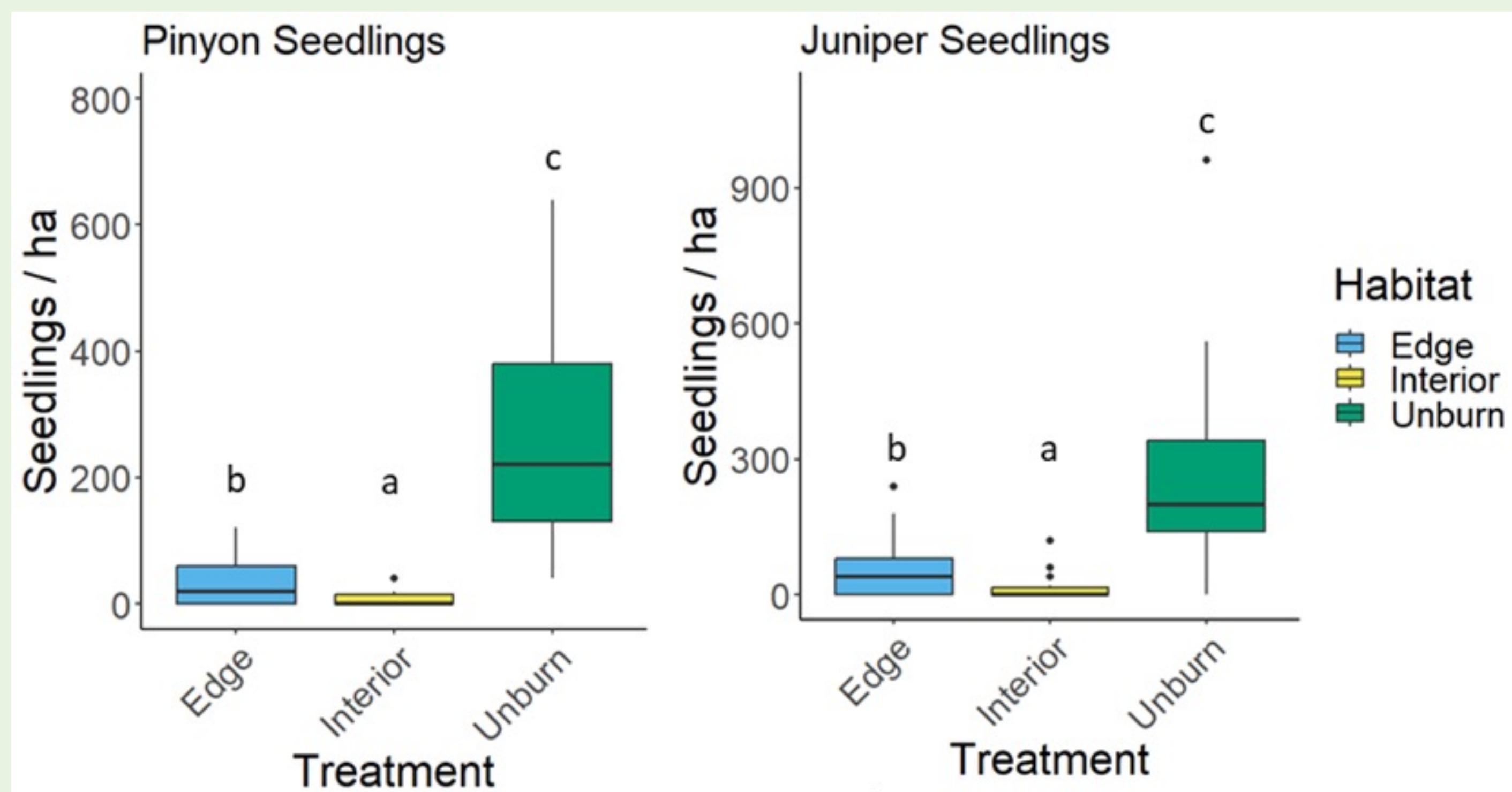


Figure 2. Piñon (left) and juniper (right) seedling density differences

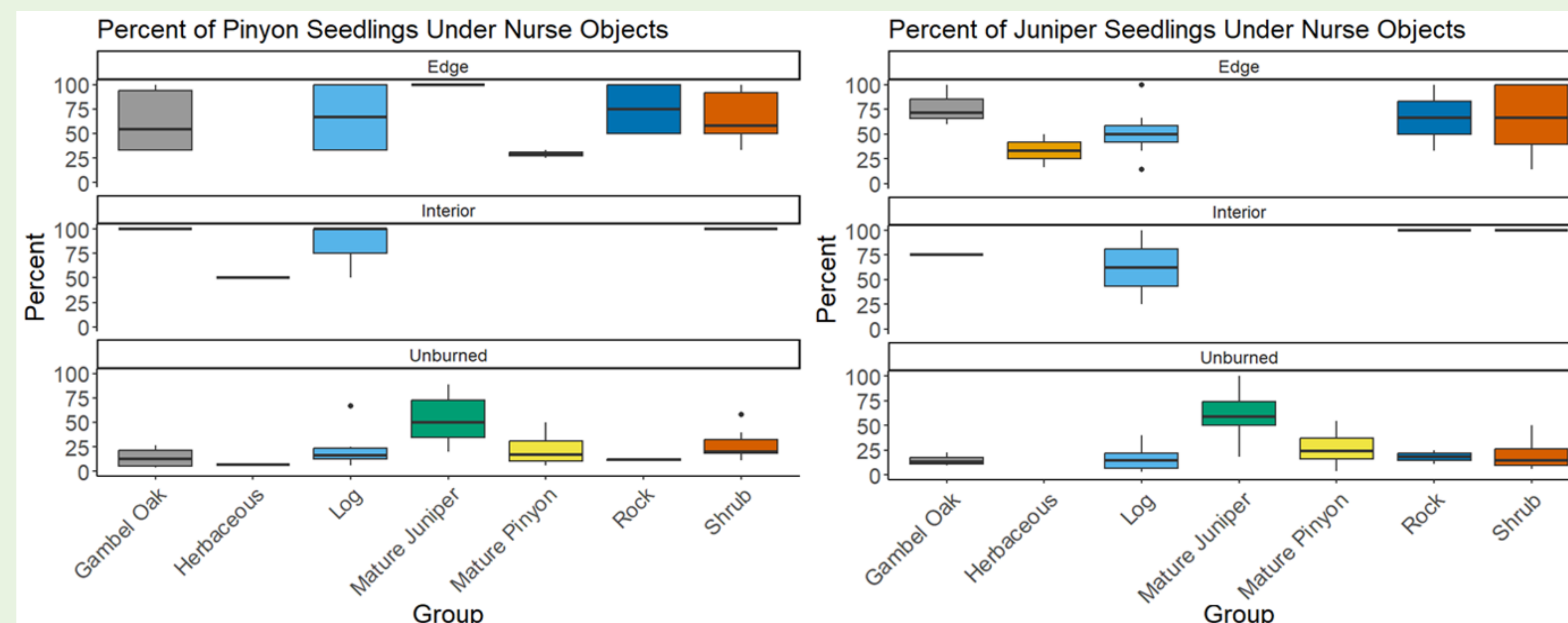


Figure 3. Nurse object effects on piñon (left) and juniper (right) seedlings

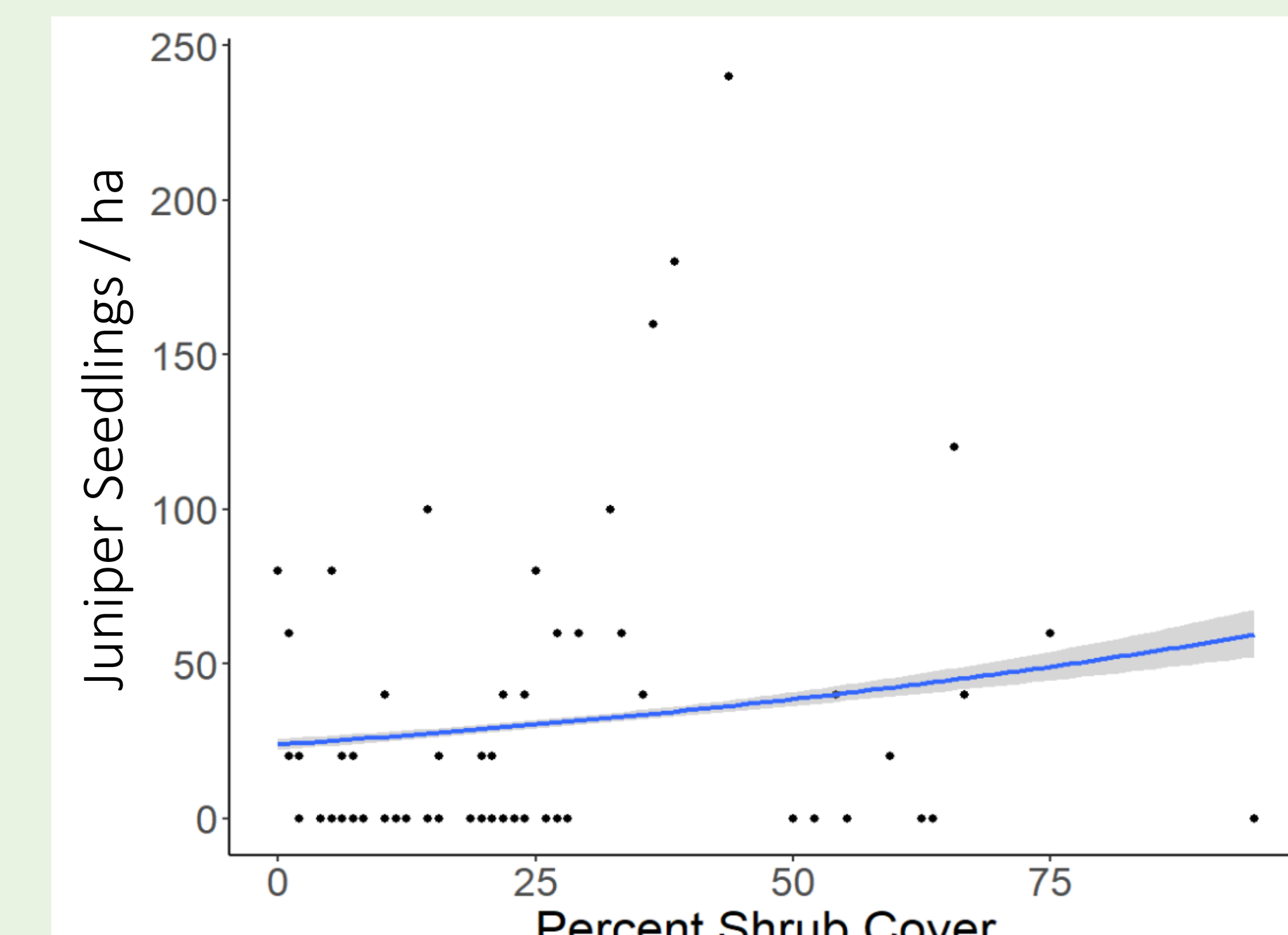


Figure 4. Positive relationship of shrubs and juniper

Discussion

- Edge plots had significantly higher regeneration than interior plots (Figure 2).
- Seedlings were more likely to be under a nurse object than not.
 - In unburned areas, seedlings were most likely under mature juniper.
 - In burned areas, piñon seedlings were most likely under Gambel oak (*Quercus gambelii*), and juniper seedlings were most likely under shrubs (Figure 3).
- Burned areas had greater percent cover of all understory functional groups, including non-native grasses and non-native forbs (Not pictured).
- For piñon, all vegetation functional groups were associated with fewer seedlings.
- For juniper, shrub cover was positively associated with seedling density (Figure 4).



Conclusions and Management Implications

- PJ regeneration 25+ years post-fire is mostly limited to the edges of burn footprints, suggesting that long-distance dispersal via birds is not enough for these areas to recover naturally and management intervention is warranted.
- Gambel oak and shrubs are important early successional nurse plants for piñon and juniper seedlings, thus ensuring their presence on the landscape may enhance PJ regeneration.
- High percent cover of non-native grasses and forbs in burn footprints may limit natural PJ regeneration.

References

1. Redmond et al. (2012) "Declines in piñon pine cone production associated with regional warming." *Ecosphere*. 2. Kerns et al (2020) "Invasive grasses: A new perfect storm for forested ecosystems?" *Forest Ecology and Management*. 3. Boone et al. (2018) "Long-term declines in the Piñon Jay and management implications for piñon-juniper woodlands." *Trends and traditions: avifaunal change in western North America. Studies of Western Birds*. 4. Rocca et al. (2014) "Climate Change Impacts on Fire Regimes and Key Ecosystem Services in Rocky Mountain Forests." *Forest Ecology and Management*. 5. Coop et al. (2020) "Wildfire-Driven Forest Conversion in Western North American Landscapes." *BioScience*.

Acknowledgements

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