

Diversity Post-Wildfire of Vegetative Understory in Rocky Mountain Ponderosa Pine Woodland and Montane Sagebrush Steppe

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Introduction

- In Montana, big sagebrush steppe, montane sagebrush steppe and rocky mountain ponderosa pine woodland take up over 16% of Montana's 380,832 km² (16.45%).
- Studies have shown that habitats dominated by graminoids depend on species abundance and richness to regulate invasion.
- The invasion process can be facilitated by the removal of native perennial species and the accumulation of seed banks of invasive annual grasses. Wildfire can contribute to these factors.
- Climate change modifies growing seasons of habitats substantially.
- A wildfire near Big Saw-Mill Gulch on September 1st 2016 offers an opportunity to compare diversity and richness in burned areas compared to unburned areas in rocky mountain ponderosa pine and montane sagebrush steppe.
- It is hypothesized that burned habitats will have lower values of diversity when compared to unburned habitats of the same ecosystem.
- Habitats with lower diversity are expected to have larger compositions of invasive species compared to habitats with higher diversity.



Methods

- The study site used was the Triple 8 ranch in Lewis and Clark County, MT. The Triple 8 ranch (46° 53.467' N, 112° 18.693' W)
- Transects were set at elevations between 1458m and 1567m.
- Data was collected from twenty 40 m transects. We evaluated understory canopy coverage using Daubenmire visual estimate with a 0.1 m² quadrat
- Five randomly sampled transects were placed in each habitat with five transects in montane sagebrush steppe, five transects in Ponderosa pine woodland, five in burned montane sagebrush steppe and lastly, five in burned ponderosa pine woodland.
- Using the Shannon-Weiner Diversity Index, diversity values for each habitat were calculated.

Results

Mean Diversity Values of Habitat

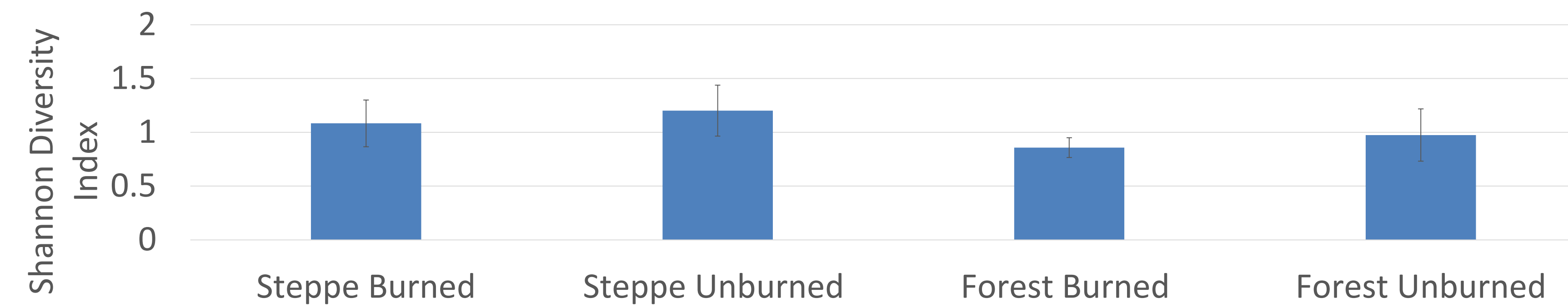


Figure 1: Shannon Diversity Index values reflecting the evenness of each habitat.

- A two-factor Anova was carried out to identify a differences in habitat diversity based on burned and unburned sites as well as differences in ecosystem. There was no effect on species diversity from either of the two factors ($p=0.122$).
- Variances were --unburned steppe:0.30, Burned Steppe:0.064, Unburned Forest:0.059, and Burned Forest: 0.0699.

Graminoid Composition

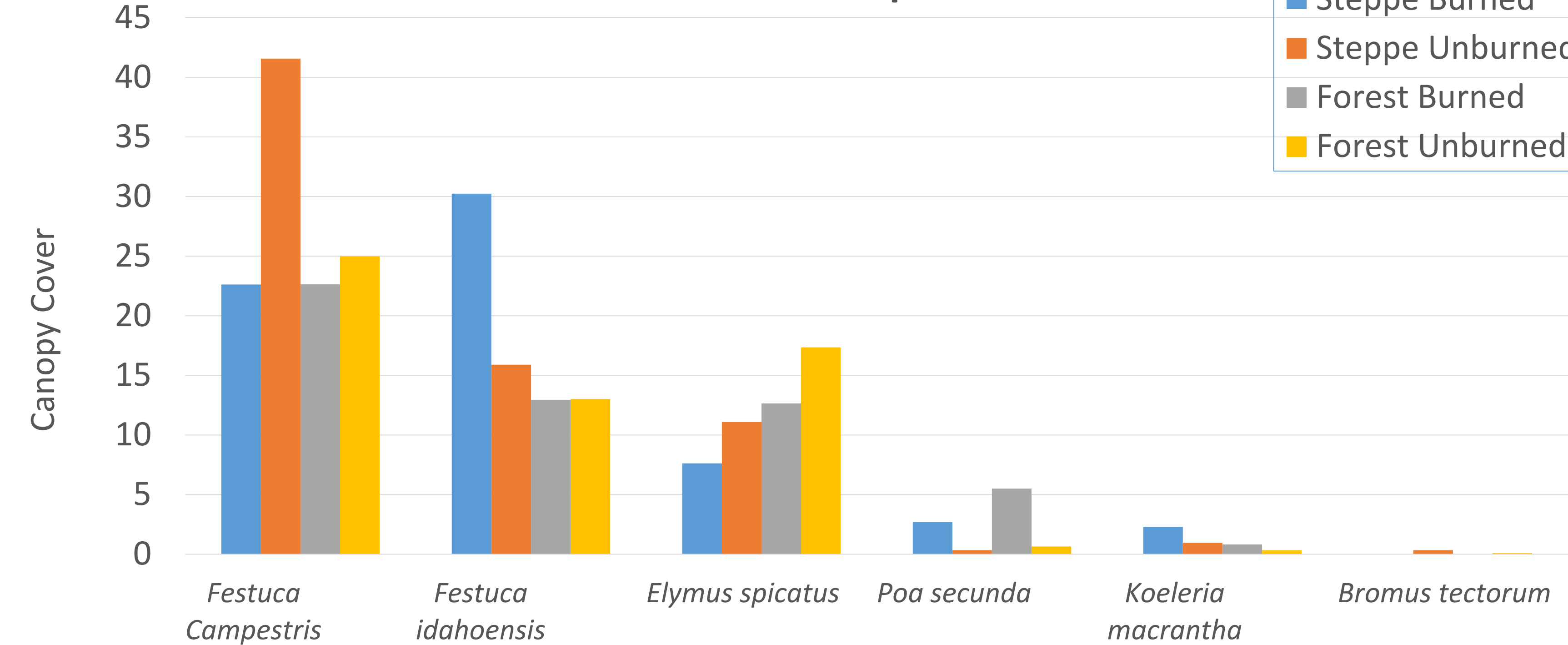


Figure 2: Graminoid Species Composition

Species of Interest

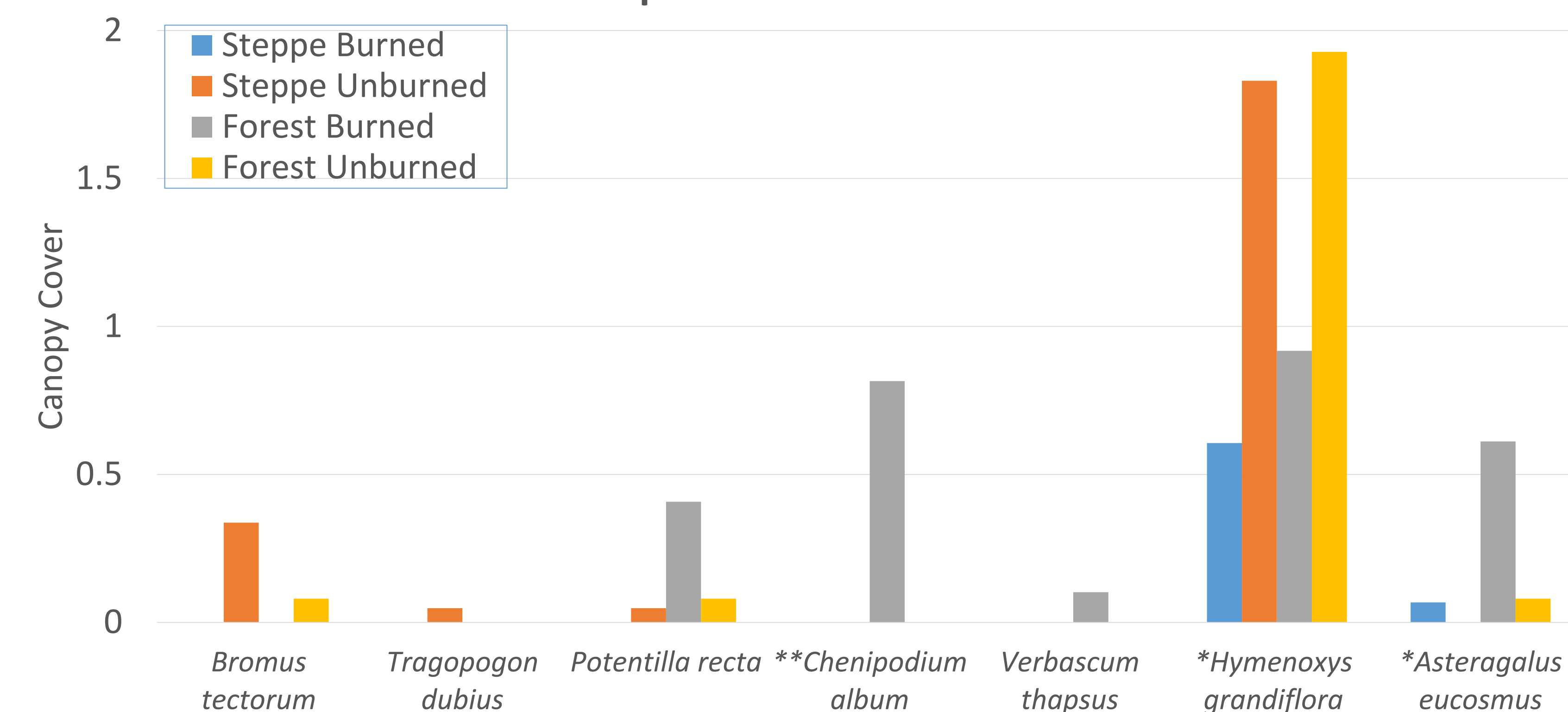


Figure 3: Threatened Species and invasive species Composition. *threatened species, **non-native species

- 59 total species were identified based off of characteristics of the samples collected.
- Diversity values were identified. Steppe Burned:1.08, Steppe Unburned:1.20, Forest Burned: 0.858, Forest Unburned: 0.974.
- Mean species richness for forest burned and unburned was 18 and 19 respectively, while burned steppe and unburned steppe was calculated at 13.8 and 17.8 respectively.



Habitat	Most Frequently Encountered Species	% Composition for Habitat	Frequency of Encounters	Coverage in Habitat (m ²)
Steppe Unburned	Idaho Fescue	30.2%	0.93	11.23
Steppe Burned	Rough Fescue	41.6%	0.67	21.58
Forest Unburned	Arenaria Fendleri	10.3%	0.59	2.53
Forest Burned	Bluebunch Wheatgrass	17.4%	0.56	5.40

Conclusion

- Species richness and abundance has been known to regulate ecological invasion and a low evenness may indicate vacant niches that if left vacant can help facilitate invasion.
- Despite the higher degree of species richness in the forest habitats, the steppe habitats evaluated had higher diversity values based on the Shannon-Weiner Index (figure 1).
- While there was no significant difference in species diversity found between burned and unburned habitats or between steppe and forest ecosystems, the diversity values found in this study reflect a relatively low evenness in all evaluated ecosystems.
- While invasion by *Bromus tectorum* is usually facilitated by wildfire, its presence was only found in unburned sites. Future studies may reflect a larger composition of *Bromus tectorum* in burned habitats.
- The burned forest habitat had the largest portion of canopy cover made up of invasive species (1.33%). This may indicate that low diversity is allowing the proliferation of invasive species into the unburned forest habitat more than the other evaluated habitats.
- Repeated studies in this study site may reflect increased presence of invasive species in burned woodland compared to either steppe habitat because of its low diversity.

Acknowledgements

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