Fueling the Fire: How Plant Traits Shape Grassland Flammability in the Front Range

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Introduction

- In dry climates, grasslands can become a significant wildfire hazard to the ecosystem and our communities.
  - Grassland fires contribute to the destruction of more homes than forest wildfires here in the US (Mahon, 2023).
  - The devastating 2021 Marshall Fire in Boulder County destroyed and damaged over 1,000 homes (Boulder County n.d).
- Grassland occur within and around communities.
  - Yards, urban parks, natural areas and other landscaped areas can all allow fire spread into neighborhoods.
  - However, grasslands provide important benefits such as recreational areas, biodiversity and can add aesthetic value, and much more.
- Managing grasslands that are surrounding and within the parameters of our communities can potentially reduce the risk of fire spread while allowing grasslands to provide other benefits.
  - Promoting and planting native species with inherently low flammability, into grasslands inside and around cities, could reduce the risk of fire spread.
  - Yet, we still don't know how species influence fire hazard when the plants are dead (during dormant season) and alive (during growing season).

Question

- How do plant traits influence the fire hazard of grassland species as they transition from live to dead?

Methods

Study Area

- 50 grassland sites in Boulder Colorado, with different elevation, ecology, and environmental factors (grazing, burn area*, etc.).*

Trait Measurements

- Leaf thickness (mm)
- Leaf curl distance(mm)
- Leaf density (mg)

Comparisons & Analyses

- Analysis of variation in leaf thicknesses within and among individual plants of each species.
- Ranking of species by flammability based on trait values
- Comparison of rankings within live vs. litter traits
- 500 iterations to gain more perspective and allowing us to account for the variation.

Results

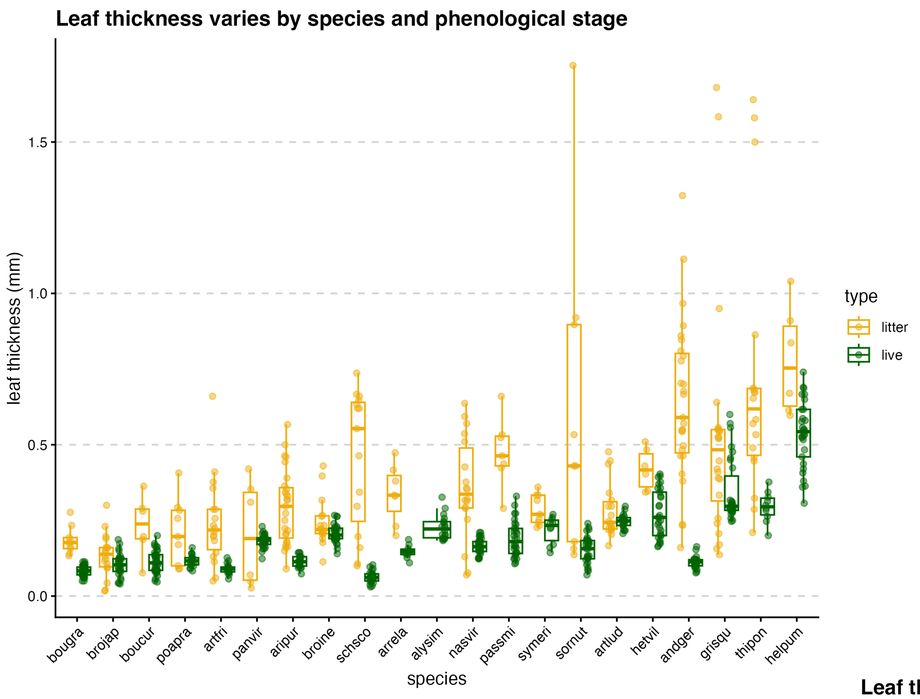

Figure 1 shows the comparability of leaf thickness while alive and dead.

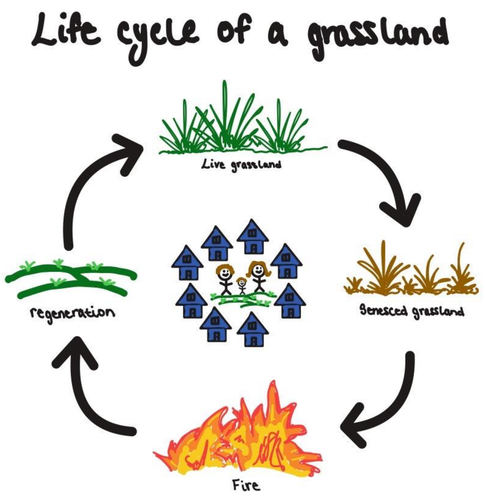

Figure 2 shows a grassland cycle and why it is important due to grasslands being in and around our communities.

Most ignitable

- **Common name**: Schizachyrium scoparium.
- **Abbreviation**: schsco

- **Common name**: Bromus japonicus
- **Abbreviation**: brojap

- **Common name**: Artemisia frigida
- **Abbreviation**: artfri

Least ignitable

- **Common name**: Heterotheca villosa
- **Abbreviation**: hetvil

- **Common name**: Grindelia squarrosa
- **Abbreviation**: grisqu

- **Common name**: Helianthus pumilus
- **Abbreviation**: helpum

- **Common name**: Thinopyrum obtusiflorum.
- **Abbreviation**: thipon

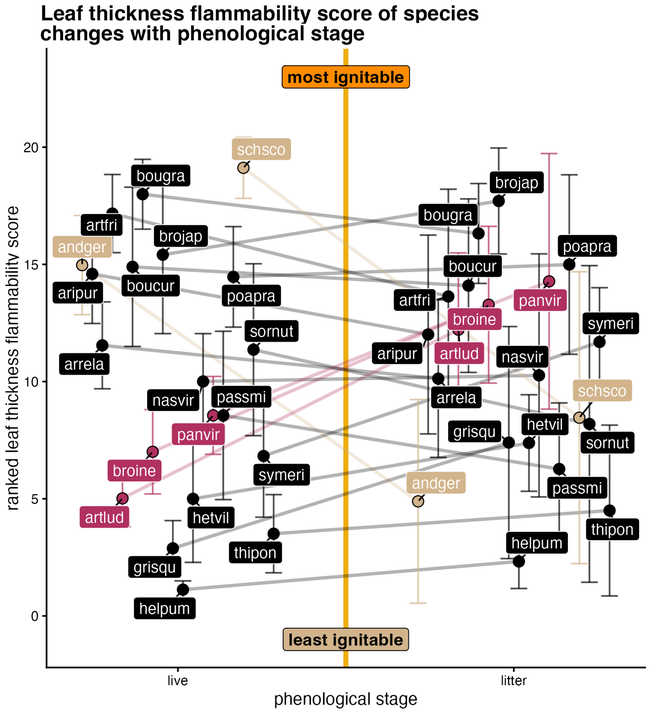

Figure 3 shows the ignitability within live and dead species comparatively when their phenological stage changes.

Discussion

- After measuring traits of live vegetation and litter, we ranked species according to leaf thickness in relation to flammability. We found that it doesn't effectively correlate to phenological stage rather than the species itself. Some species have thinner leaves when dead and thicker leaves when alive, and vice versa.
- This data was quite unexpected given our hypothesis was for the dead leaves to have been smaller due to less moisture content.
  - However, as leaves dry up, they may curl which can increase the effective thickness.
  - Additionally, we found some species have greater dry mass in dead leaves than in live leaves, suggesting plants may be concentrating wastes into litter.
- Thicker leaves are harder to ignite, allowing us to see that helpum is the least flammable when it comes to the leaf thickness and schsco is the most flammable.
- This is the first time leaf thickness has been looked at while the plant is alive and dead, meaning this is exploratory research, allowing future researchers to build off this data set.

Future Work and References

Due to plant flammability being influenced by many interacting factors, additional research is needed to develop a more complete understanding. Future studies should examine chemical composition, combustion characteristics, and plant architecture, allowing us to improve fire risk assessment and management in Front Range communities and ecosystems.

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