Apr 11th, 3:00 PM - 4:00 PM

Leaky Moss in Montana's Grasslands

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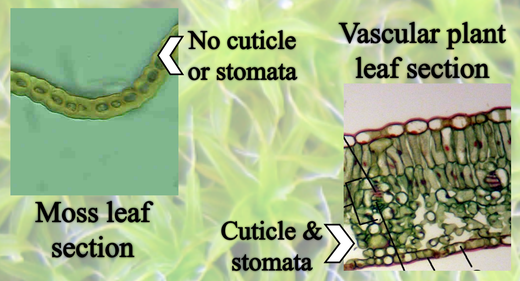
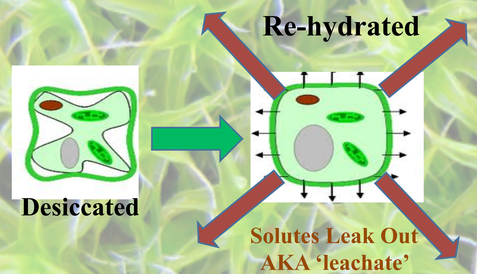
Why do mosses leak?



Mosses lack the cuticle and stomata that vascular plants use to regulate the movement of water and solutes. In mosses, water and nutrients move across the leaves and diffuse straight across cell walls.



Mosses are extremely resistant to desiccation, and can rehydrate within minutes, allowing them to thrive in Montana's dry grasslands. However, mosses rehydrate so quickly that their cell walls burst and water and solutes leak out, potentially leaching nutrients to surrounding plants.

What's in the 'leachate'?

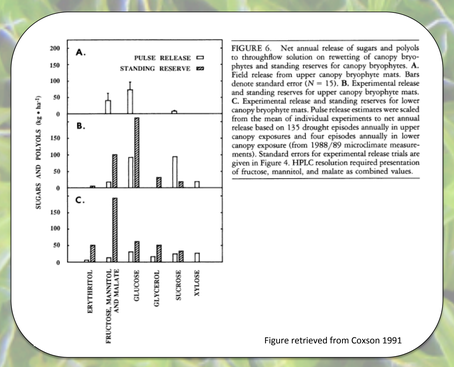


FIGURE 6. Net annual release of sugars and polyols to throughflow solution on rewetting of canopy bryophytes and standing reserves for canopy bryophytes. **A.** Field release from upper canopy bryophyte mats. Bars denote standard error ($N = 15$). **B.** Experimental release and standing reserves for upper canopy bryophyte mats. **C.** Experimental release and standing reserves for lower canopy bryophyte mats. Pulse release estimates were scaled from the mean of individual experiments to net annual release based on 135 drought episodes annually in upper canopy exposures and four episodes annually in lower canopy exposure (from 1988/89 microclimate measurements). Standard errors for experimental release trials are given in Figure 4. HPLC resolution required presentation of fructose, mannitol, and malate as combined values.

Figure retrieved from Coxson 1991

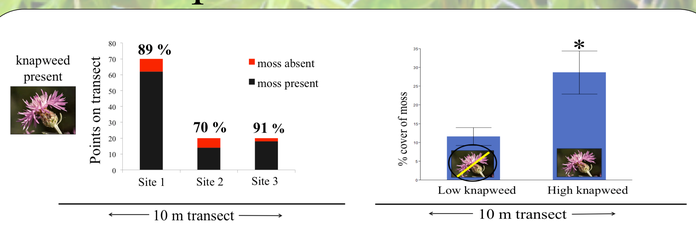
Using Total Organic Carbon and Nitrogen (TOCN) analysis we were able to get preliminary data suggesting sugars are present in moss leachate. These sugars could potentially be used by the surrounding plants after each rehydration event. Using the method of leachate collection in our current experiment we found a mean Total Soluble Carbon Release of 29.82 mg/L.

Can vascular plants benefit from moss leachate?

Could nutrient pulses from rehydrating moss be influencing vascular plant recruitment? What effect do these nutrient pulses have on plants in competition? Do native and non-native plants benefit differently?

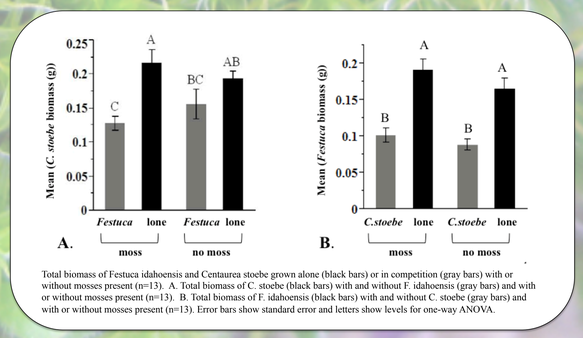
Moss interacts with grassland plants:

Spatial Association



In our study site near Bonner, MT, we found that moss co-occurred with knapweed at least 70% of the time and moss cover was greater in sites with a high concentration of knapweed.

Influence in Competition



Total biomass of Festuca idahoensis and Centaurea stoebe grown alone (black bars) or in competition (gray bars) with or without mosses present (n=13). A. Total biomass of C. stoebe (black bars) with and without F. idahoensis (gray bars) and with or without mosses present (n=13). B. Total biomass of F. idahoensis (black bars) with and without C. stoebe (gray bars) and with or without mosses present (n=13). Error bars show standard error and letters show levels for one-way ANOVA.

The effect of moss on knapweed and fescue was not significant when either plant was grown alone. When in competition with fescue, moss suppressed knapweed whereas fescue was unaffected.

Current Experiment:

Does moss leachate impact growth in a native and a non-native grassland species, *Centarea stoebe*, and *Festuca idahoensis*?

Common Garden:

Collect Moss Leachate

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Water Fescue and Knapweed, both alone and in competition with moss leachate or normal water

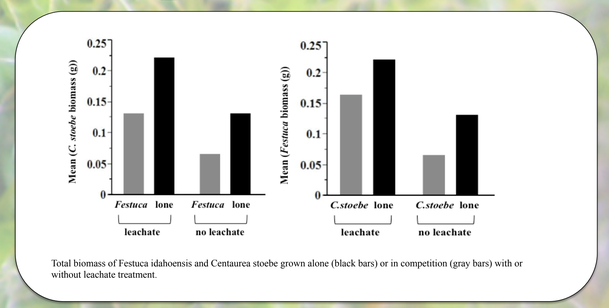
↓

Measure final plant biomass and compare

Leachate Collection Units: Dehydrated moss is placed on top and watered. Leachate throughfall is collected below.

Tube Pots containing either Knapweed, Fescue, or both. Watered with either moss leachate or tap water

Expected Results



Total biomass of Festuca idahoensis and Centaurea stoebe grown alone (black bars) or in competition (gray bars) with or without leachate treatment.

We expect to find that both fescue and knapweed have increased growth when grown alone and watered with moss leachate. In competition we might see that native plants are able to compete better against nonnative invaders when moss leachate is present. This could have many management implications especially among restoration efforts. The presence of moss could fortify natives against potential invaders.

Acknowledgments

Much thanks to Mandy Slate, Ragan Callaway, and the rest of the Callaway Lab for their support and resources. Funding provided by the Davidson Honors College Undergraduate Research Award.

Selected References

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