An Investigation of Intraspecific Variation of *Bolboschoenus Maritimus* (Alkali Bulrush)

Audree Van Valkenburg[a], Karin Kettenring[b], Trisha Atwood[b], Rachel Chamberlain[c]

[a]*Fisheries and Aquatic Science BS – Utah State University (USU)*

[b]*Department of Watershed Science and Ecology Center – USU*

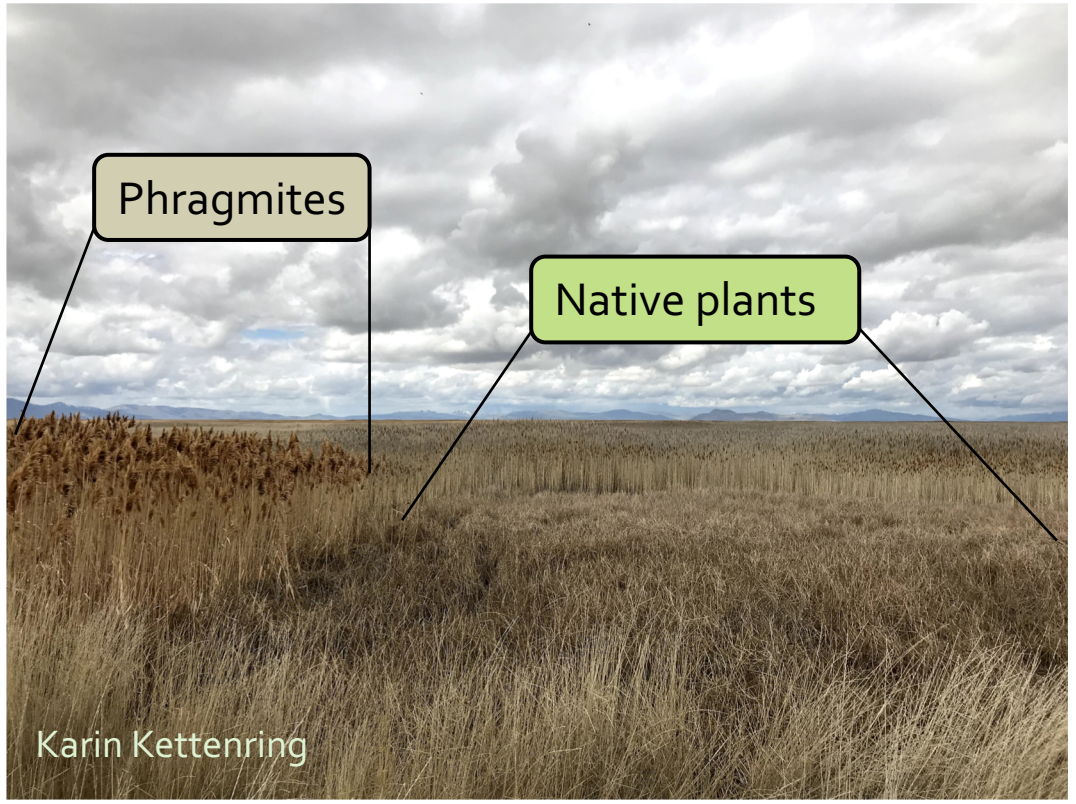
[c]*Conservation and Resoration Ecology – USU*

Alkali bulrush is a keystone species for migratory birds

Kettenring et al. 2018

Why care?

Phragmites australis monotypic stand

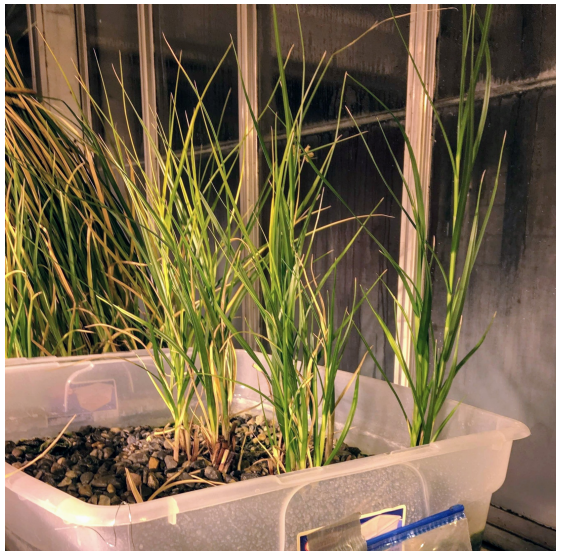


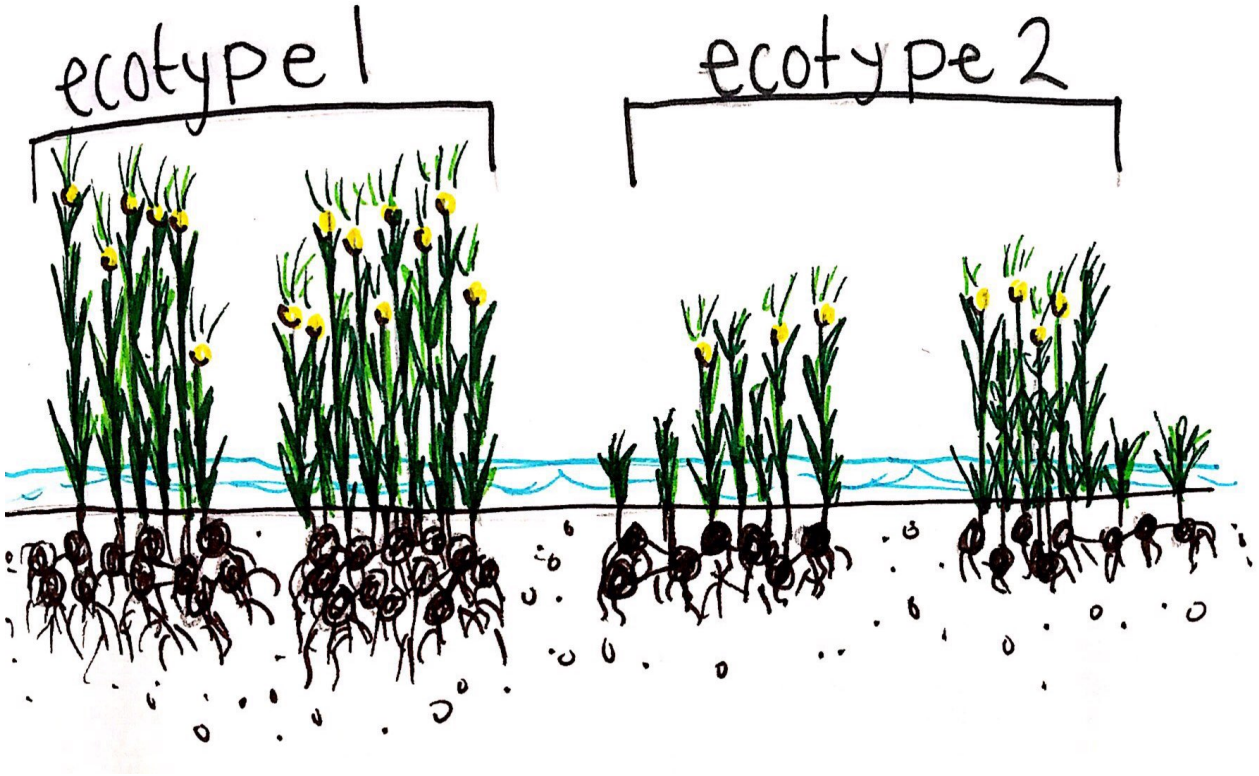
Post *P. australis* treatment

Kettenring et al. 2012, Marty and Kettenring 2017

Inform Wetland Restoration Managers

Alkali bulrush traits vary between ecotypes

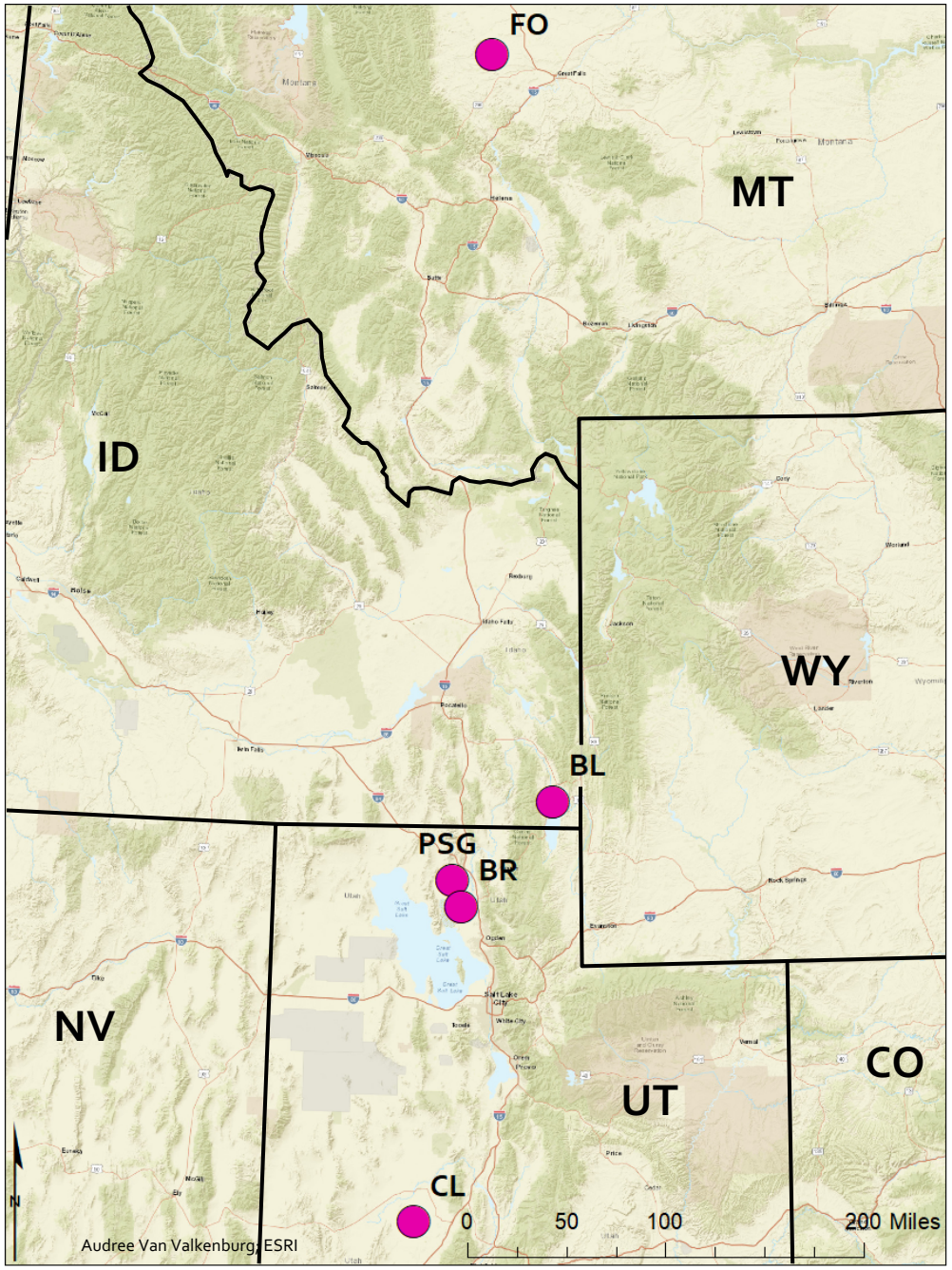




Hypothesis

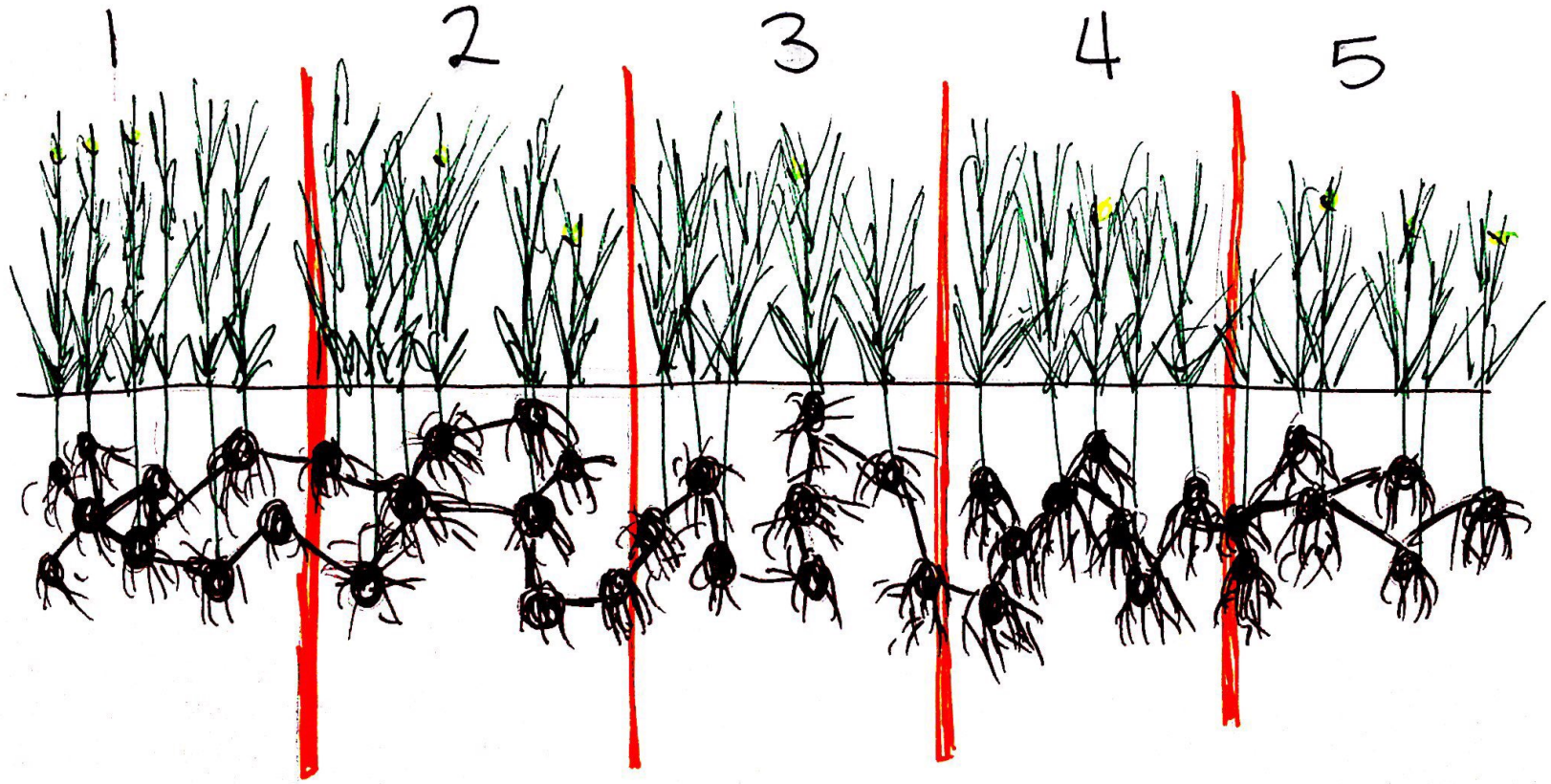
Traits between different ecotypes will be different and traits within ecotypes will be similar.

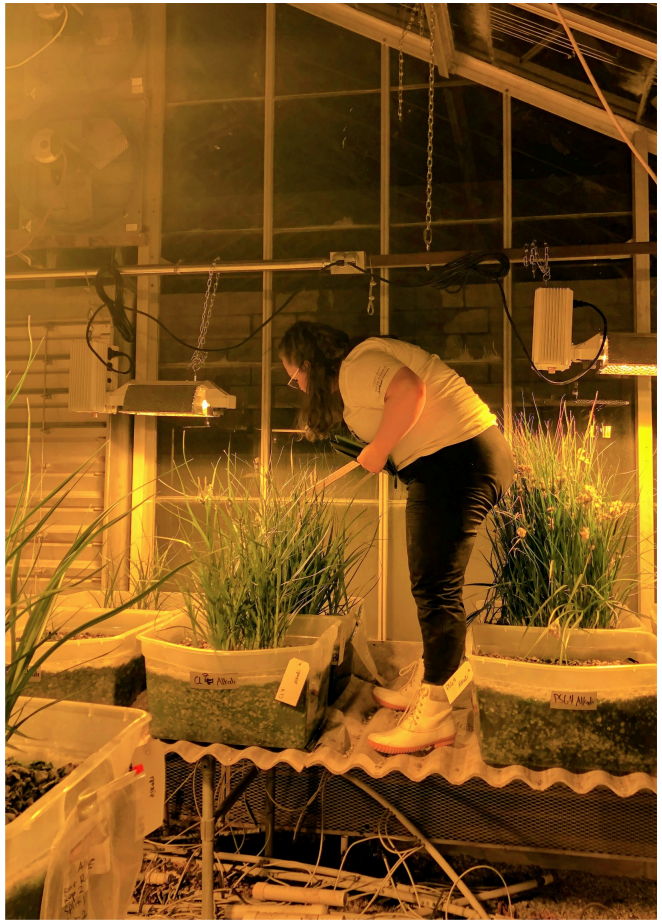
Ecotype Locations



FO: Freeze Out Lake, MT
BL: Bear Lake Wetlands, ID
PSG: Public Shooting Grounds, UT
BR: Bear River Migratory Bird Refuge, UT
CL: Clear Lake, UT

Five replicates per ecotype





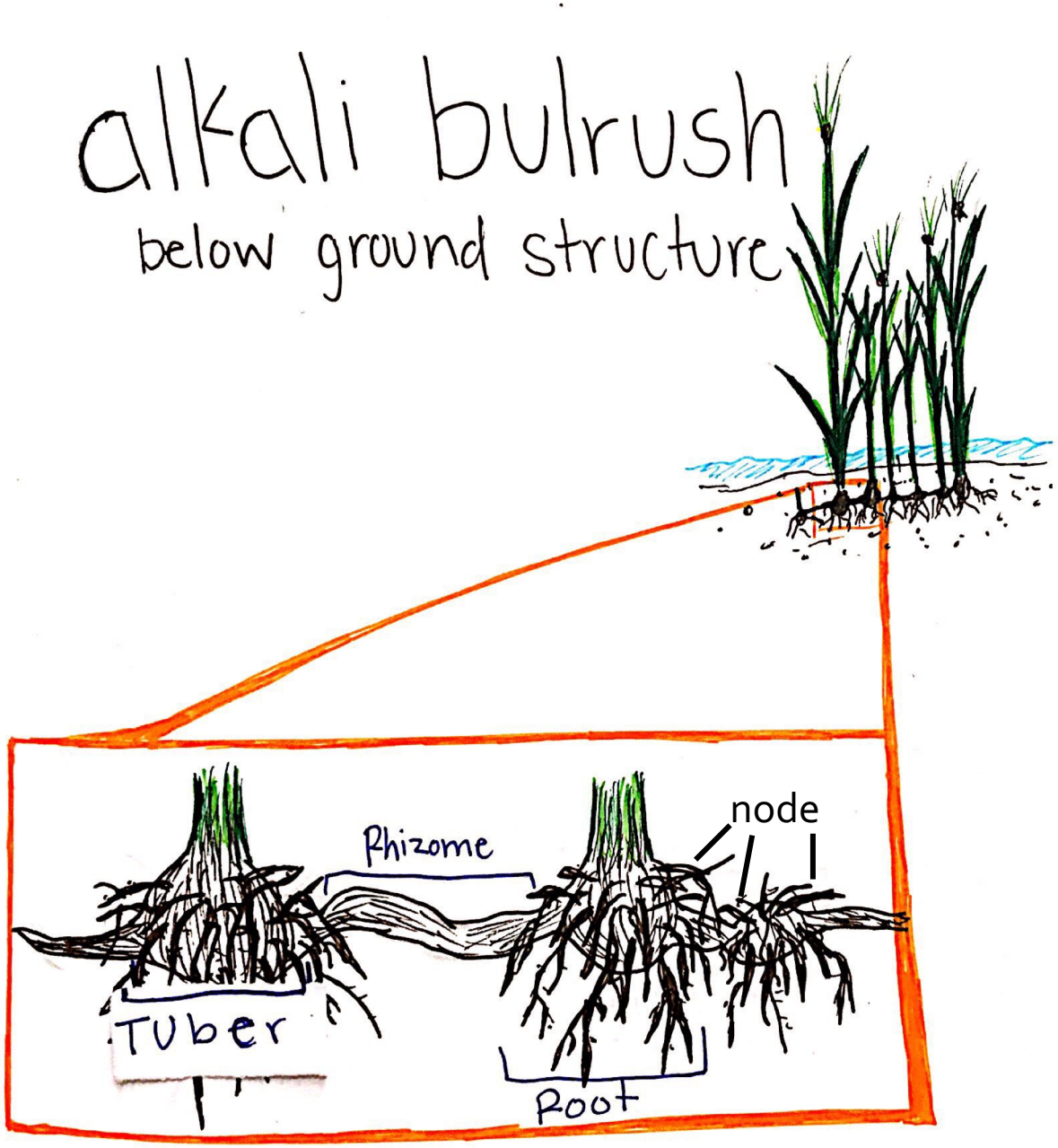
Common Garden Experiment

Above Ground Traits:

- Above ground biomass
- Maximum Vegetative Height
- Average height
- Stem count
- Inflorescence count

Below Ground Traits:

- Below ground biomass
- Stems per tuber
- Nodes per tuber
- Root biomass per tuber

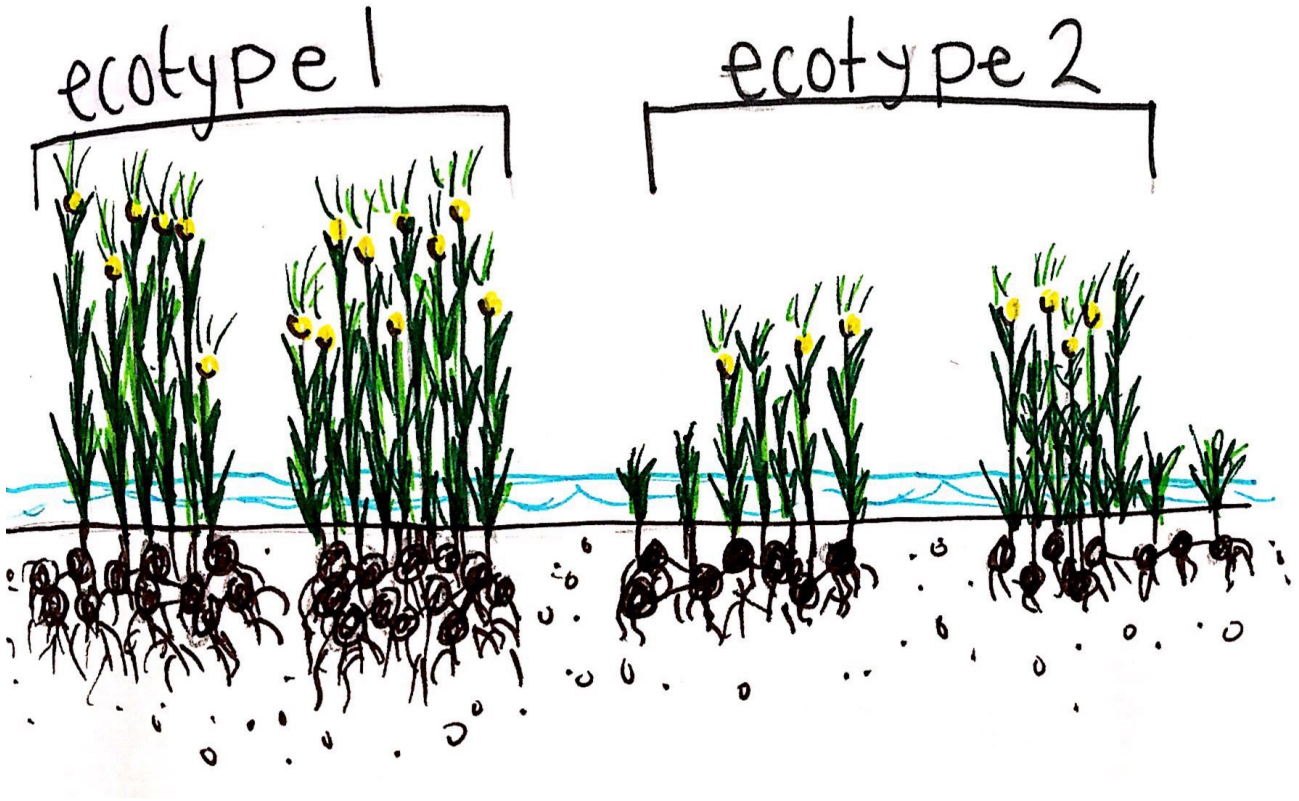


Downard et al. 2018

Statistical analysis

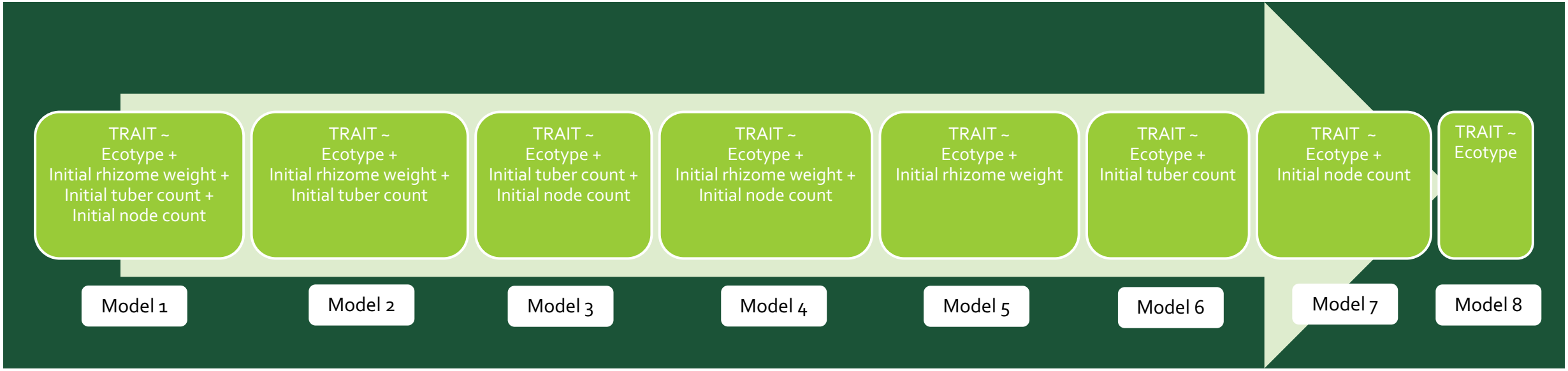
Levene's test: p-value > 0.05 for all traits

Variation is equal between ecotypes for each trait



Statistical analysis

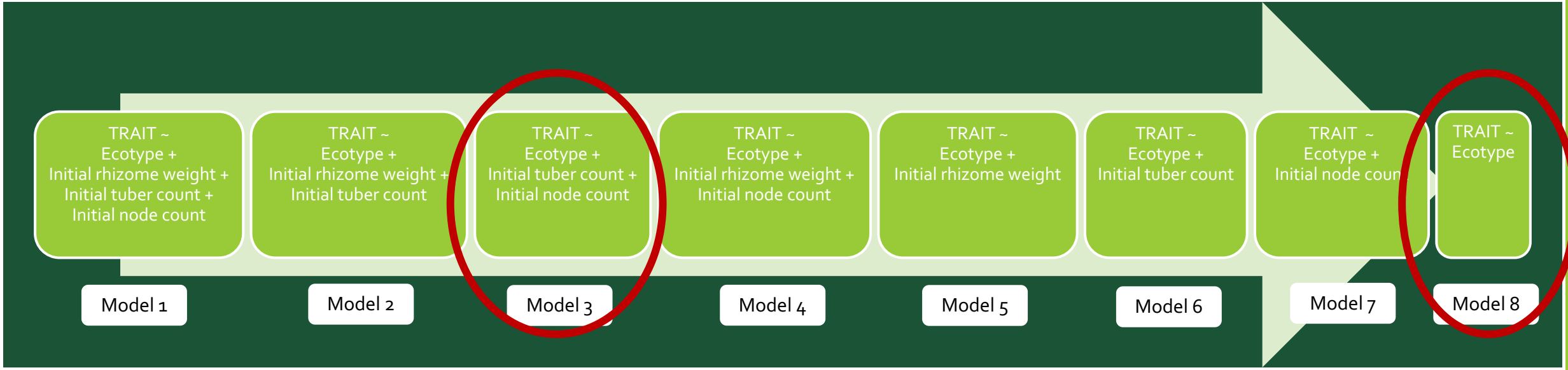
Generalized Linear Model



- Akaike's Information Criterion (AIC) to find the best fit model

Statistical analysis

Generalized Linear Model

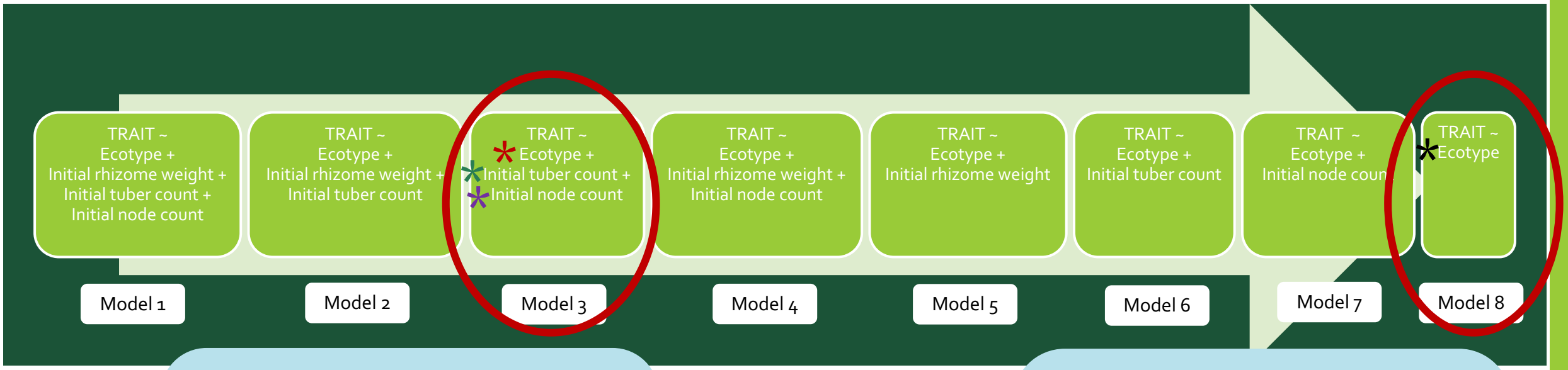


- Akaike's Information Criterion (AIC) to find the best fit model

Statistical analysis

Generalized Linear Model

* P-value < 0.05 **The variable has an effect on the ecotype**



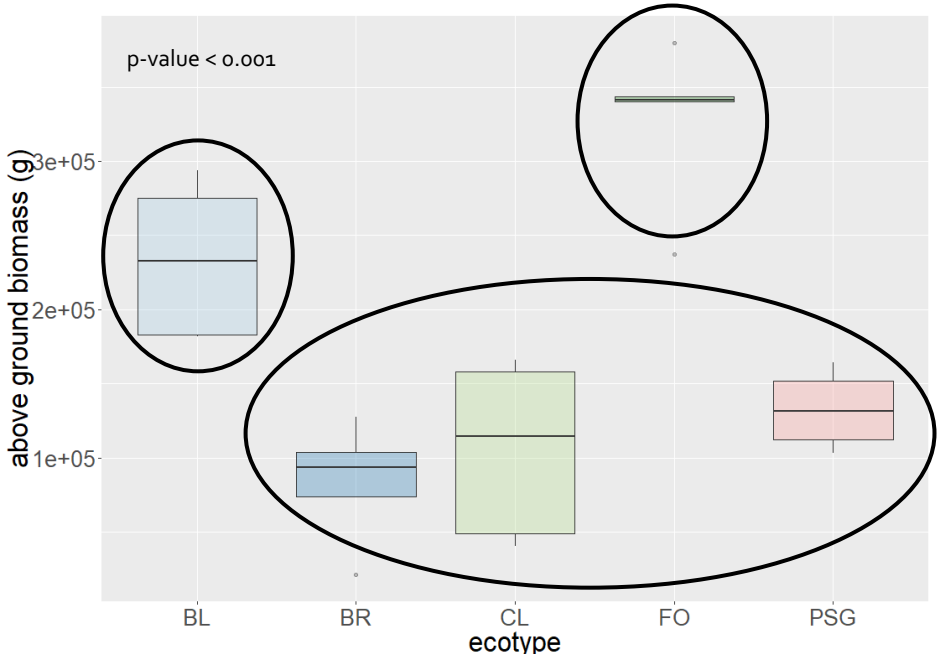
Model 3

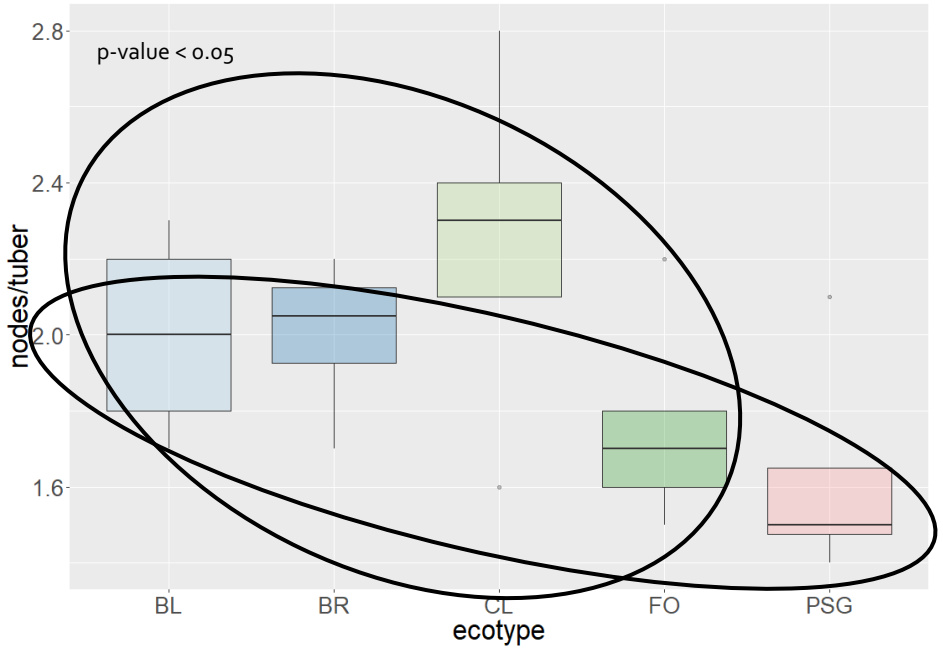
- Above Ground Biomass * *
- Below Ground biomass
- Proportion of stems to tubers *
- Stem count *

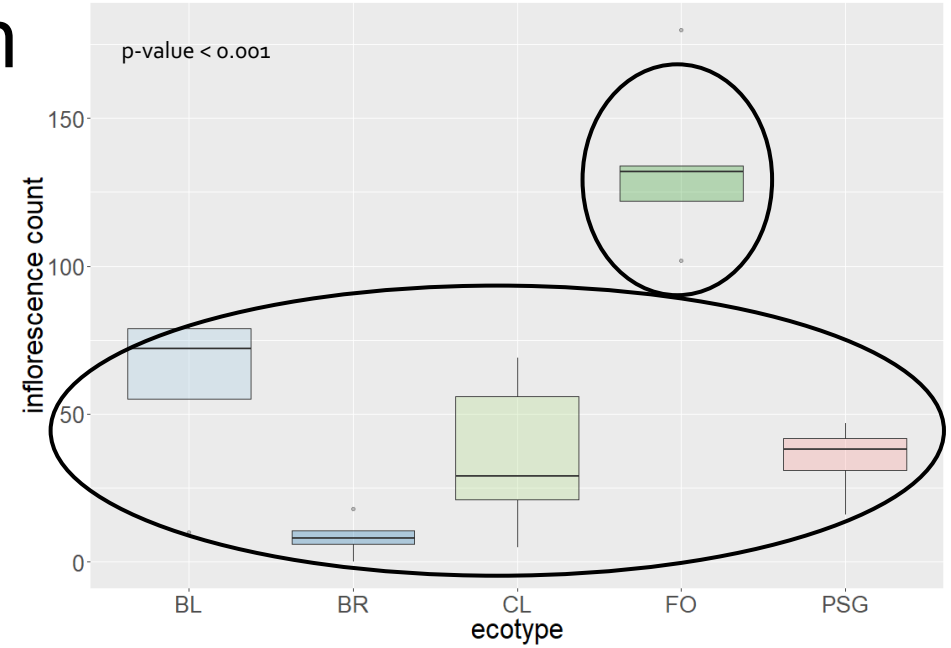
Model 8

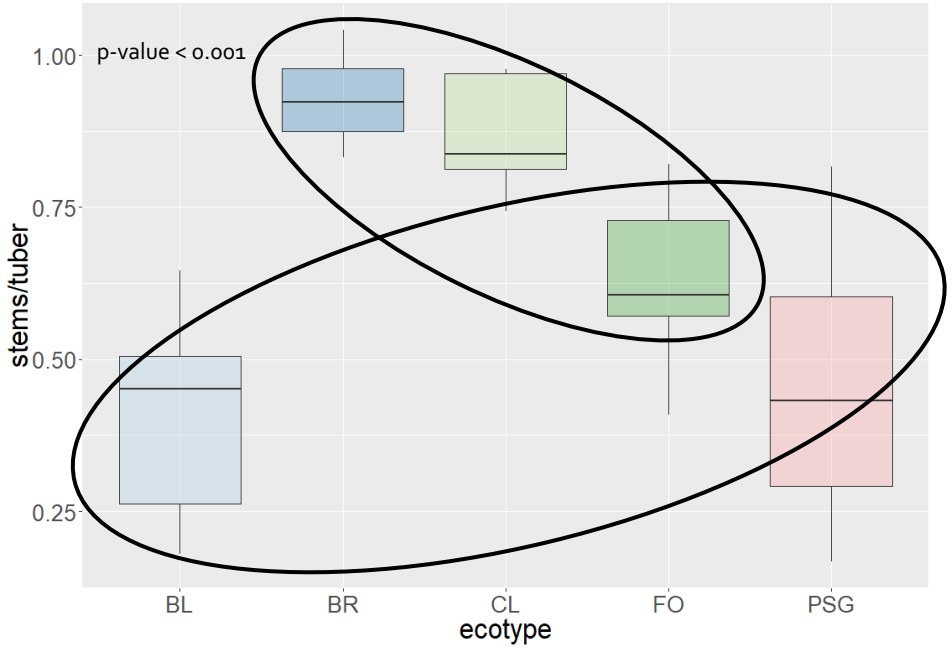
- Proportion of nodes to tubers *
- Root biomass per tuber *
- Maximum vegetative height
- Inflorescence count *
- Average height

Pairwise comparison









Variable traits

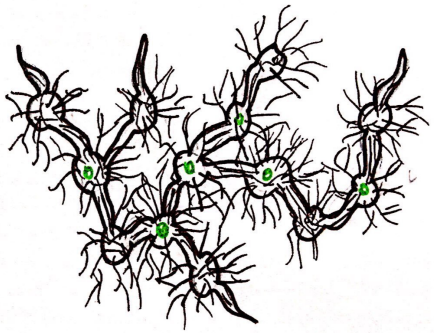
High biomass and inflorescence count

Lower biomass and inflorescence count

Greater production, reproductive potential, and crowding resistance

Lower production, reproductive potential, and crowding resistance

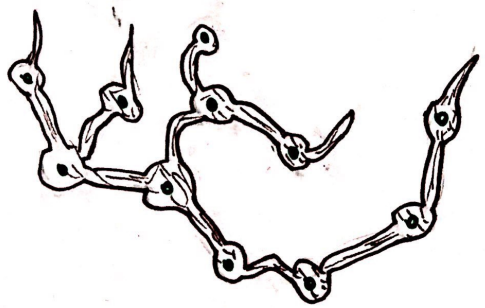
High nodes per tuber



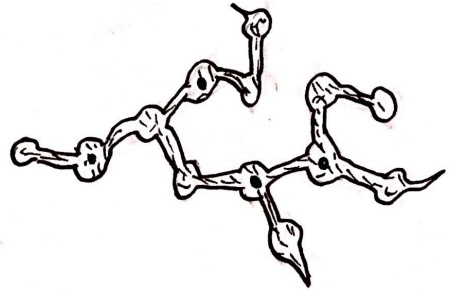
Lower nodes per tuber

High crowding resistance

Lower crowding resistance



Stems per tuber = 1



Stems per tuber = 0.25

High production and crowding resistance

Lower production and crowding resistance

Moore et al. 2017

Conclusion and Implications

- Plants from different ecotypes have **variable traits** for
  - **Crowding resistance**
  - **Productivity**
  - **Spread**
  - **Reproductive potential**

- Inform **managers** on restoration of alkali bulrush
- Inform **researchers** on methods to analyze below ground traits of wetland plants

Thank you
Karin Kettenring,
Trisha Atwood,
and Rachel Chamberlain
for you support and
contributions!

Questions?

Citations

Downard, R., M. Frank, J. Perkins, K. Kettenring, and M. Larese-Casanova. 2018. Wetland plants of Great Salt Lake: a guide to identification, communities, and bird habitat.

Kettenring, K. M., S. de Blois, and D. P. Hauber. 2012. Moving from a regional to a continental perspective of Phragmites australis invasion in North America. AoB Plants 2012:pls040-pls040.

Kettenring, K. M., B. N. Mossman, R. Downard, and K. E. Mock. 2018. Fine scale genetic diversity and landscape-scale genetic structuring in three foundational bulrush species: implications for wetland revegetation. Restoration Ecology.

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Moore, H., H. Rydin, K. Hylander, M. B. Nilsson, R. Lindborg, and J. Norberg. 2017. Towards a trait-based ecology of wetland vegetation. Journal of Ecology 105: 1623-1635.