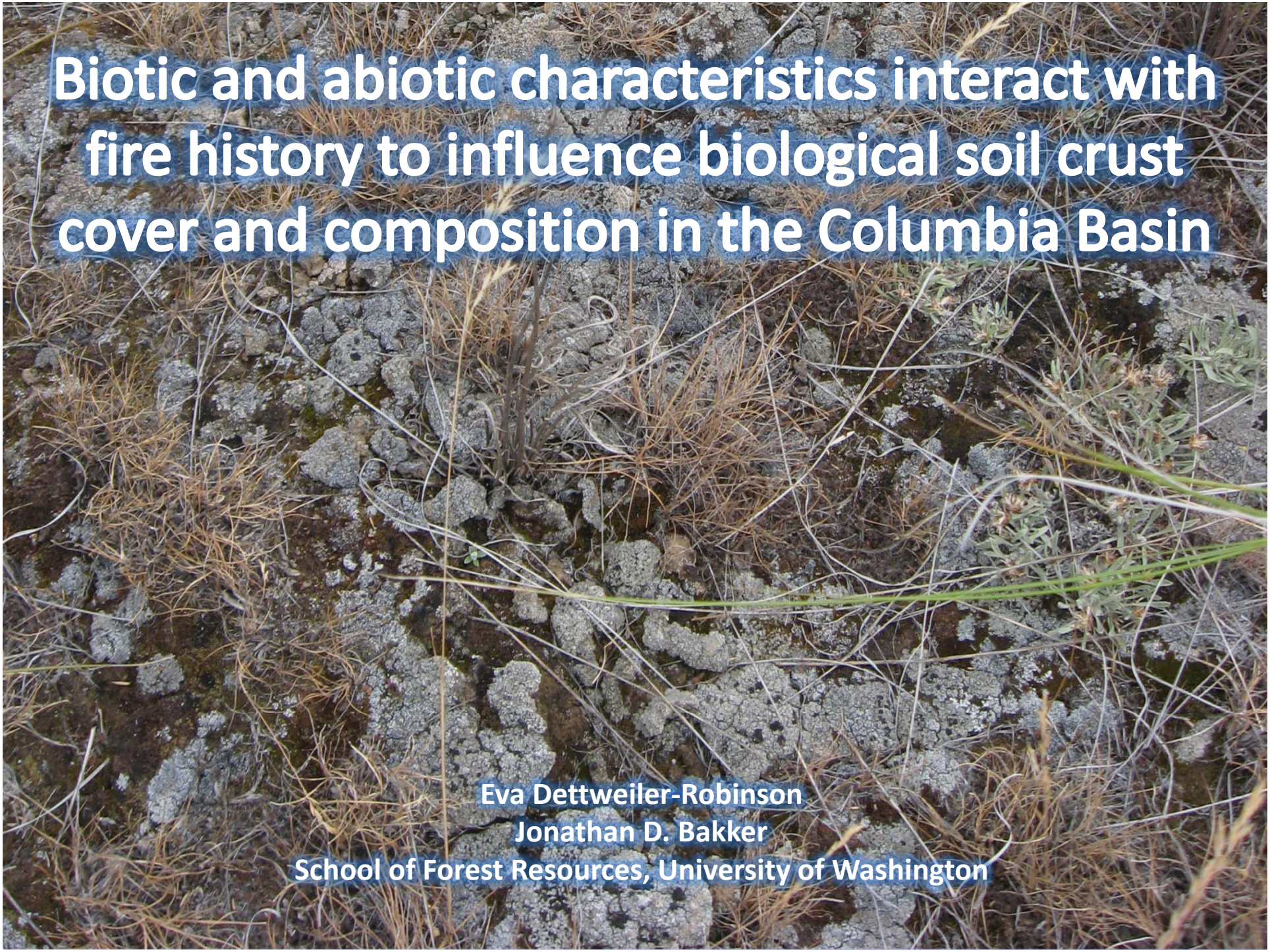
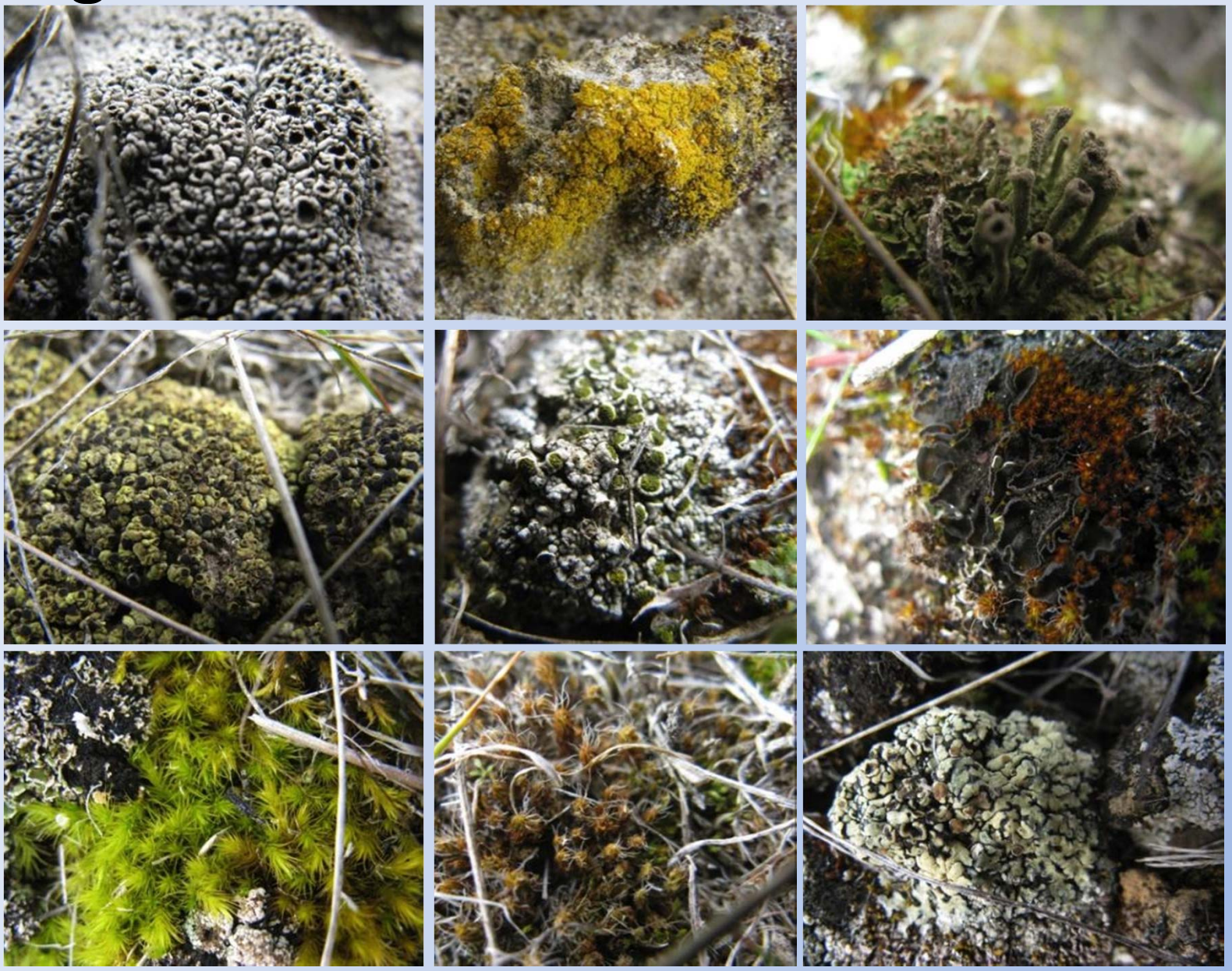


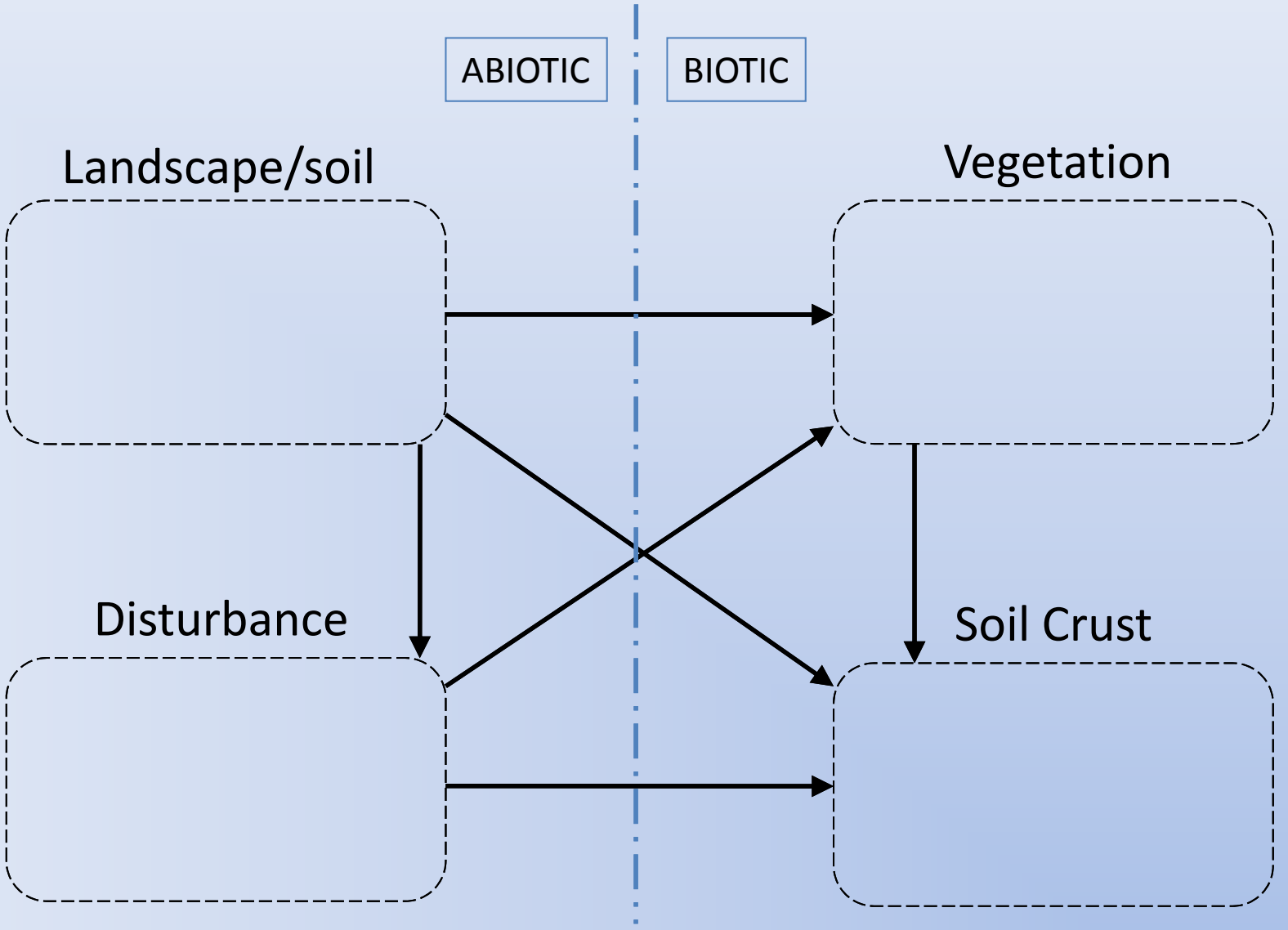
Biotic and abiotic characteristics interact with fire history to influence biological soil crust cover and composition in the Columbia Basin

Eva Dettweiler-Robinson
Jonathan D. Bakker
School of Forest Resources, University of Washington

Biological soil crusts in the Columbia Basin



Question:
What is the relative importance of factors that influence moss and lichen cover and composition?



Initial Model

- There are many possible mechanisms
- Looking only at net effects

Methods

- 100 Transects
- Range of soil type, elevation, vegetation, and fire history (1-30+ years since fire)

Analysis

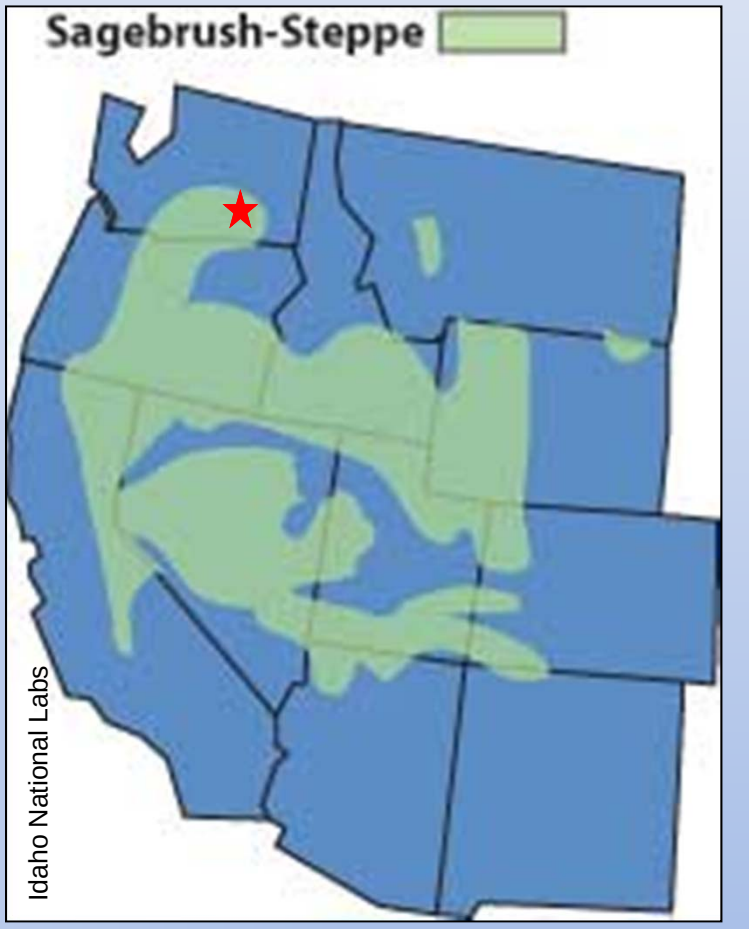
- Transformed explanatory variables to improve normality

Moss and lichen cover:

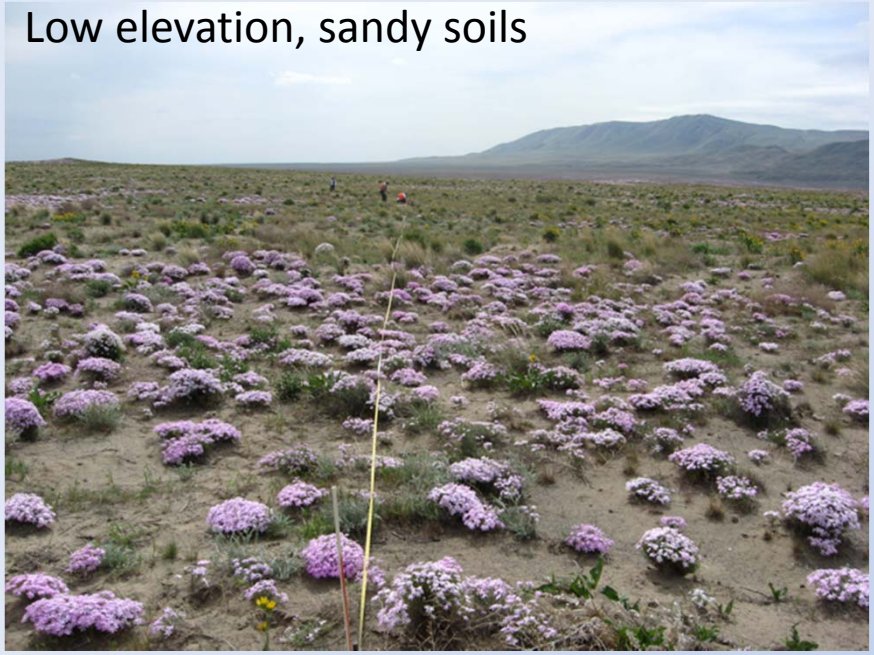
Structural Equation Modeling

Moss and lichen composition:

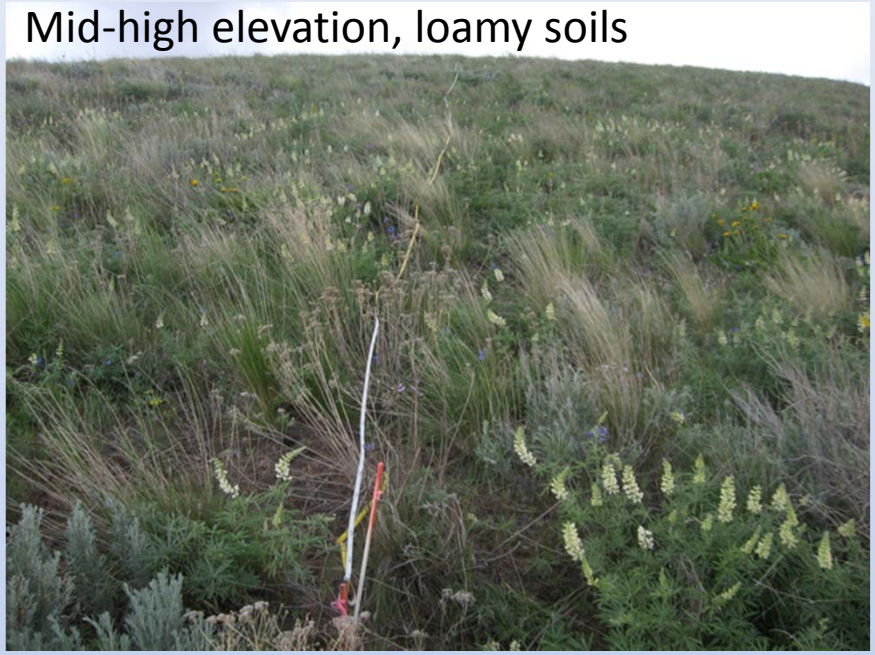
Distance-based linear modeling



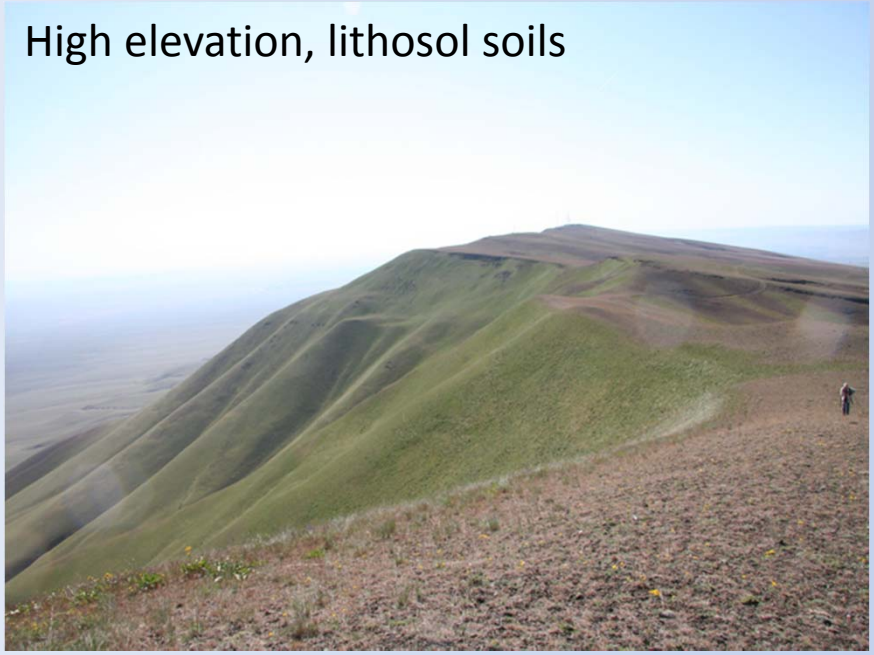
Low elevation, sandy soils



Mid-high elevation, loamy soils



High elevation, lithosol soils



Range of aspects and slopes

Bare ground

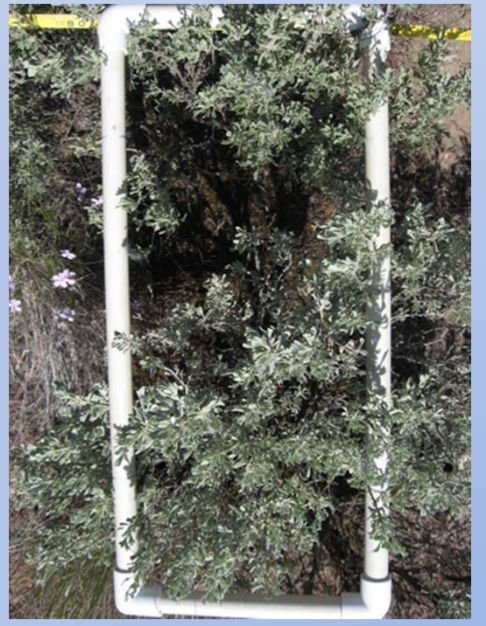
Bunchgrasses

Invasive annual grass

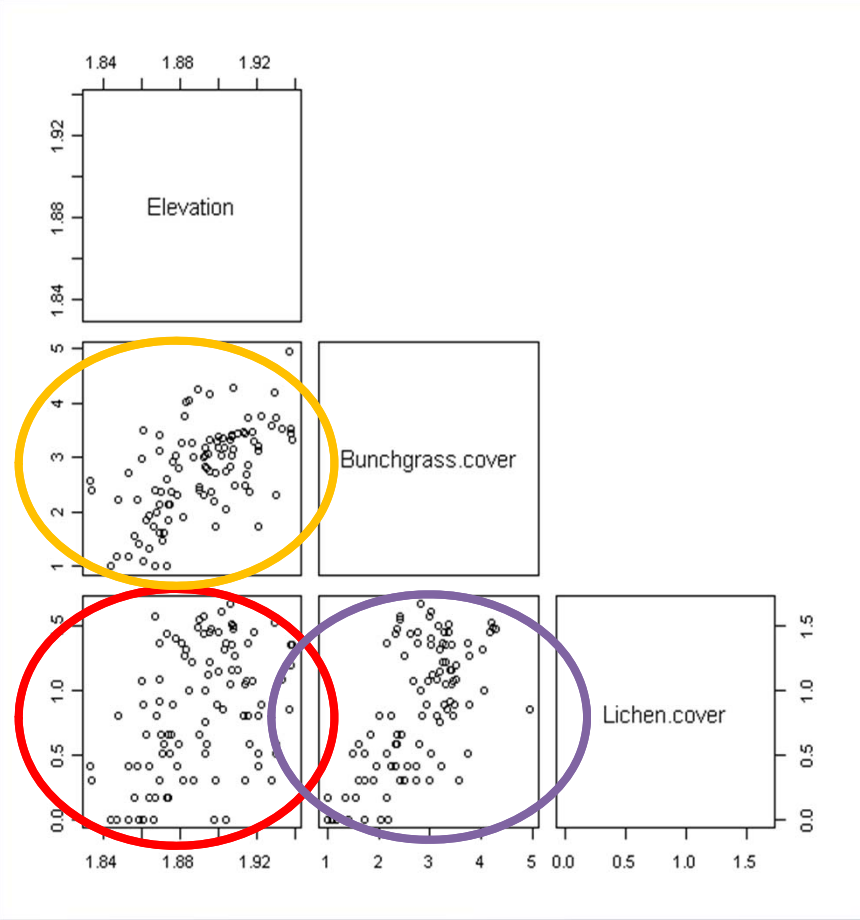
Small forbs

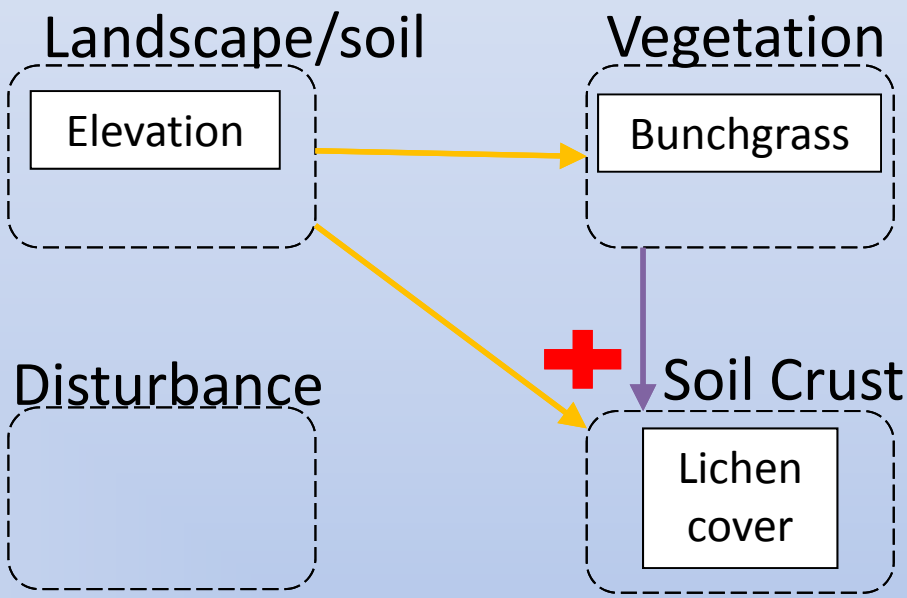
Large forbs

Shrubs



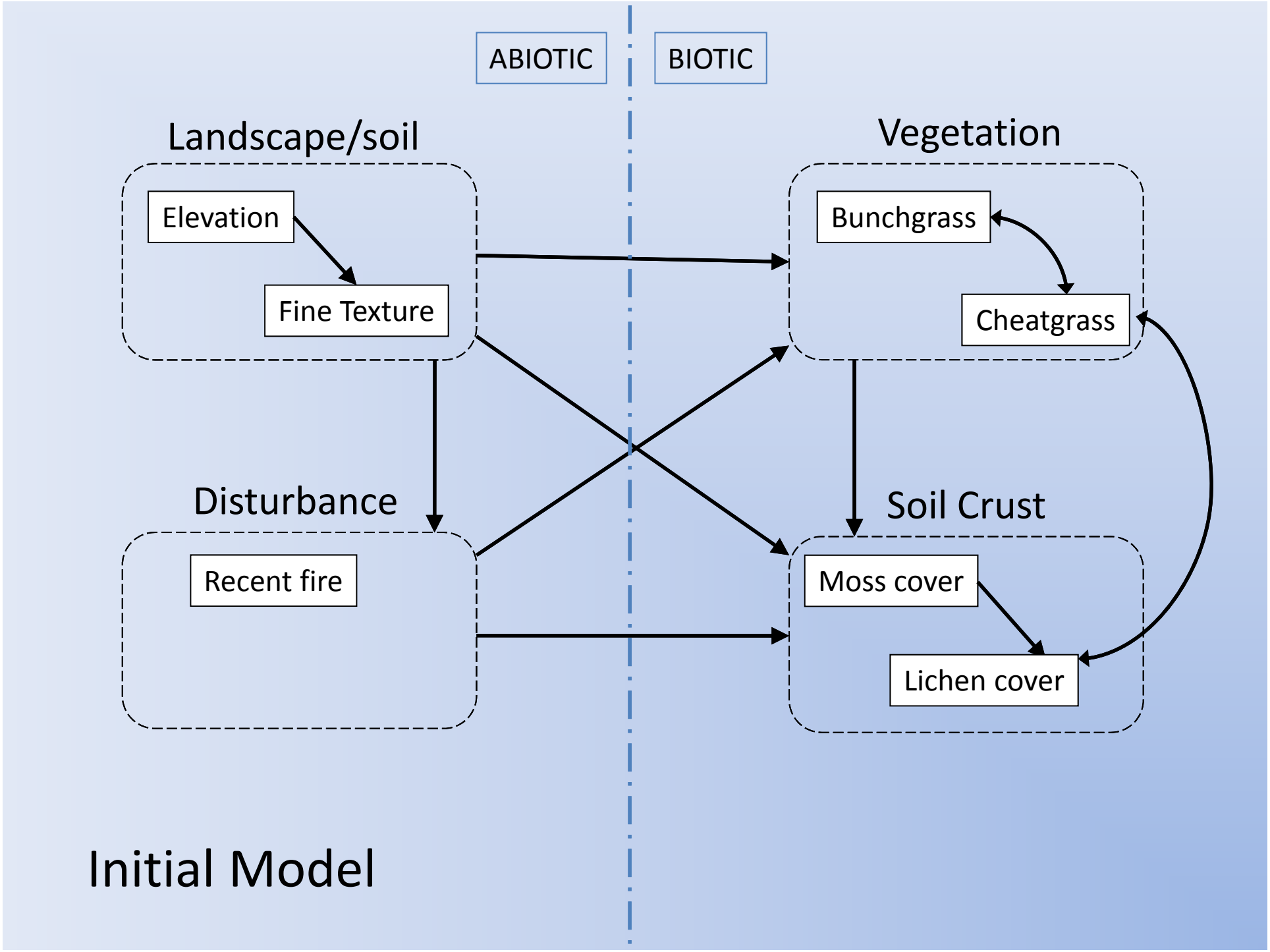
Structural Equation Modeling

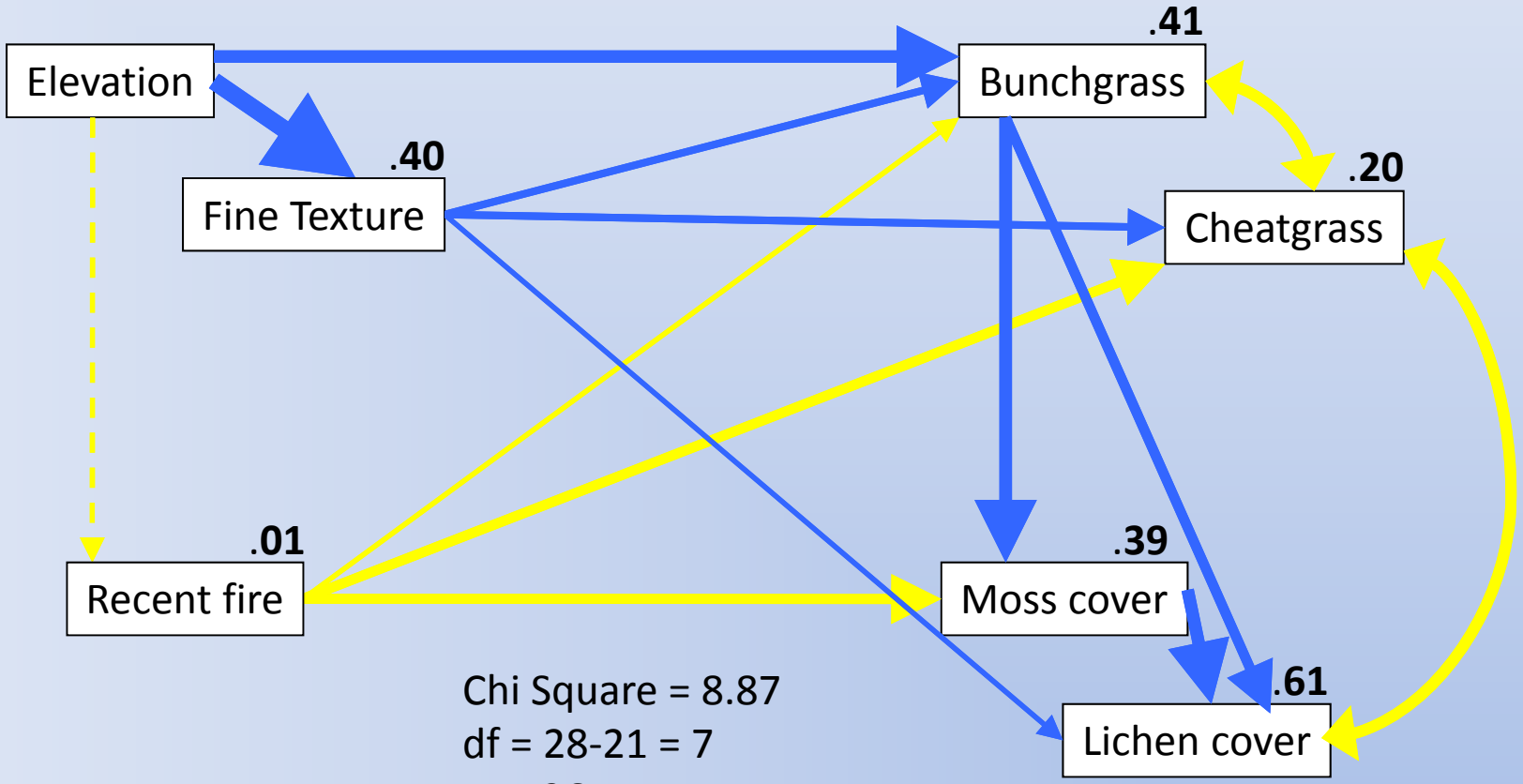




Bunchgrass cover is a simultaneous response AND predictor variable

SEM can determine strengths of direct and indirect effects

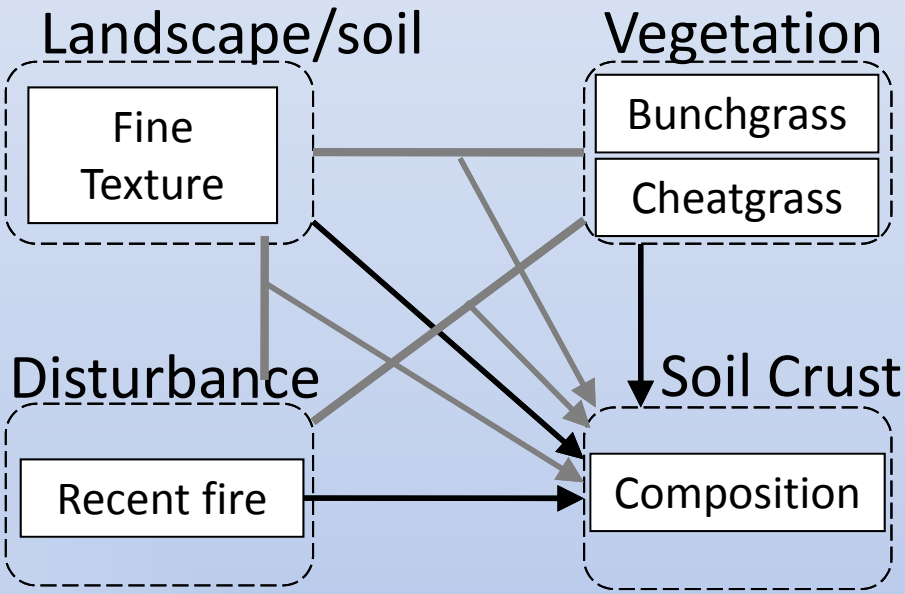

ABIOTIC
BIOTIC
Landscape/soil
Elevation
Fine Texture
Vegetation
Bunchgrass
Cheatgrass
Disturbance
Recent fire
Soil Crust
Moss cover
Lichen cover
Initial Model


Elevation
Fine Texture
.40
Recent fire
.01
.41
Bunchgrass
.20
Cheatgrass
.39
Moss cover
.61
Lichen cover
Chi Square = 8.87
df = 28-21 = 7
p = .26
Standardized Effect Size
.1
.6
Direction of Effect
+
-

Final Model

Composition

- Species scored as proportion of quadrats per transect
- Nonmetric multidimensional scaling



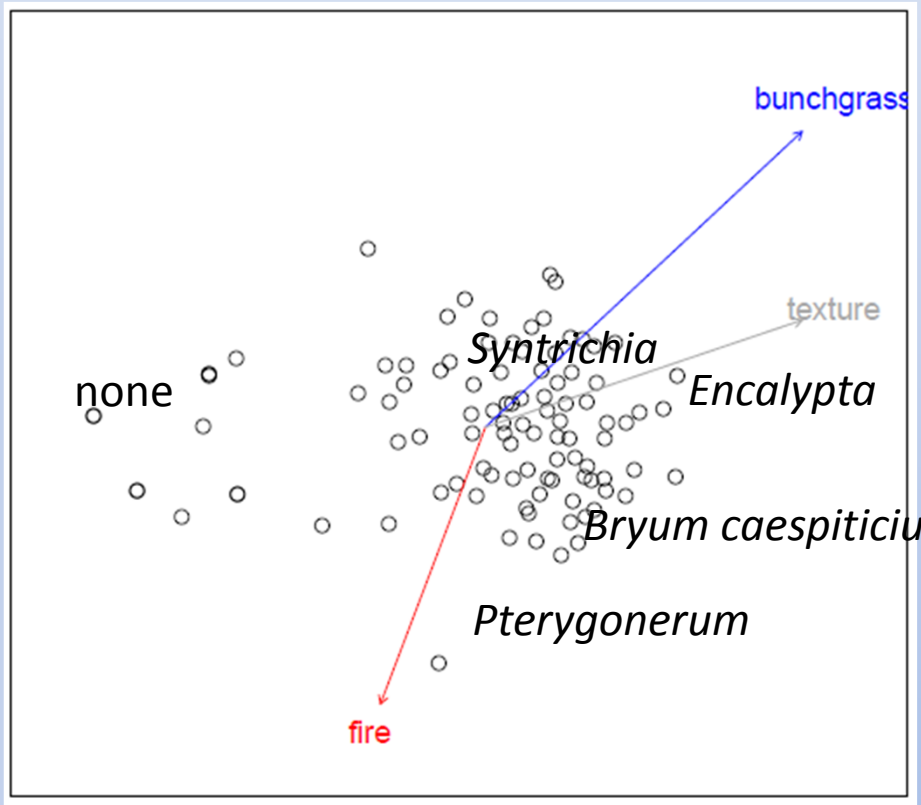
Distance-based linear modeling

Tested main effects and 1st order interactions

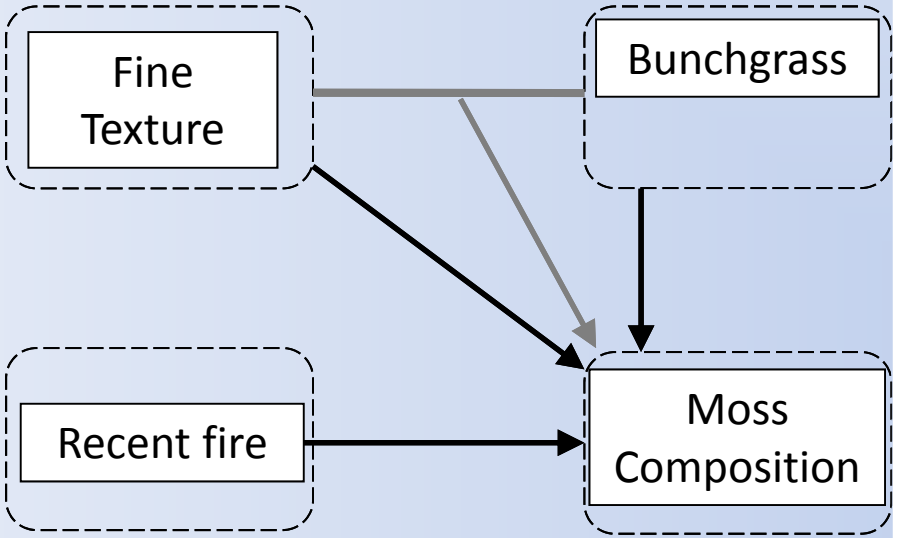
(not simultaneous predictors and responses)

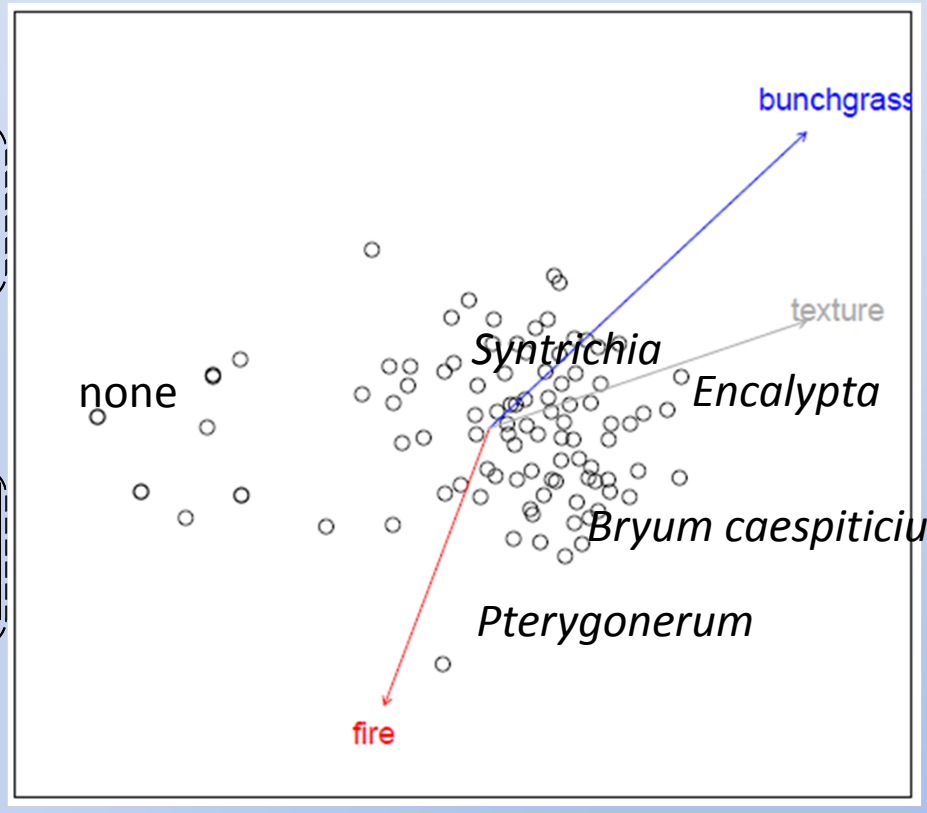
Moss composition

- 9 moss “species”
  - All found on >5% of transects



Moss composition



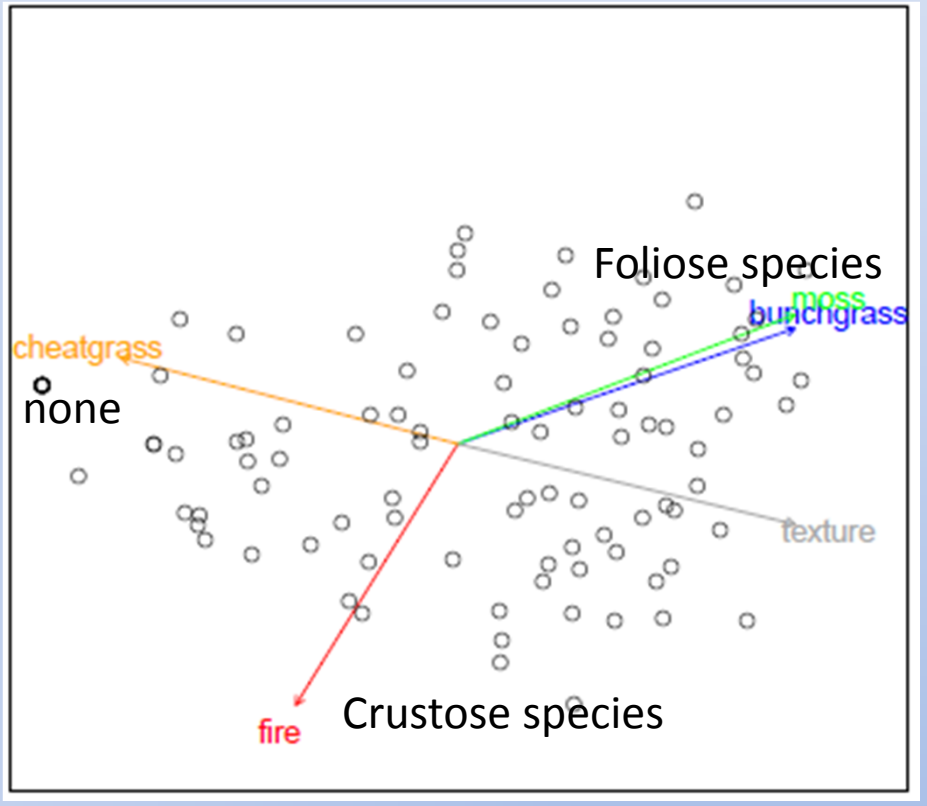


Final Model

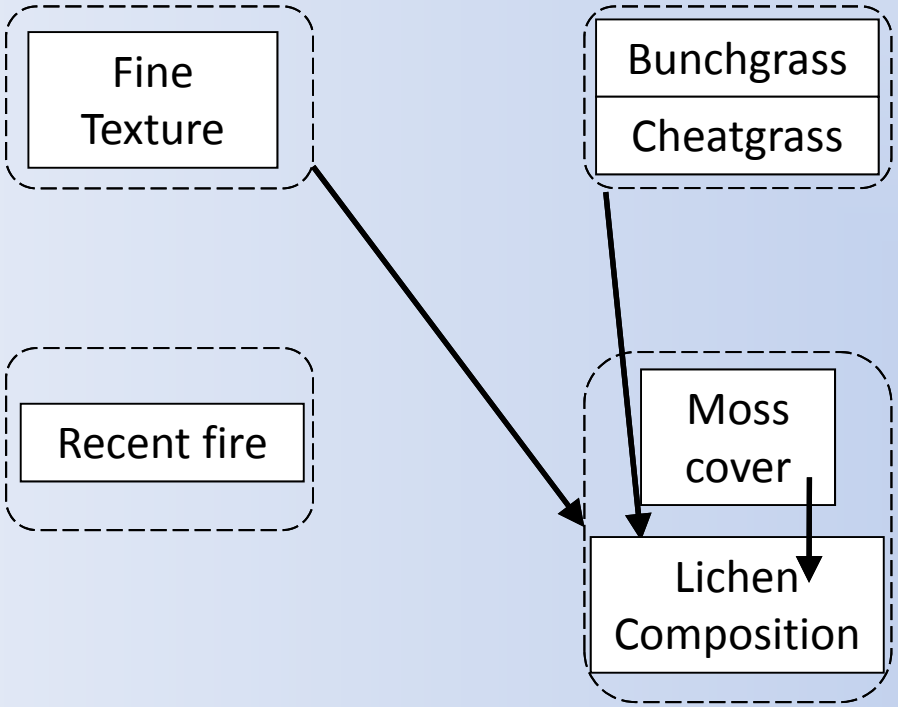
R^2= .39

Lichen composition

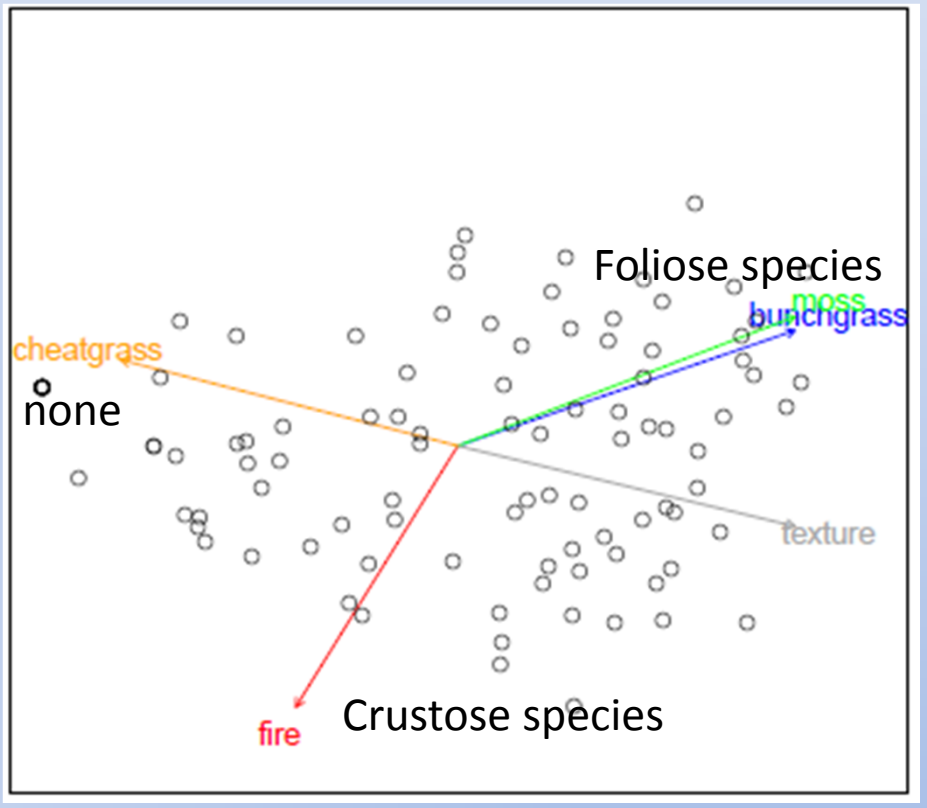
- 34 lichen “species”
  - 24 found on > 5% of transects



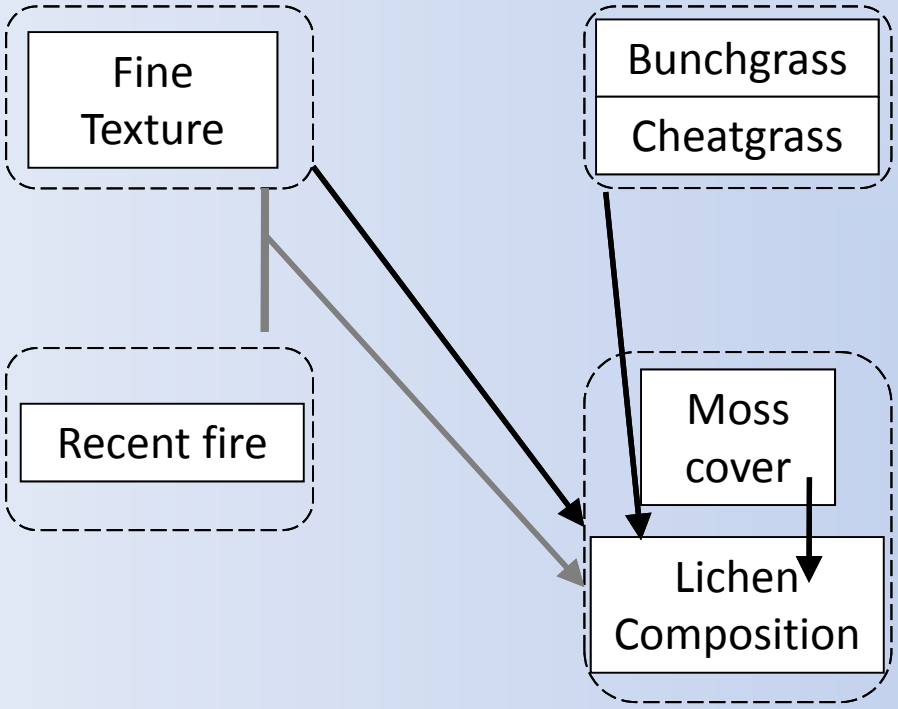
Lichen composition



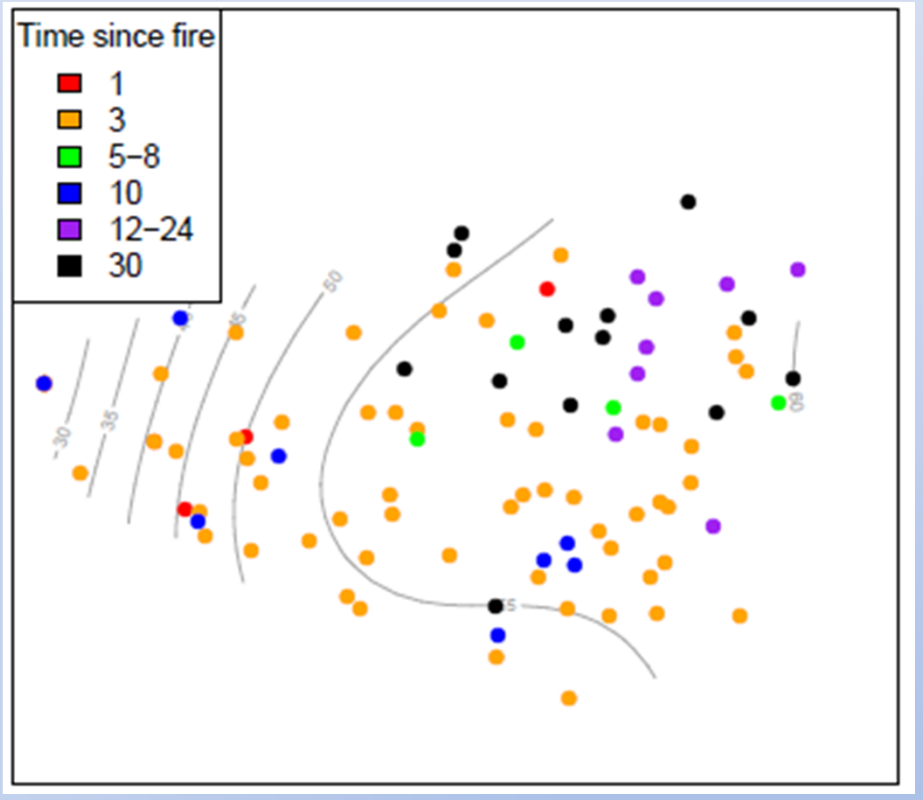
Final Model



Lichen composition



Final Model



R^2= 0.56

Conclusions

Elevation

Soil Texture

Acknowledgements

Matt Davies, Peter Dunwiddie, Sonia Hall

Jim Grace

Katherine Glew, Jeanne Ponzetti, Roger Rosentreter, Terry McIntosh

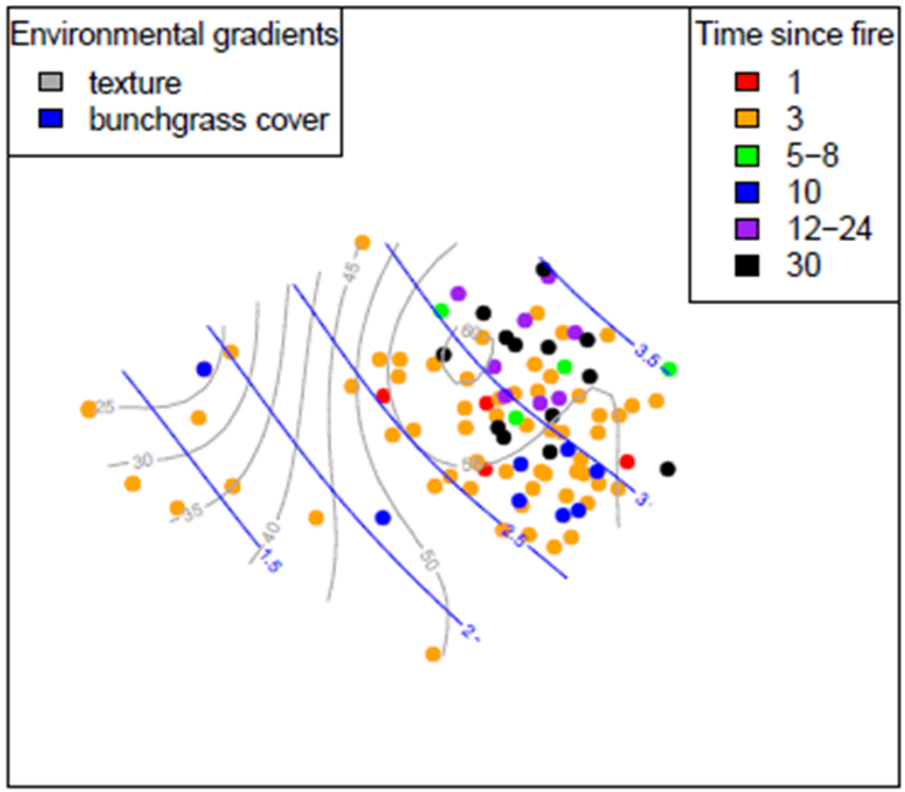
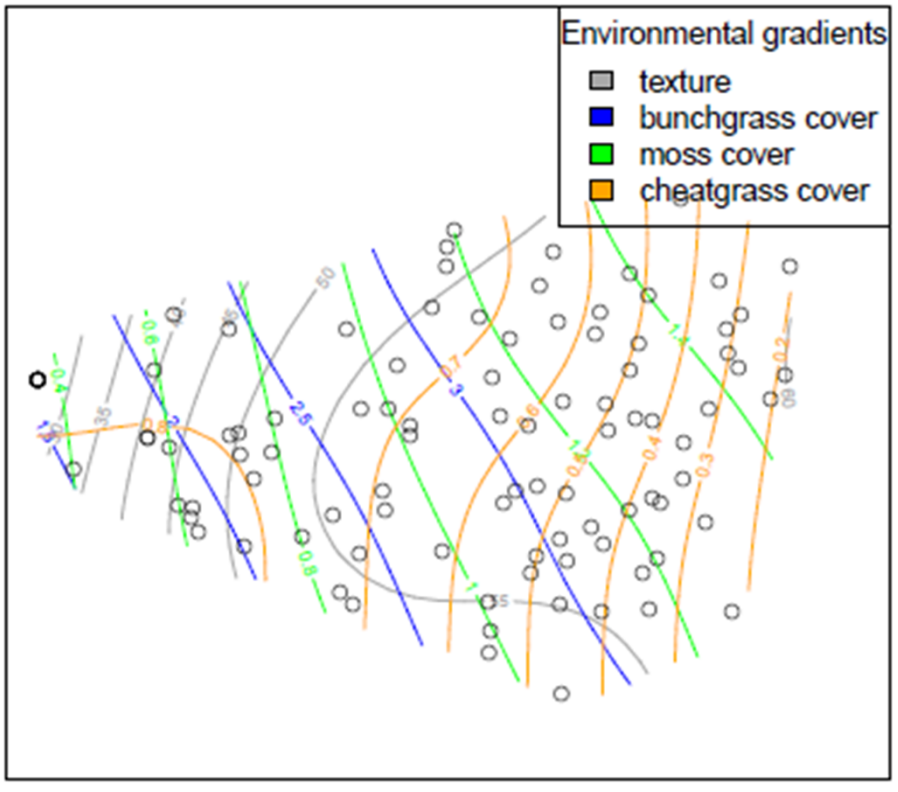
US FWS, BLM, many private landowners

Joint Fire Science Program

Elevation

Soil Texture

Moss Composition with Gradients



Lichen Composition with Gradients