

Classifying Plant Functional Groups and Assessing Disturbance Gradients For Wet Meadows, Sierra Nevada, CA

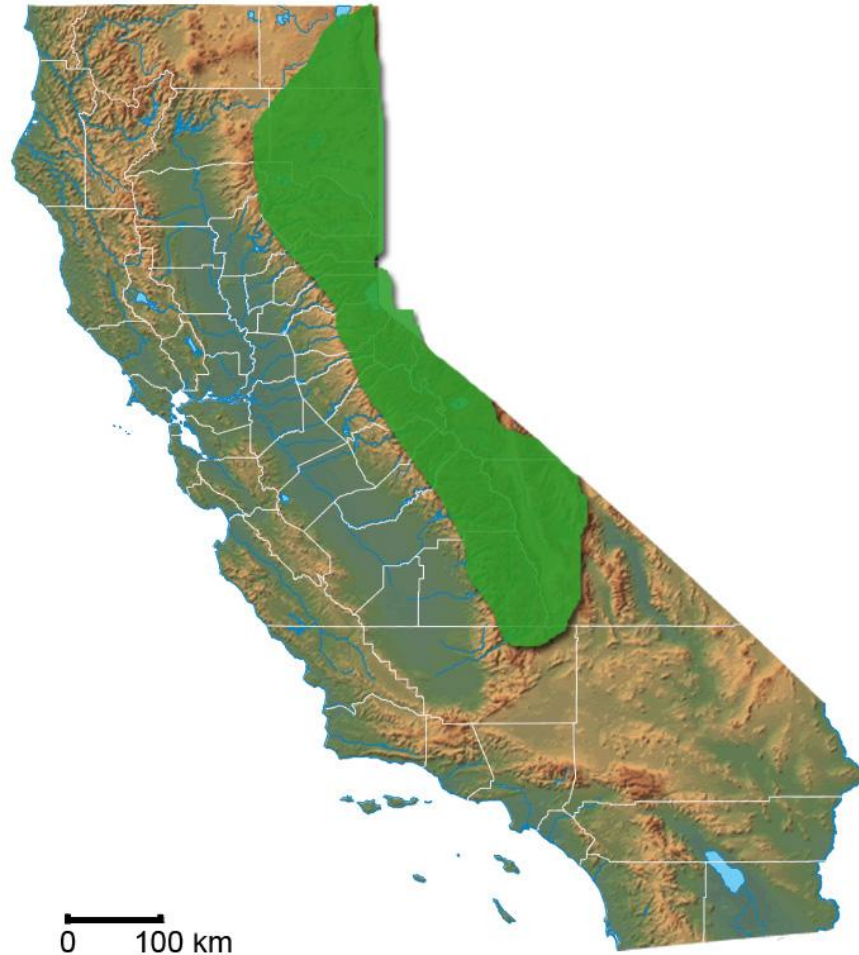
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Objectives

- Process for determining plant functional groups to assess disturbance for wet meadows in the Sierra Nevada
- Develop a wet meadow functional matrix for condition assessment

Study Area



Wet Meadow

- A slope wetland fed predominately by groundwater and the vegetation is composed of one or more plant communities that are dominated by herbaceous plant species.
- Occurs on floodplains, stream terraces, spring-fed slopes, drainways, swales.



Plant Functional Groups

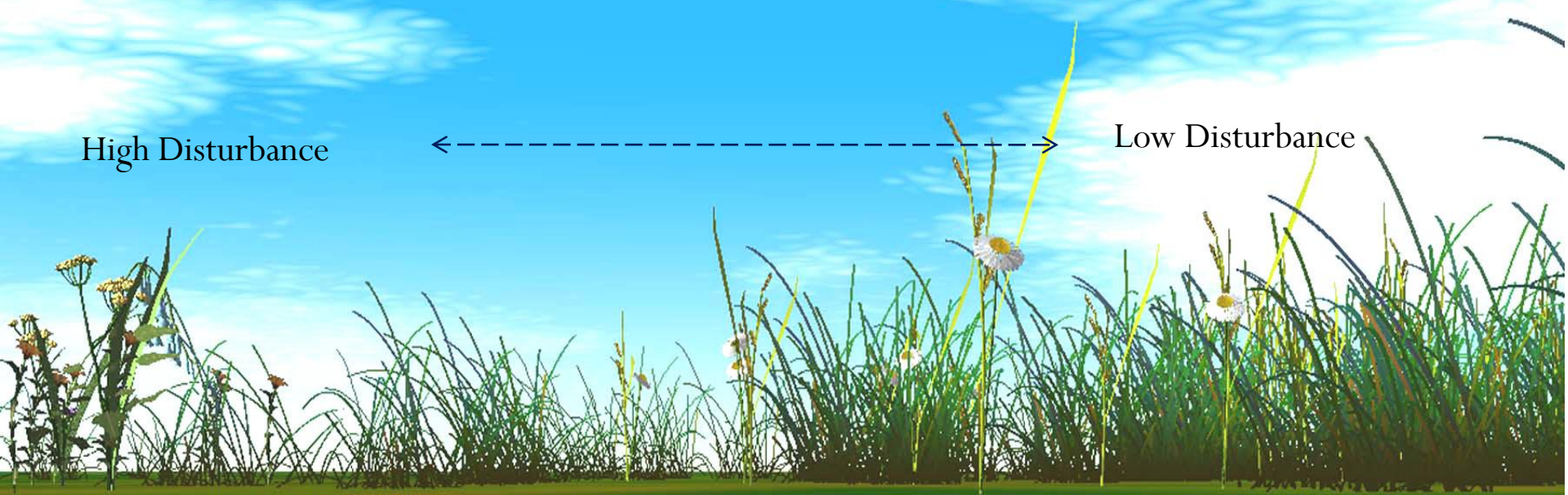
- Groupings of plant species which perform similarly in an ecosystem based on a set of common functional traits.

Disturbance Gradient, Wet Meadow, Sierra Nevada, CA

High Disturbance



Low Disturbance



Annuals

Fast growth rate

r-strategists

weak competitive

traits

Perennials

Slow growth rate

K-strategists

Strong

competitive traits

Stages in the development of plant functional groups

- Describe the disturbance gradient (response gradient) you are interested in
- Identify hypothetical list of plant traits that are related to the disturbance gradient
- Collection of relevant trait attributes for all species recorded
- Grouping of plant species into functional groups based on plant traits (cluster analysis)
- Statistical testing of ability of traits to discriminate between condition classes

Disturbance Gradient, Wet Meadow, Sierra Nevada, CA

High Disturbance



Low Disturbance



Grime (CSR theory)

Ruderal

Stress Tolerater

Competiter

Keddy

Ruderal

Interstitial

Matrix

Classification of Functional Traits

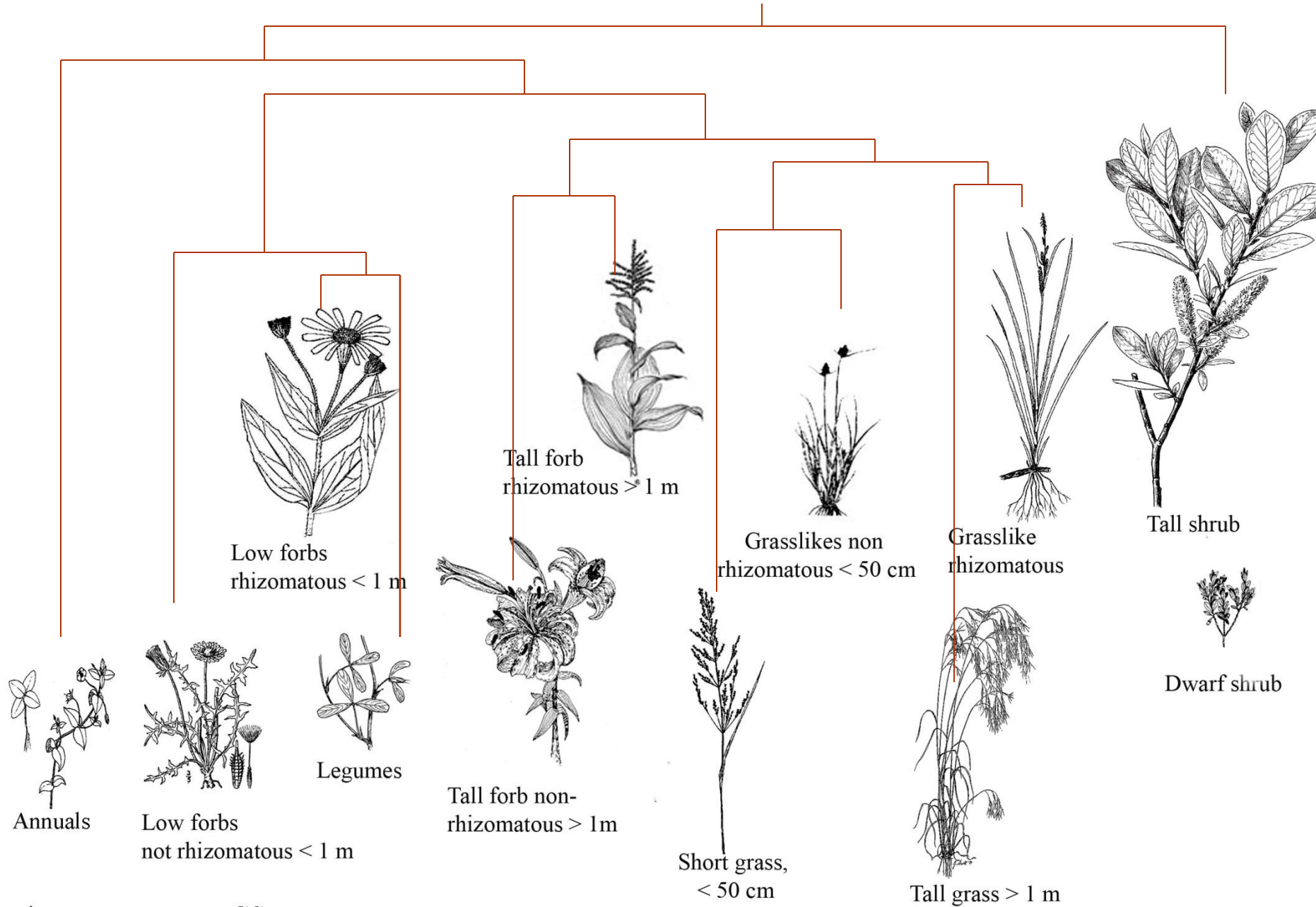
Focus on traits that underlie disturbance response in herb-dominated wet meadow sites and have been cited in research. Measurements for these traits can generally be found in the literature.

1. Life form – grass, grasslike, forb, shrub, tree
2. Lifespan – annual perennial, biennial
3. Maximum height – (cm) from Jepson Manual of CA
4. Rhizomatous – Y/N
5. Nitrogen fixing – Y/N

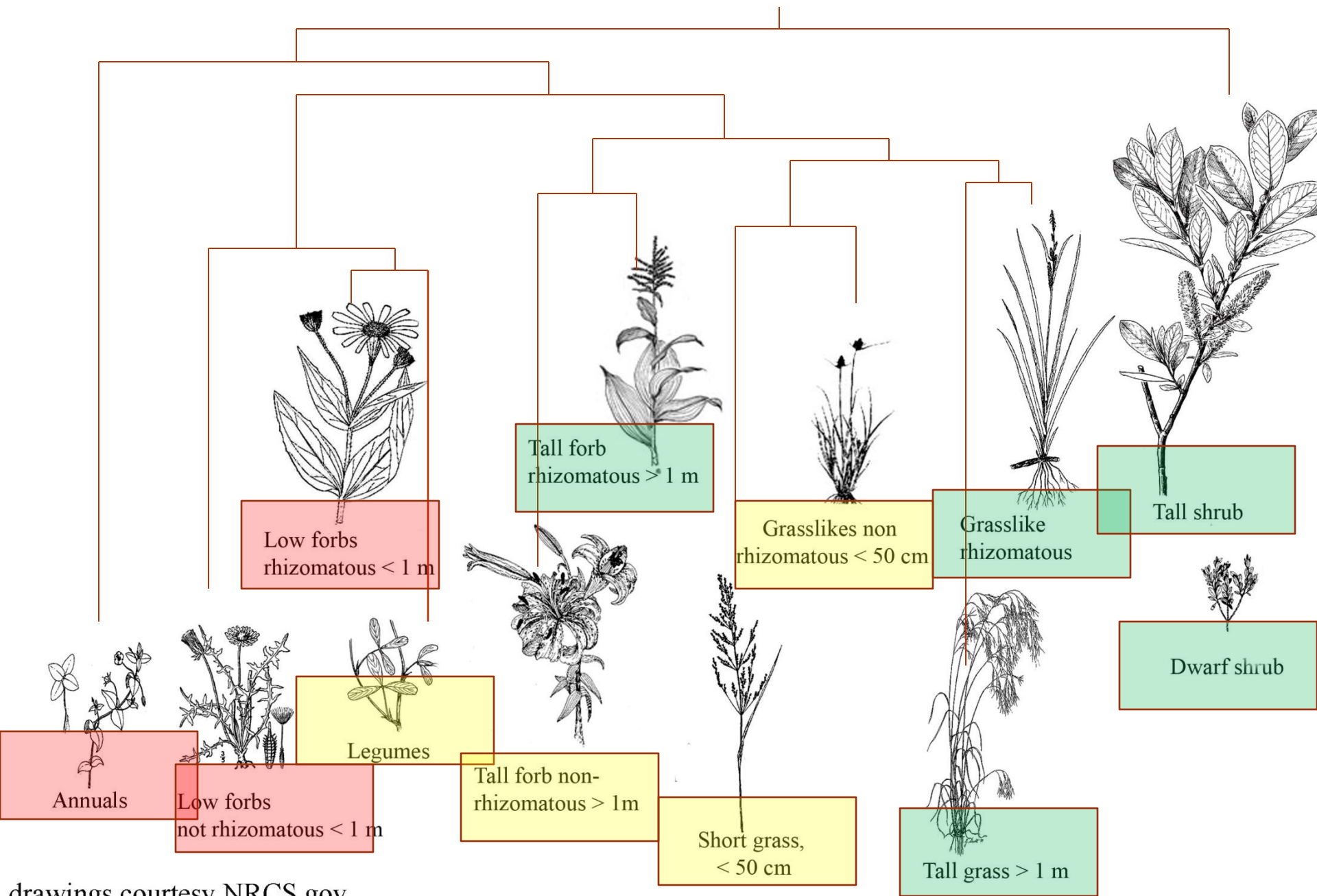
Table of plant species and traits

Code	Species	lifespan	lifeform	ht	Nfix	rhizomes
ACCO4	<i>Aconitum columbianum</i>	1	1	2.00	0	0
ACMI2	<i>Achillea millefolium</i>	1	1	1.70	0	1
AGEX	<i>Agrostis exarata</i>	1	2	1.95	0	1
AGGL	<i>Agoseris glauca</i>	1	1	1.41	0	0
AGST2	<i>Agrostis stolonifera</i>	1	2	1.53	0	1
ALINT	<i>Alnus incana</i>	1	4	2.88	0	0
ANRO2	<i>Antennaria rosea</i>	1	1	1.39	0	1
AQFO	<i>Aquilegia formosa</i>	1	1	1.93	0	0
ARACA13	<i>Artemisia cana</i>	1	4	1.95	0	1
ARCHF	<i>Arnica chamissonis</i>	1	1	1.60	0	1
ASALA	<i>Aster alpigenus</i>	1	1	1.40	0	1
ASOC	<i>Aster occidentalis</i>	1	1	1.65	0	1
CAAT3	<i>Carex athrostachya</i>	1	3	1.79	0	0

Cluster analysis of 5 plant traits on 116 plant species



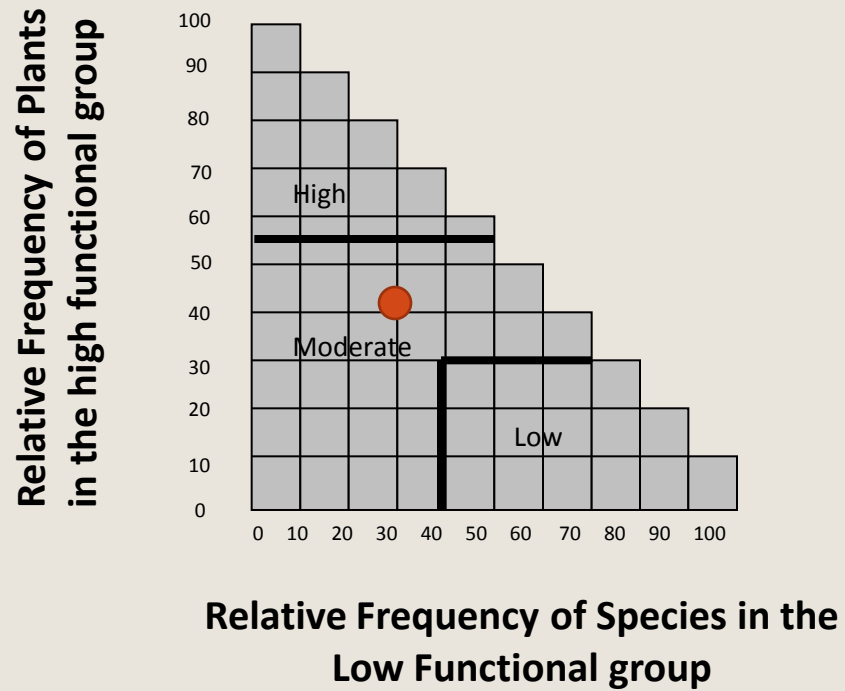
Cluster analysis of 5 plant traits forming 12 plant functional groups



Plant Functional Groups for Meadows In the Sierra Nevada

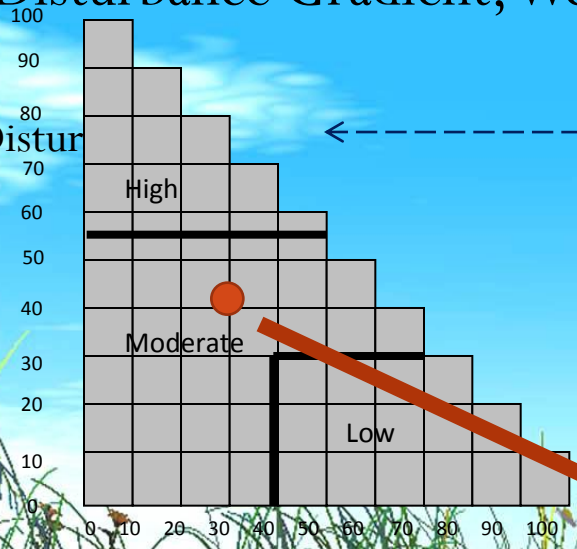
1. All annual spp., “R”, e.g. *Hypericum anagalloides*
2. Ruderal forbs, perennial, < 1 m, rhizomes no “R”, e.g. *Sidalcea oregana*
3. Tall forbs < 1 m, rhizomes no, “R”, e.g. *Dugaldia hoopsii*
4. Tall forbs > 1 m, rhizomes yes, “C”, e.g. *Veratrum californicum*
5. Legumes (N-fix spp.), “S”, e.g. *Trifolium* spp.
6. Grasslikes, rhizomes no, < 50 cm, “S”, e.g. *Luzula comosa*
7. Grasslikes, > 50 cm, rhizomes yes or no, “C”, e.g. *Carex nebrascensis*
8. Grasses < 50 cm, “S”, e.g. *Agrostis pallens*
9. Grasses > 50 cm, “C”, e.g. *Calamagrostis canadensis*
10. Medium and tall shrubs: 40 - 200 cm “C”, e.g. *Salix lemmonii*
11. Dwarf shrub: < 40 cm tall, “C”, e.g. *Vaccinium cespitosum*

Scorecard for rating condition of a wet meadow site



Disturbance Gradient, Wet Meadow Sites In the Sierra Nevada, CA

Relative Frequency of Plants
in the high functional
group



← High Disturbance → Low Disturbance

Relative Frequency of Species in the
Low Functional group



Statistical Analysis: Can these plant functional groups discriminate between condition classes?

- 112 wet meadows in the Sierra Nevada that had previously been rated by condition class were used as a test data set
- The abundance of 3 management indicator groups derived from the 11 plant functional groups were used to classify plots using discriminant analysis.
- 89% of the plots were correctly classified using discriminant analysis in SPSS

Classification Results (a)

			Predicted Group Membership		Total
			1	3	
Original	Count	Overall_rating	10	2	12
		3	1	16	17
	%	1	83.3	16.7	100.0
		3	5.9	94.1	100.0

¢

a 89.7% of original grouped cases correctly classified.

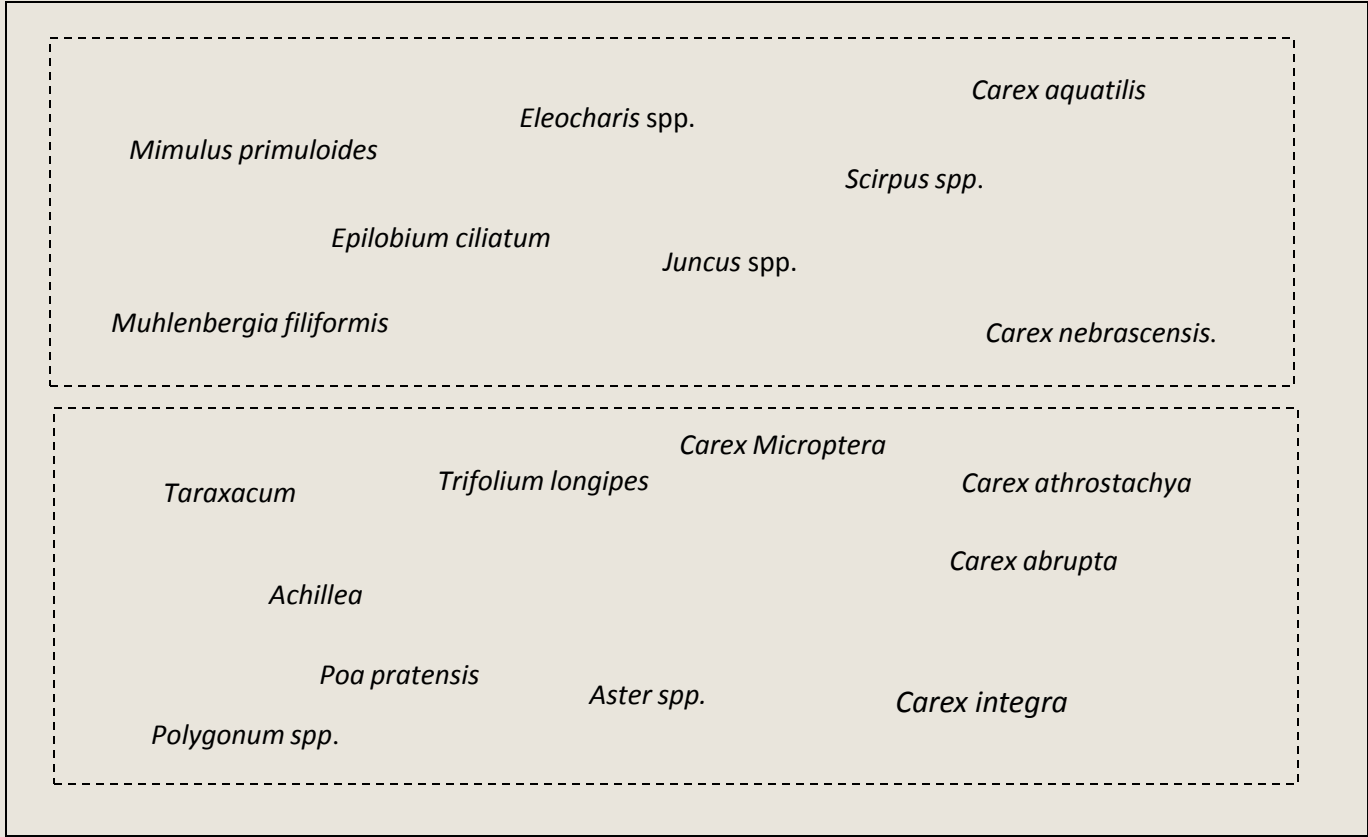
Functional Matrix

- Describes the relationship between ecosystem processes and functional groups (Eviner and Chapin III, 2003)
- This example of a functional matrix for meadow sites describes the relationship of hydrology and plant functional groups

Obligate
wetland
plants
dominate

Facultative
wetland
(FACW or
FAC)
plants
dominate

Wetland Rating



High

Disturbance

Low

Annuals

Fast growth rate

r-strategists

weak competitive traits

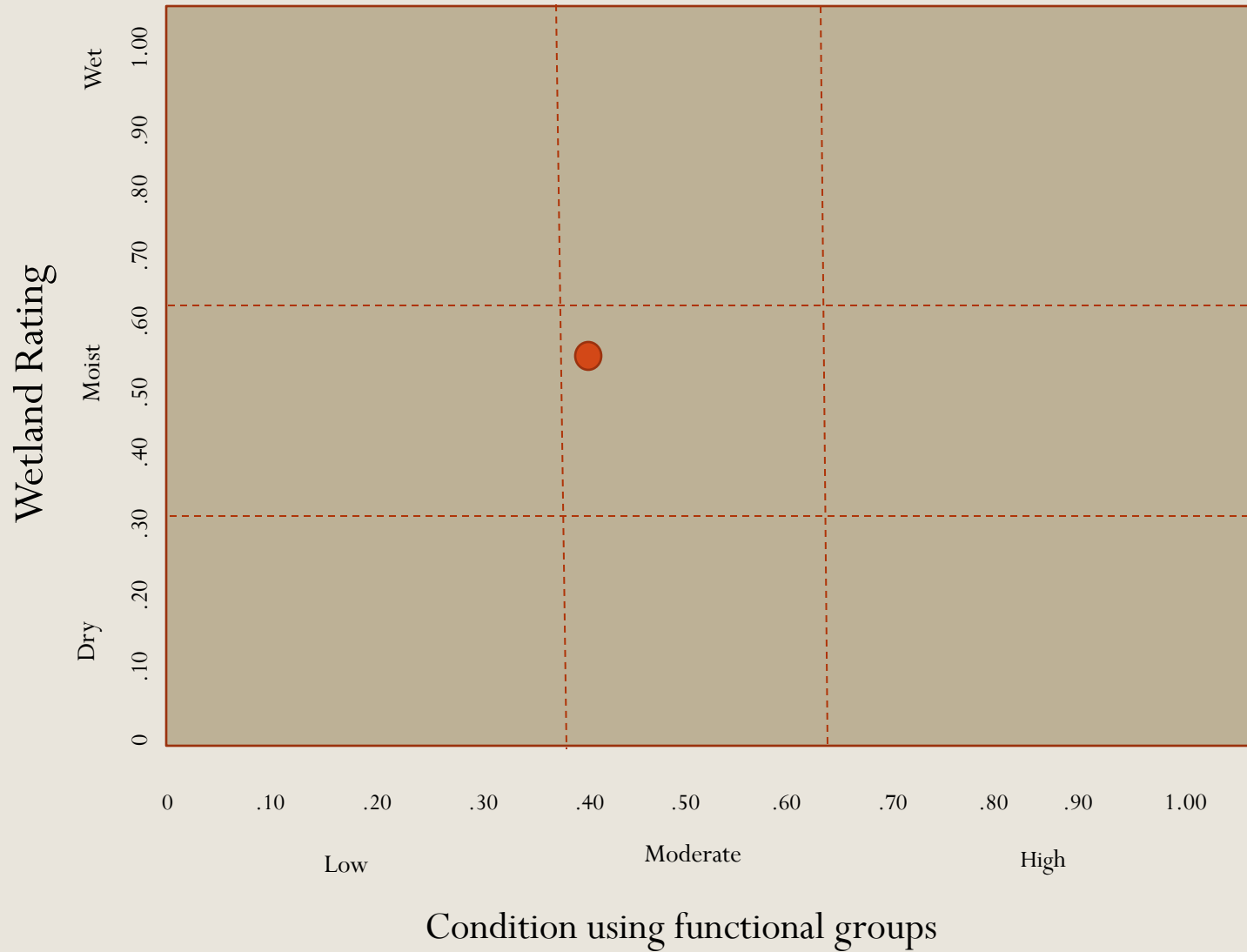
Perennials

Slow growth rate

K-strategists

Strong competitive traits

Functional Matrix For Meadow Sites



Conclusions

- The response gradient being assessed must be clearly defined
- Specific plant functional groups are a direct result of the types of plant traits chosen
- Based on these results, plant Functional groups appear to be a useful way assess the level of disturbance in wet meadow systems of the Sierra Nevada
- Functional matrices offer promise for describing the relationships between functional groups and ecosystem processes



All Monitoring plots are permanently marked