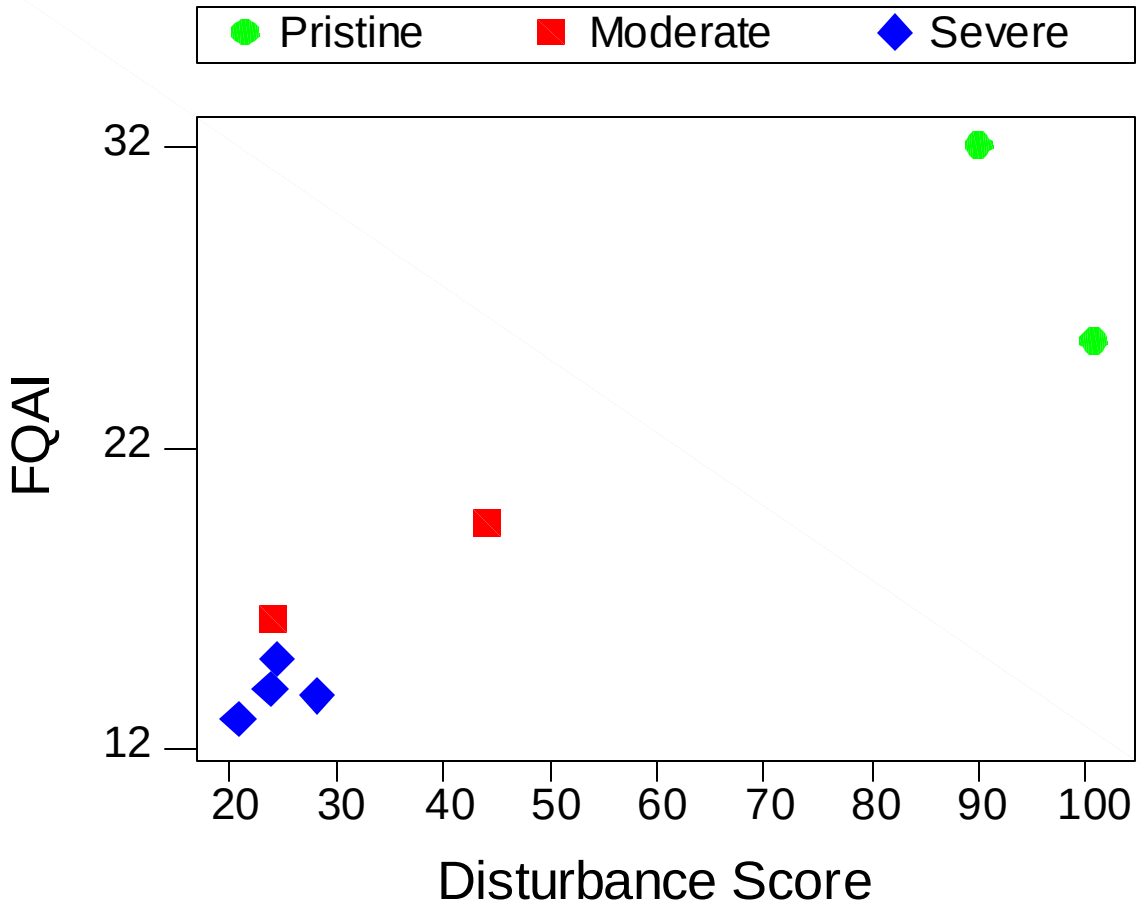
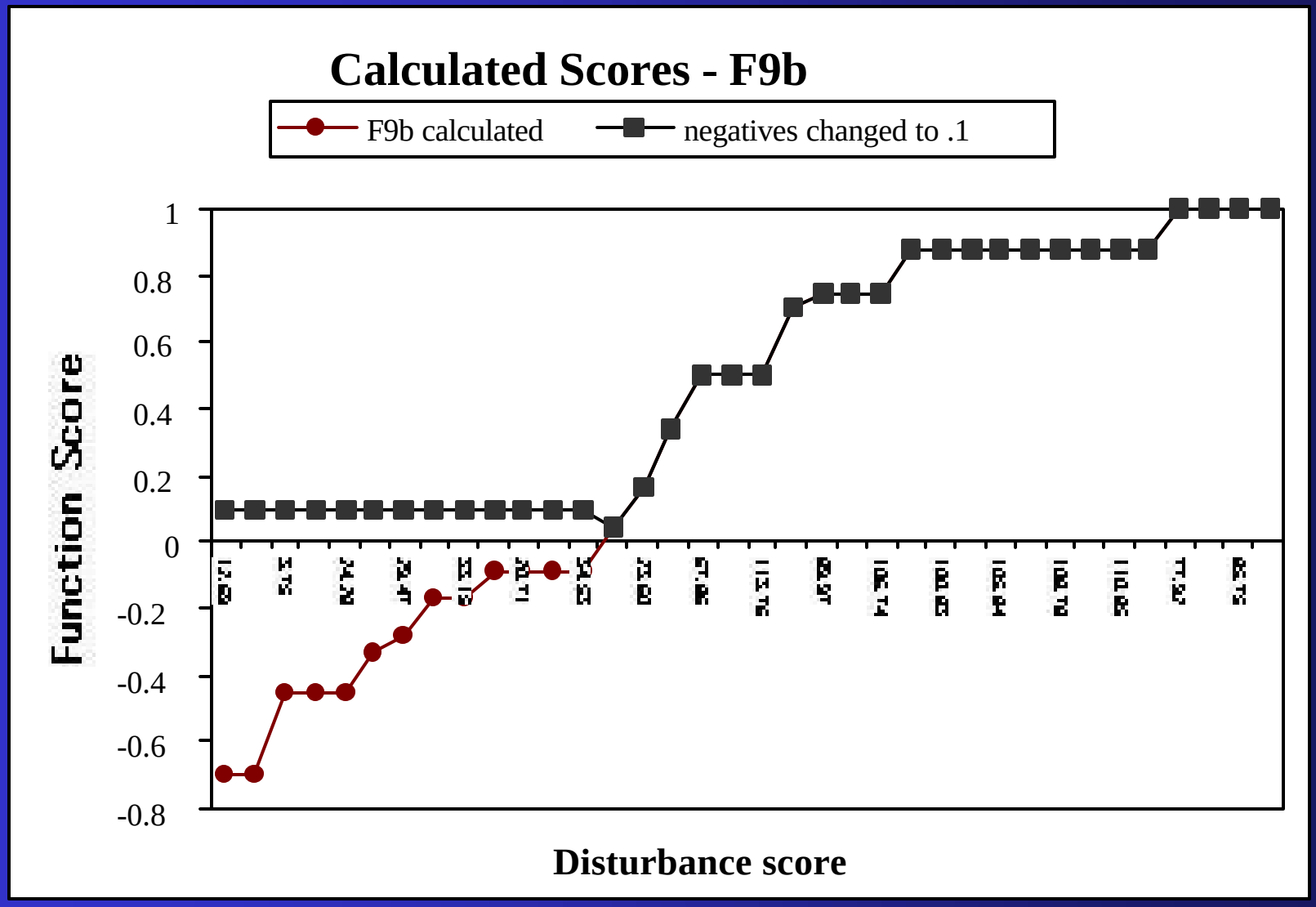
Maintain Characteristic Plant Community

- VFQAI
- Vregen
- Vexotics
- F9b=(Vfqai*.66+Vregen*.33)-(1-Vexotics)

Headwater Floodplain Wetlands




Calculated Scores - F9b
F9b calculated
negatives changed to .1
Function Score
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
Disturbance score

Adjustment for Taxa

- Macroinvertebrates
  - Water chemistry
  - Substrate type
- Birds
  - Vegetation structure
  - Core area

What Can We Do Now?

- Identify causes of wetland impairment
- Select individual wetland classes in specified landscape settings for further investigation
- Prepare TMDLs for major land use patterns and individual stressors
- Identify restoration targets

Investigating the Links

- Development of stressor-specific metrics
- Investigation of mechanisms
- Theoretical underpinnings of biological assessment

Need for “Affinity Group” Plant Metrics

- Traditional community measures often do not respond
- Existing “functional groups” do not incorporate disturbance responses
- Accounts for variability in community species composition

Clustering of Plant Species Based on Site Affinities

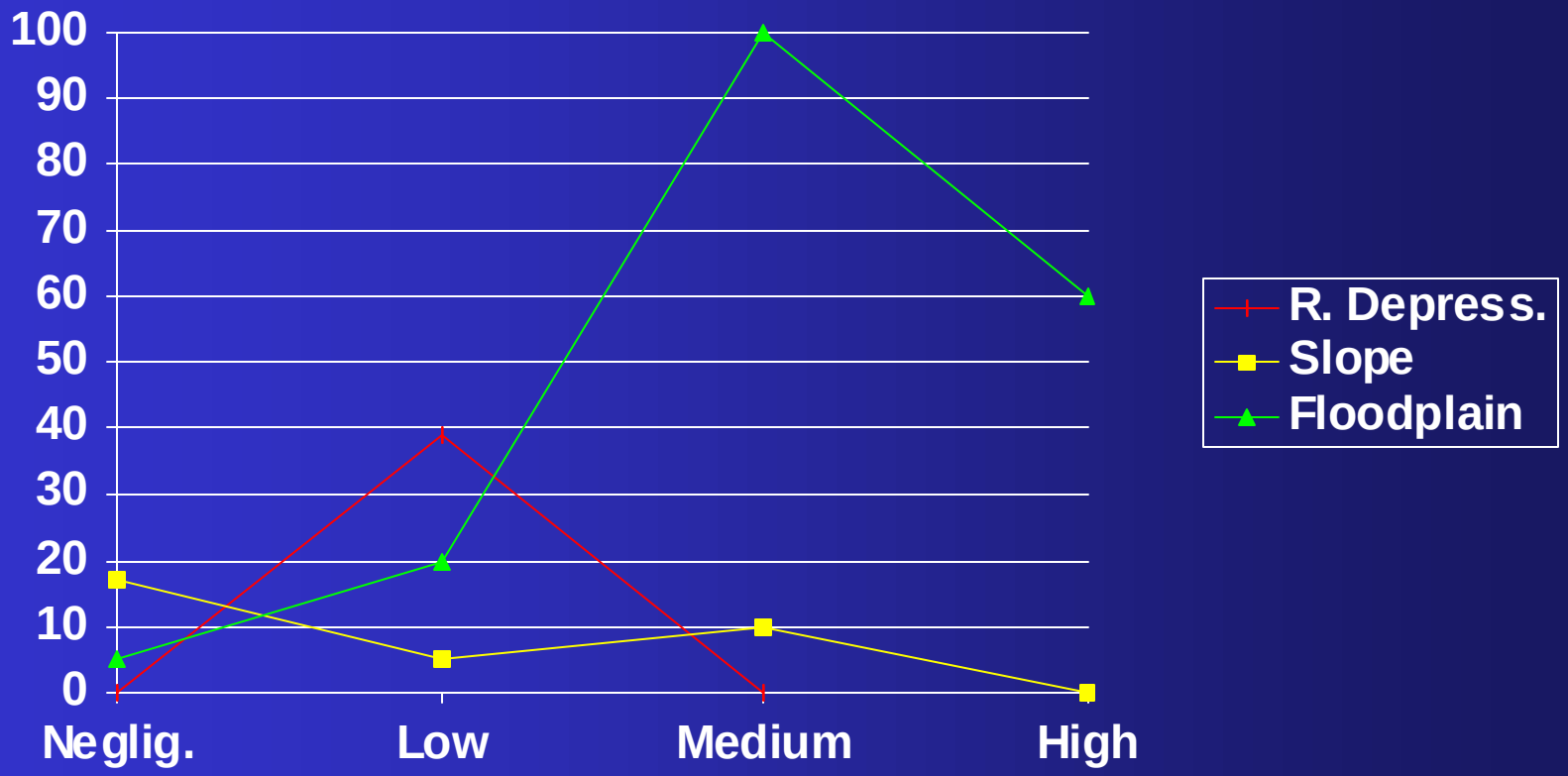
- Identification of stressors
- Selection of sites subjected to stressors
- Calculate mean percent cover (when present) for each species within the sites comprising a stressor level
- Groups based on observed site affinities

Why Field-based Construction?

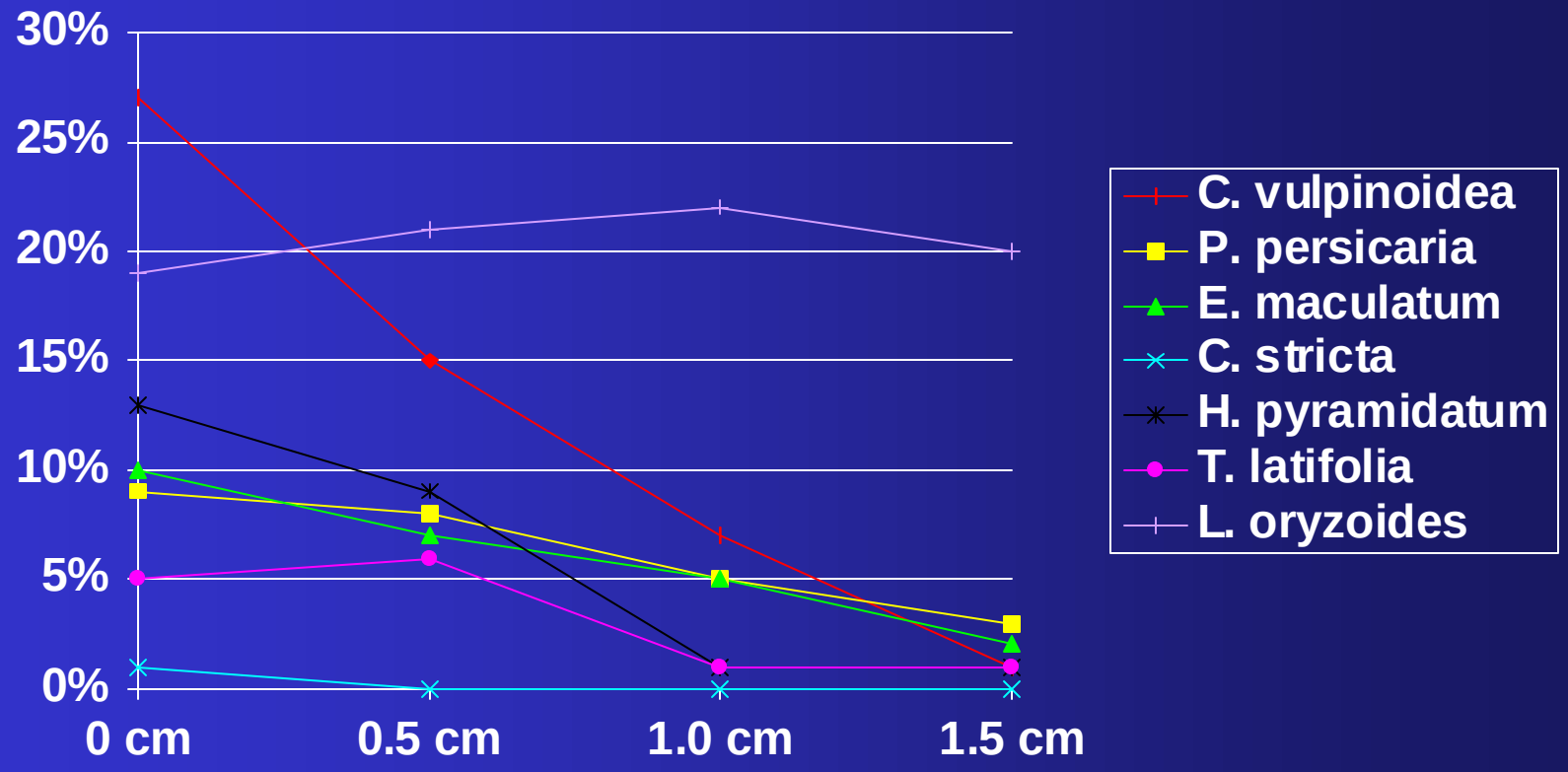
- Linkages to specific stressors are well-documented
- Ecological suitability of site for an individual plant species is documented
- Complements literature-based groupings
- Improves diagnostic capabilities of metrics

Species	Sediment Accumulation Cluster			
	Negligible	Low	Medium	High
	n=36	n=44	n=18	n=4
Sediment Tolerators				
Leersia oryzoides	90	39	0	65
Dipsacus sylvestris	19	0	0	60
Impatiens capensis	12	24	55	60
Polygonum sagittatum	5	0	0	30
Dulichium arundinaceum	5	10	0	30
Moderately Tolerant				
Phalaris arundinacea	46	54	67	0
Thelypteris noveboracensis	15	10	60	0
Carex emoryi	0	0	50	0
Carex retroflexa	0	0	50	0
Symplocarpus foetidus	25	40	40	0
Carex prasina	10	20	30	0
Solidago sp.	21	10	30	0
Carex vulpinoidea	17	20	25	0
Slightly Tolerant				
Juncus canadensis	30	48	0	0
Carex sp.	30	41	0	0
Toxicodendron radicans	5	25	0	0
Sediment Intolerant				
Poa pratensis	90	0	0	0
Lysimachia nummularia	13	0	0	0
Mentha arvensis	10	0	0	0
Asclepias syriaca	5	0	0	0

Mean % Cover for I. capensis by Sedimentation Cluster



Mean % Germination by Sediment Depth



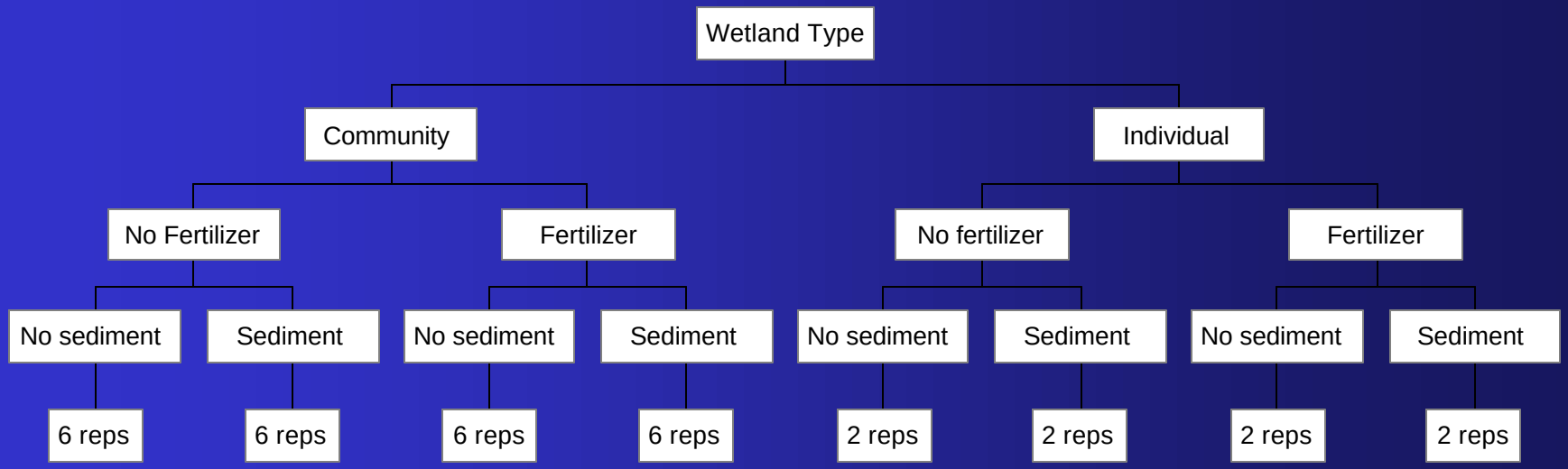
Investigating Mechanisms

- Examine the impact of co-occurring stressors on both individual wetland plant species responses and community composition across three wetland types

Methods

- Cooperative Wetlands Center Database
  - Wetland vegetation for 100 sites in central Pennsylvania
  - Three wetland types
    - 4 species chosen from “Pristine” sites
    - 4 species chosen from “Disturbed” sites
    - These 8 species combined to form plant communities
- Greenhouse Experiment
  - Stressor Factors:
    - Sedimentation:
    - Eutrophication:

Greenhouse Experimental Design

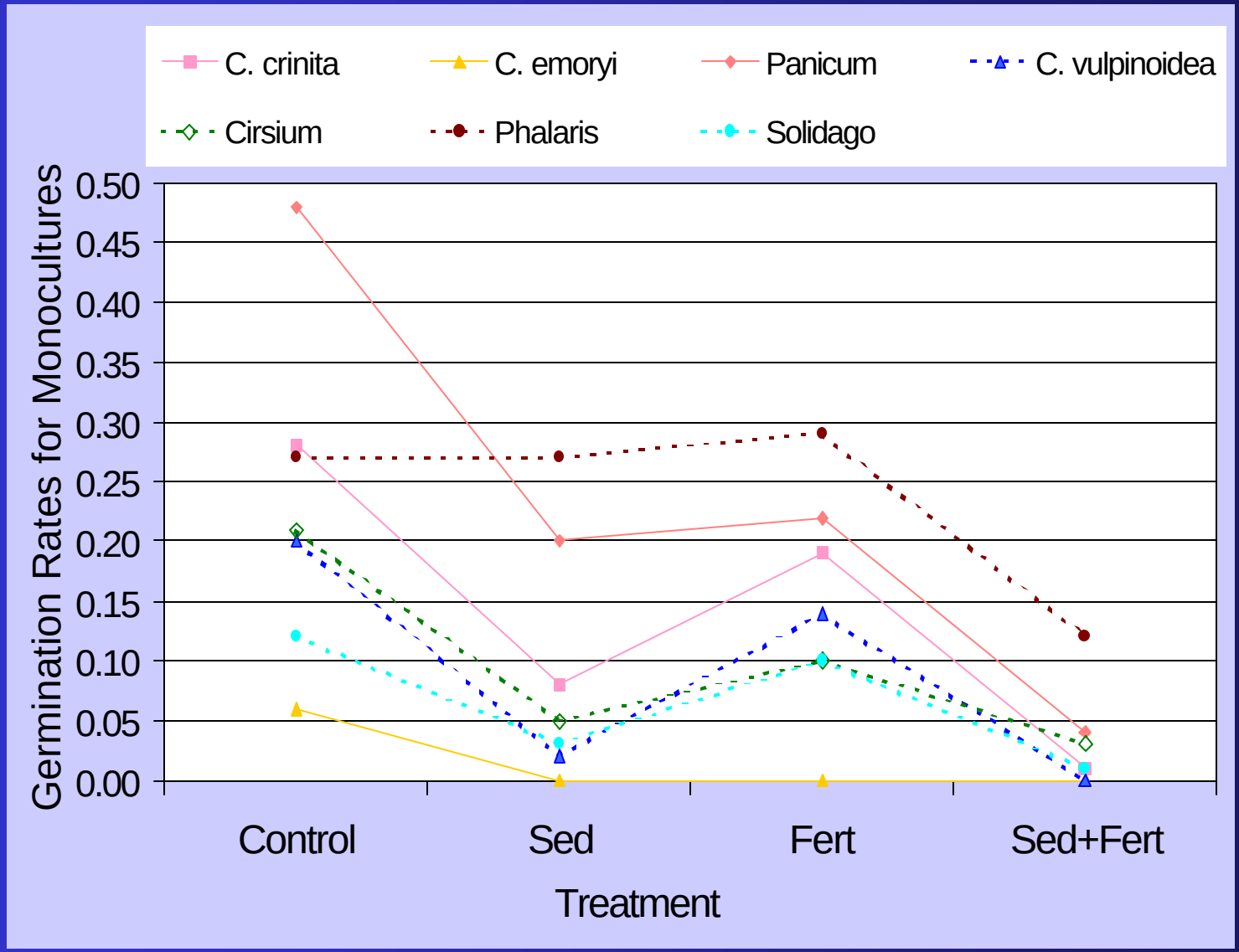


Measurements & Calculations:

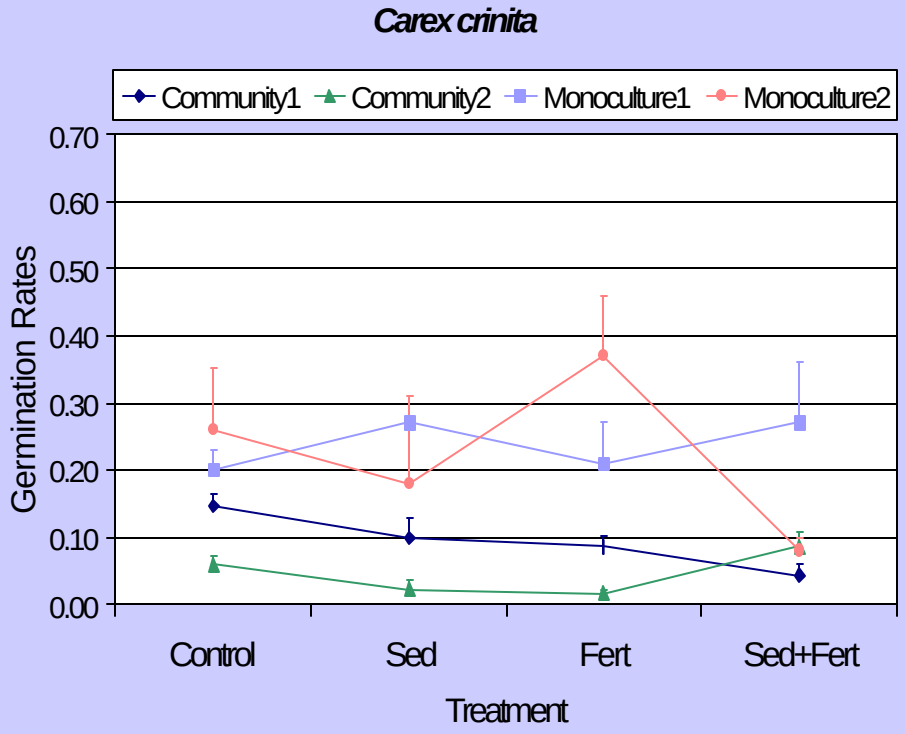
Looking for Predictable Responses to Stressors

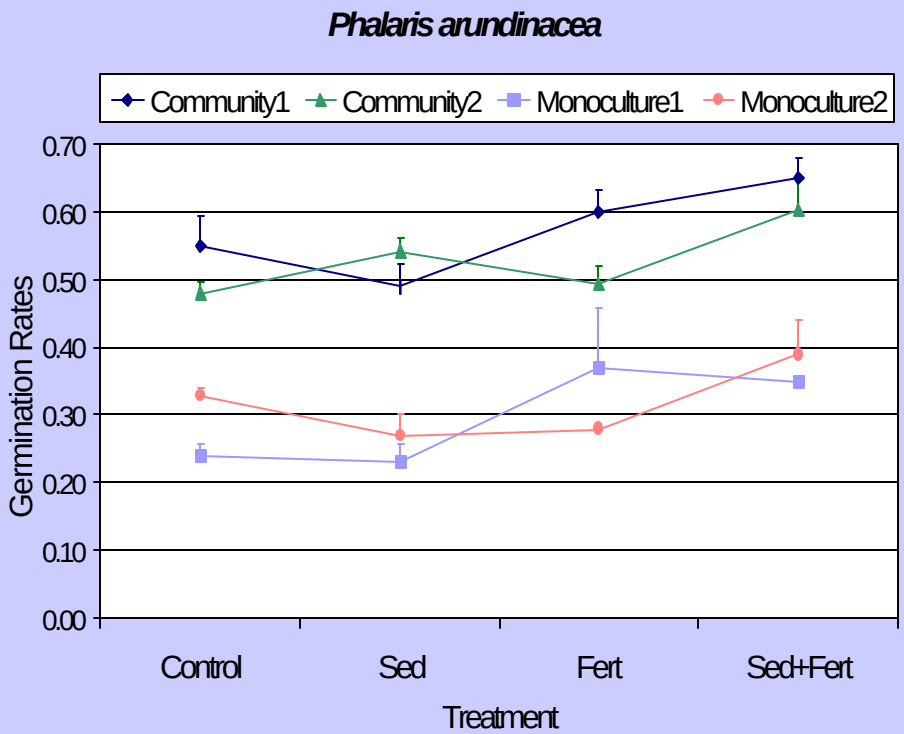
- Heights at 4, 8, 12, and 20 weeks
- Germination rates
- Mortality rates
- Growth rates (140 days)
- # of stems per plant
- Flowering rate
- Leaf area
- Biomass
- Plant tissue chemistry

Riparian Depression Germination Rates



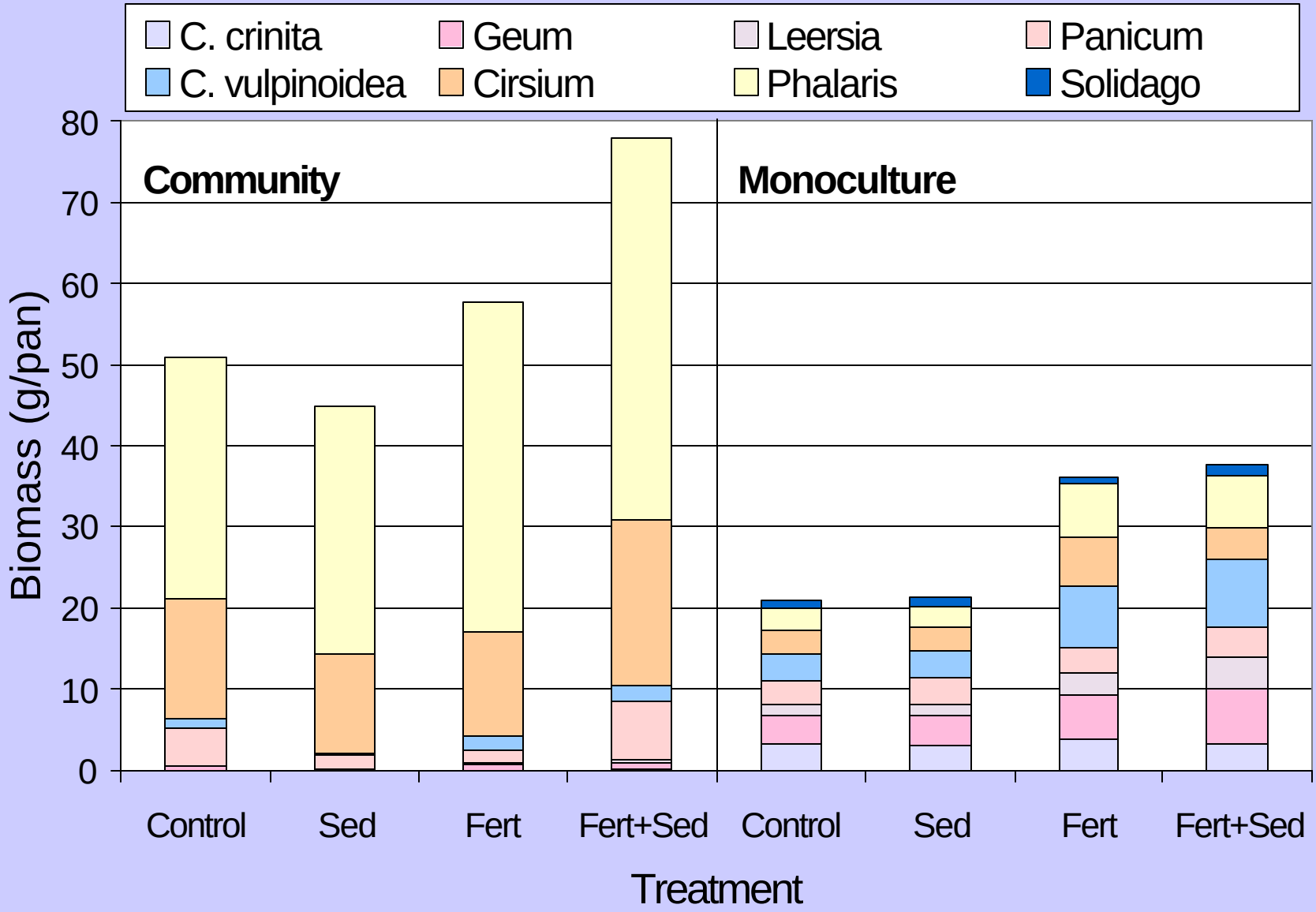
Headwater Floodplain Germination Rates





Carex crinita is a pristine species, *Phalaris arundinacea* is a disturbed species

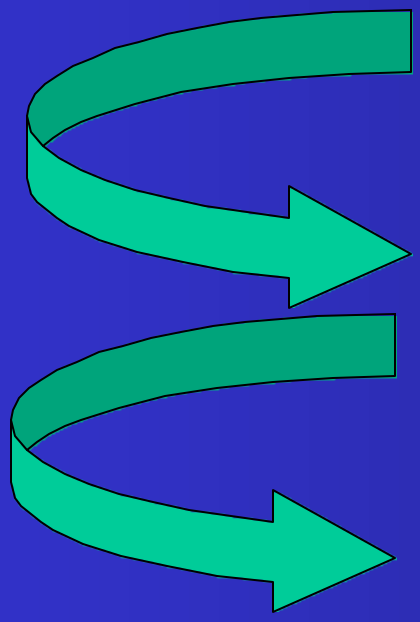
Headwater Floodplain Biomass



Summary

- Disturbed species, such as *Phalaris*, germinate more successfully, grow taller, and acquire more biomass than pristine species, such as *Carex crinita*
- The overall fitness of pristine species is more impacted by competition than disturbed species
- We can finally build disturbance-based functional groups

To achieve protection and restoration of aquatic habitats, ecological indicators must link:



Stressors

Sources

Solutions