DIFFERING DRIVERS OF PLANT COMMUNITIES IN FLOODING VS. NON-FLOODING SITES

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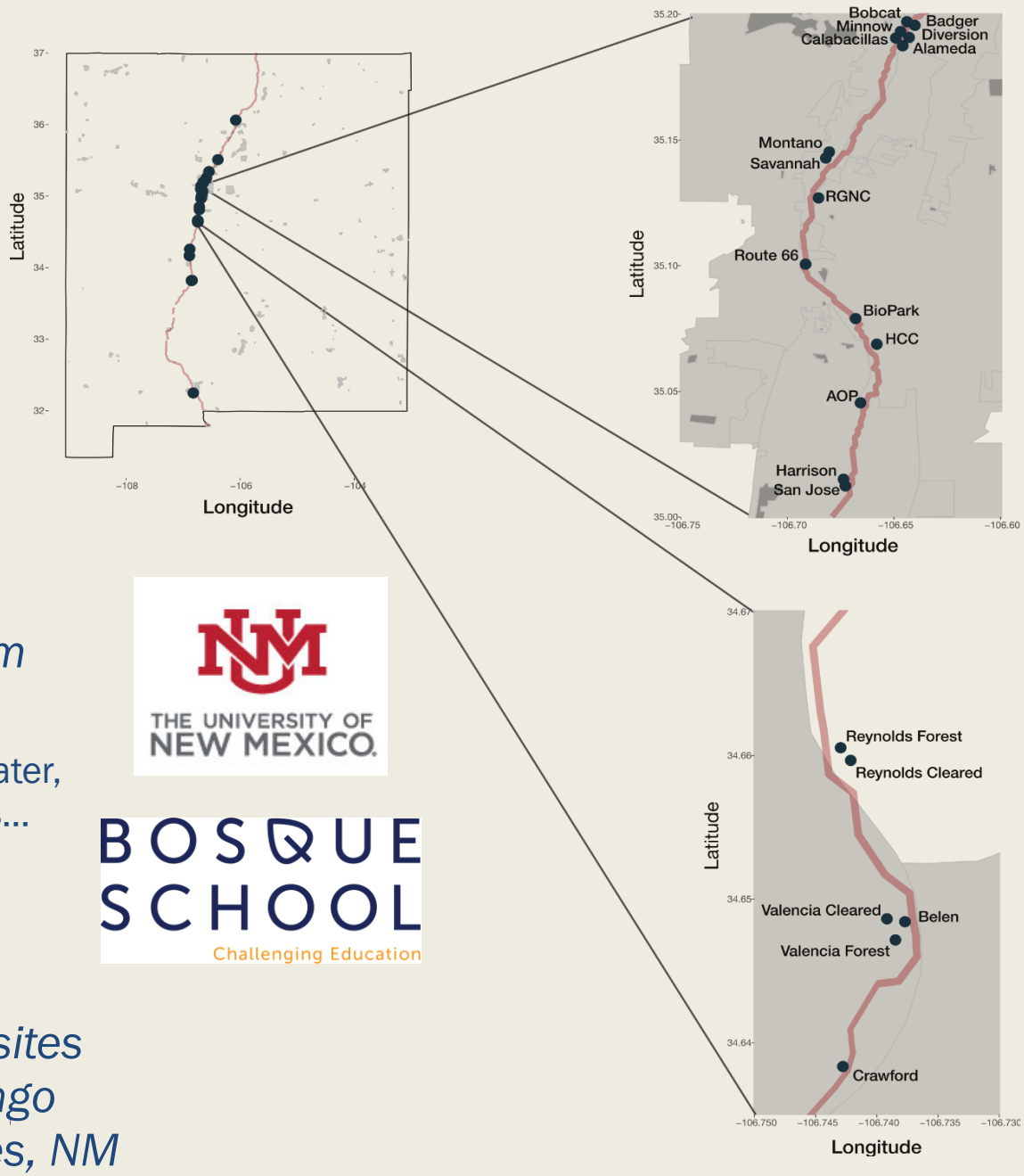
BEMP
Bosque Ecosystem Monitoring Program

SEVILLETA LTER

How is this forest different from this forest?

Do they respond to climate differently?

Bosque Ecosystem Monitoring Program



- 1997 to Present

  Monitoring ecosystem change:

  - Surface and ground water, vegetation, arthropods…

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BOSQUE SCHOOL
Challenging Education

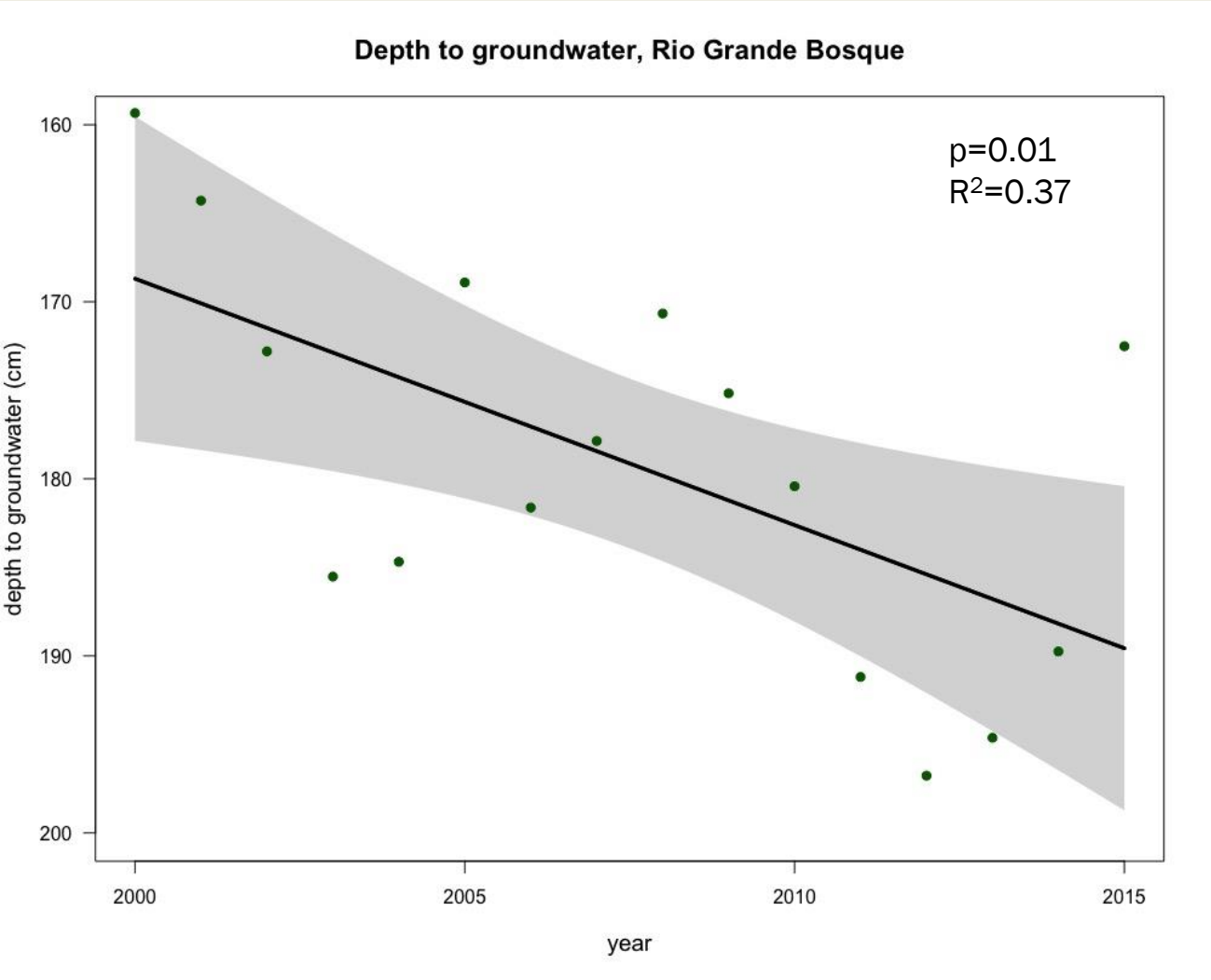
- 2019

  33 active monitoring sites between Santo Domingo Pueblo and Las Cruces, NM

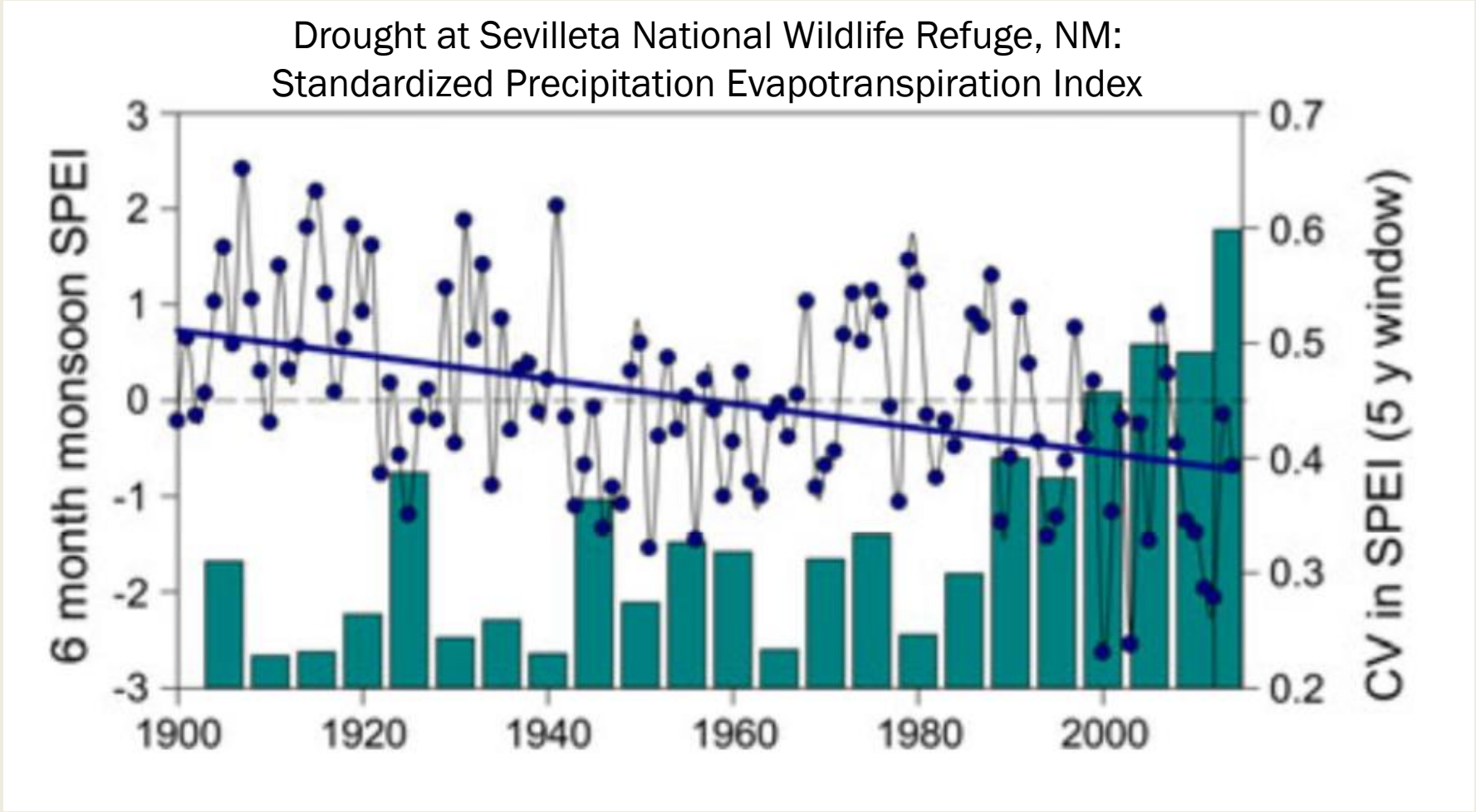
BEMP sites are located on federal, state, local and tribal lands

Images courtesy of BEMP

Groundwater is decreasing since monitoring began

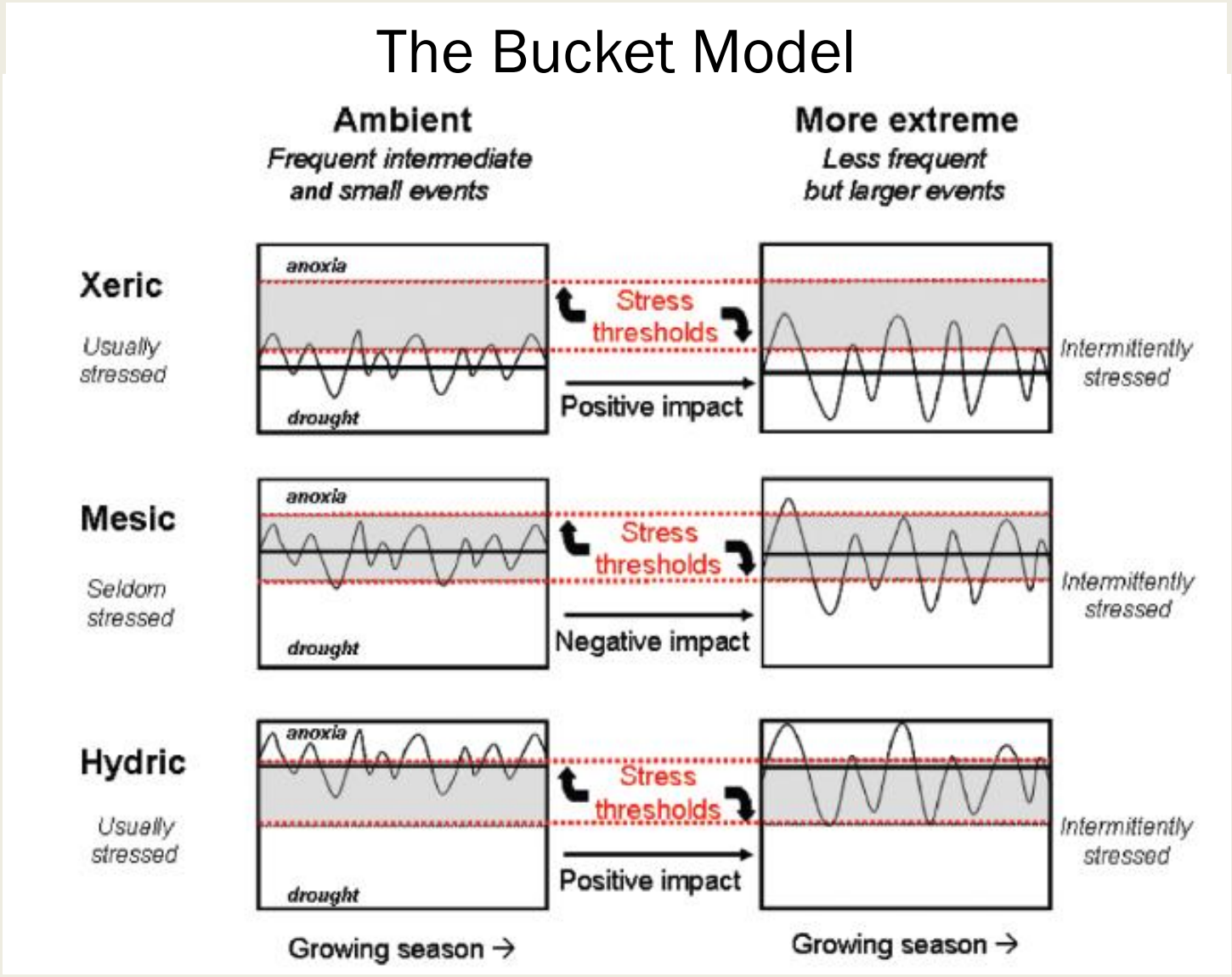


Climate change- New Mexico is getting drier and more variable



Rudgers et al. 2018

Variability



Knapp et al. 2008

Research focus

Does the riparian plant community respond differently to climate depending on flood regime?

Citizen Science Ecosystem Monitoring

K-12 Classes adopt a monitoring site and collect data monthly

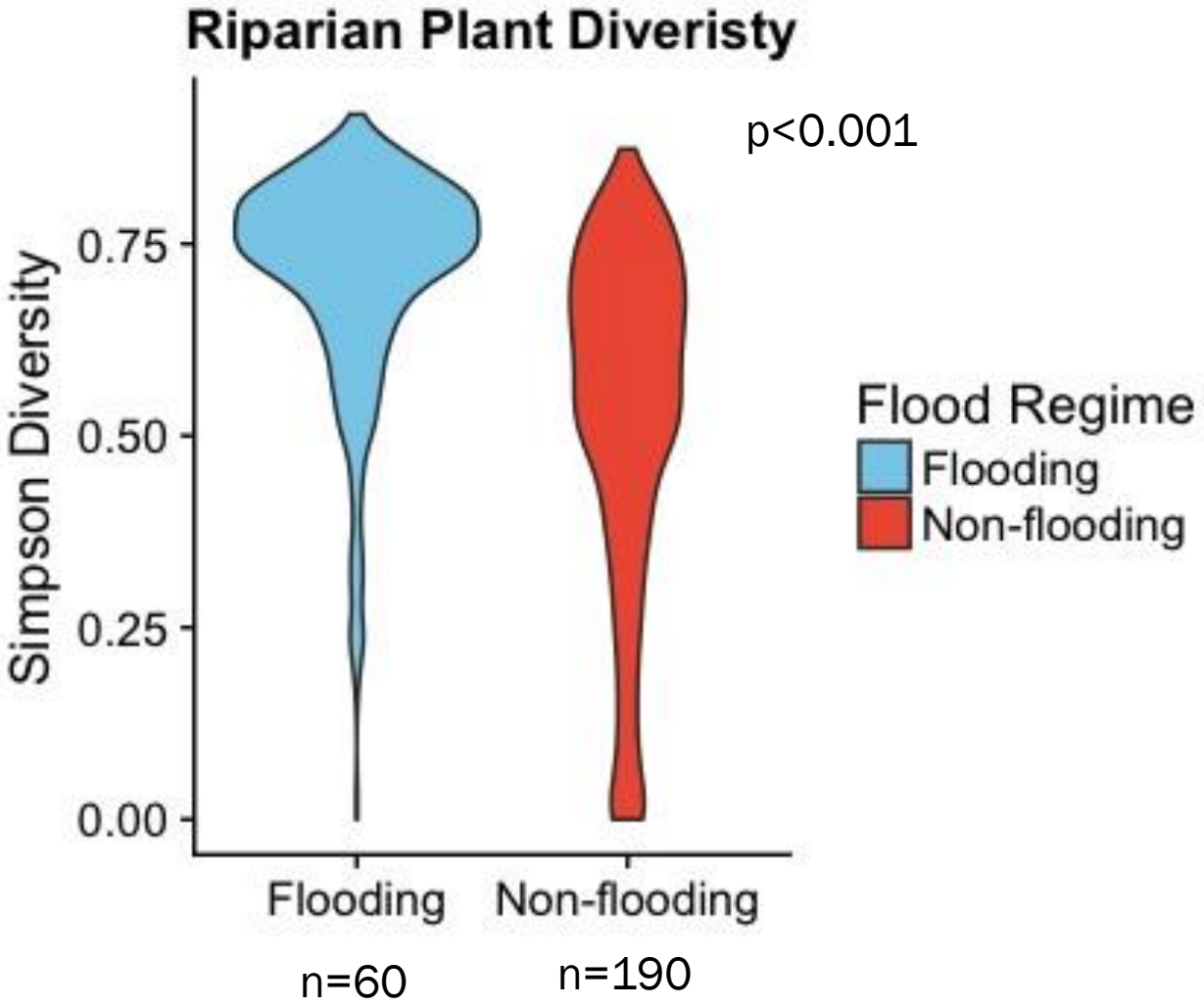
- *Depth to groundwater at 5 wells*
- *Precipitation at 2 rain gauges*

Images courtesy of BEMP

Vegetation cover surveys

- Line intercept sampling:
  - 10 30m transects per site
  - Surveyed annually Aug-Sept
  - All species cover recorded to nearest centimeter

Does riparian plant community composition change with flooding regime?



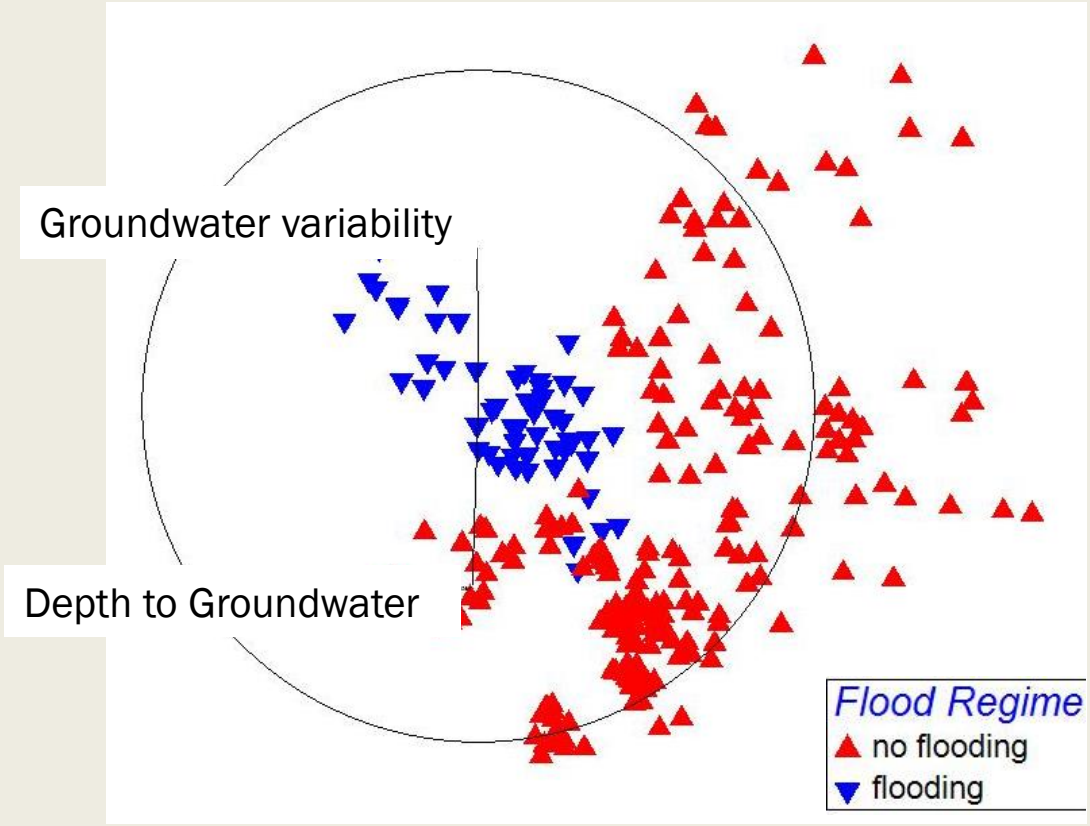
On average diversity is 35% higher at flooding sites

There is a wider spread of diversity at non-flooding sites

Does riparian plant community composition change with flooding regime?

Community Composition

Stress 0.20
R^2= 0.10



Where flooding does not occur, plant communities diverge

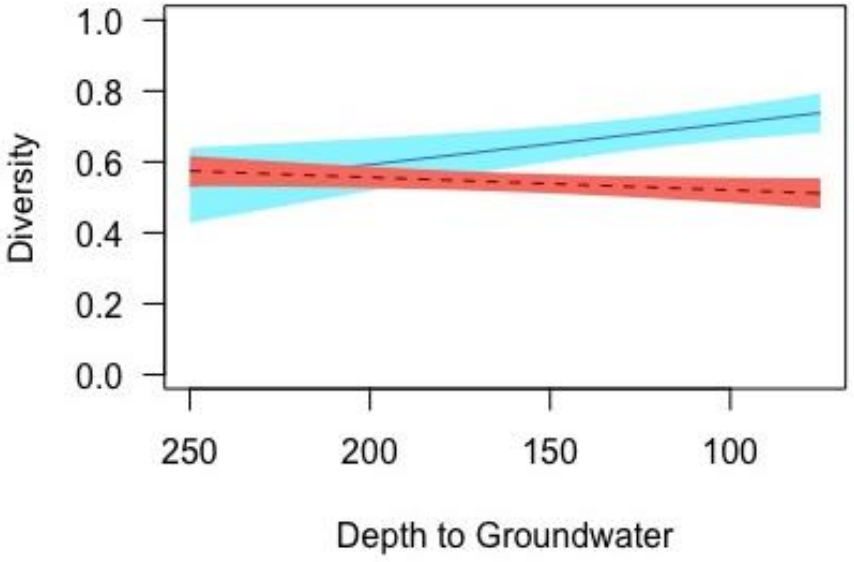
Differences are correlated with water availability

What is driving differences between flooding and non-flooding sites?

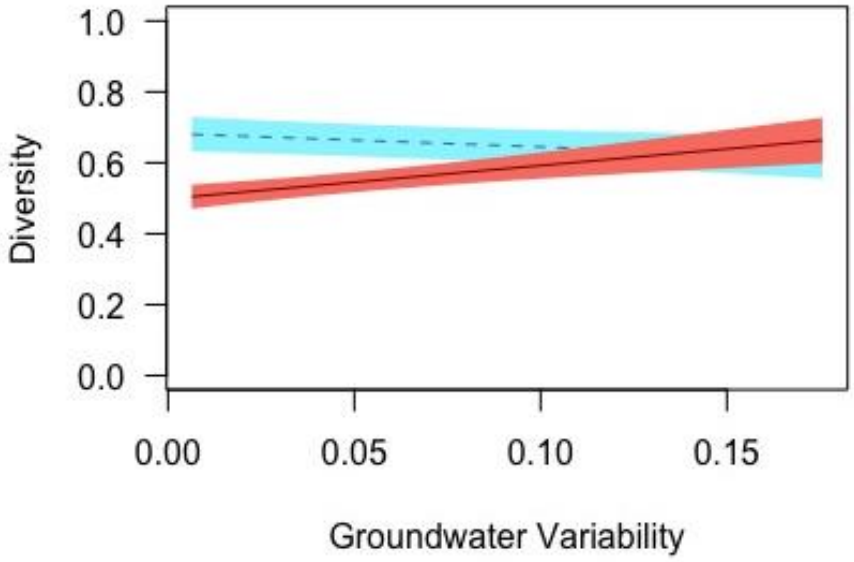
Flood regime:
Flooding
Non-Flooding

Significant
Non-significant

Diversity increases with water groundwater levels at flooding sites.



Diversity increases with groundwater variability at non-flooding sites.

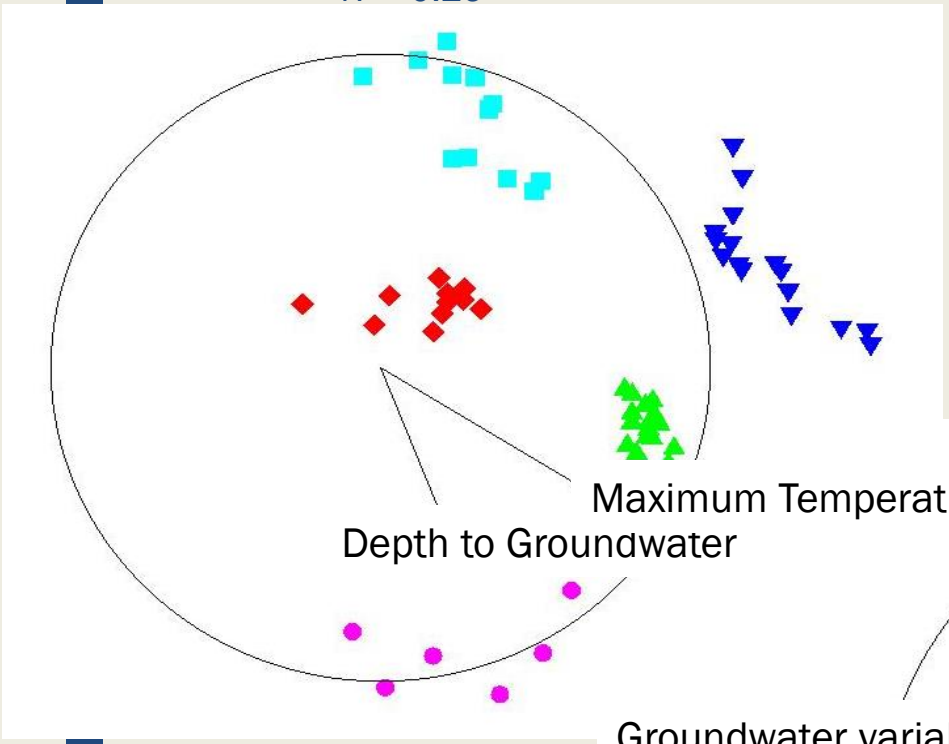


These patterns are the same for both total and native diversity.

Flooding Sites

Stress 0.12

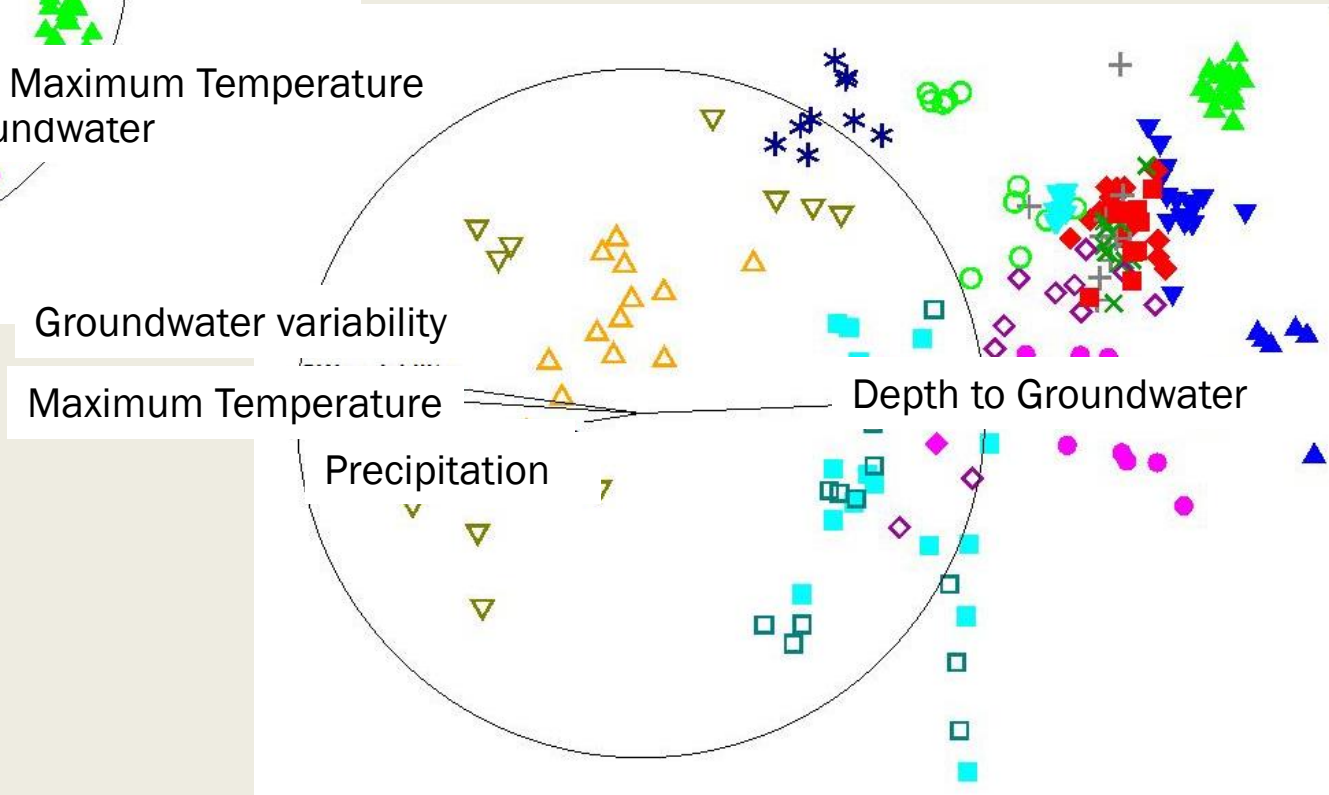
R^2= 0.29



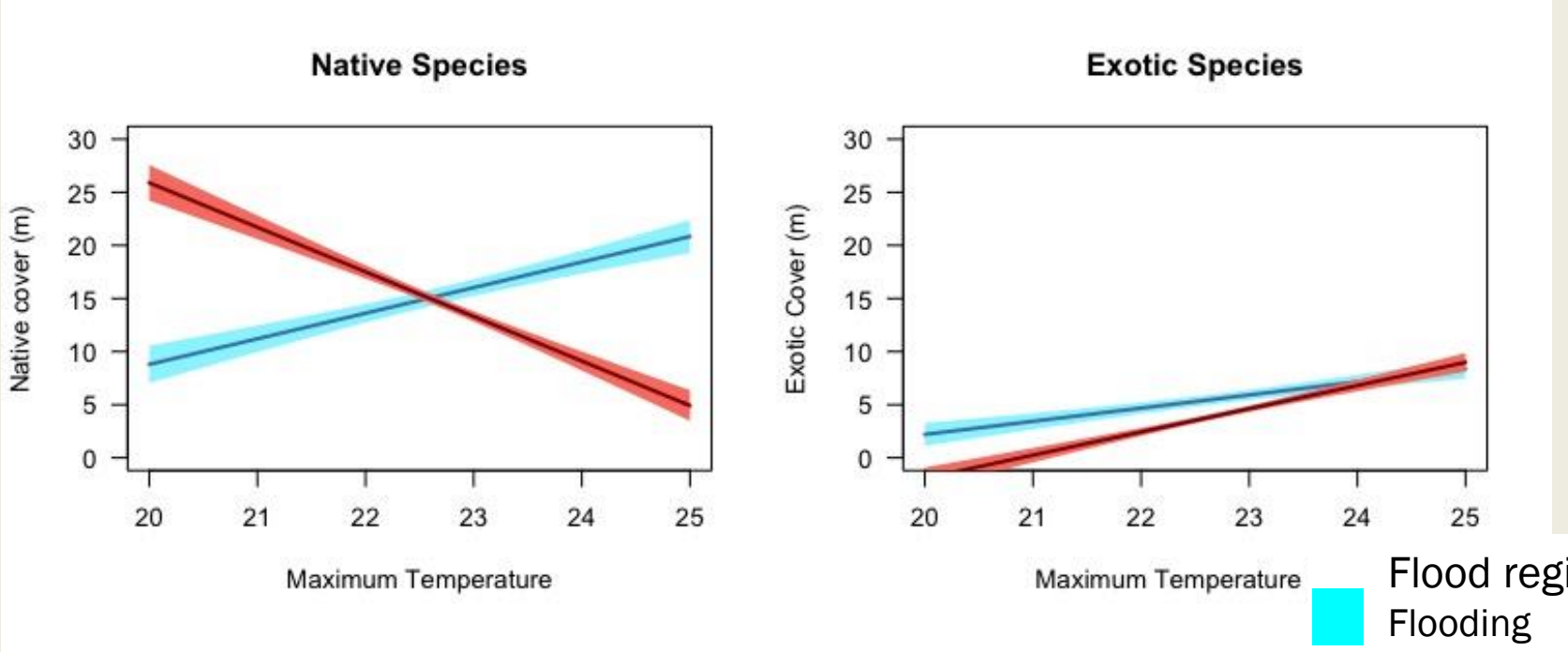
Non-flooding Sites

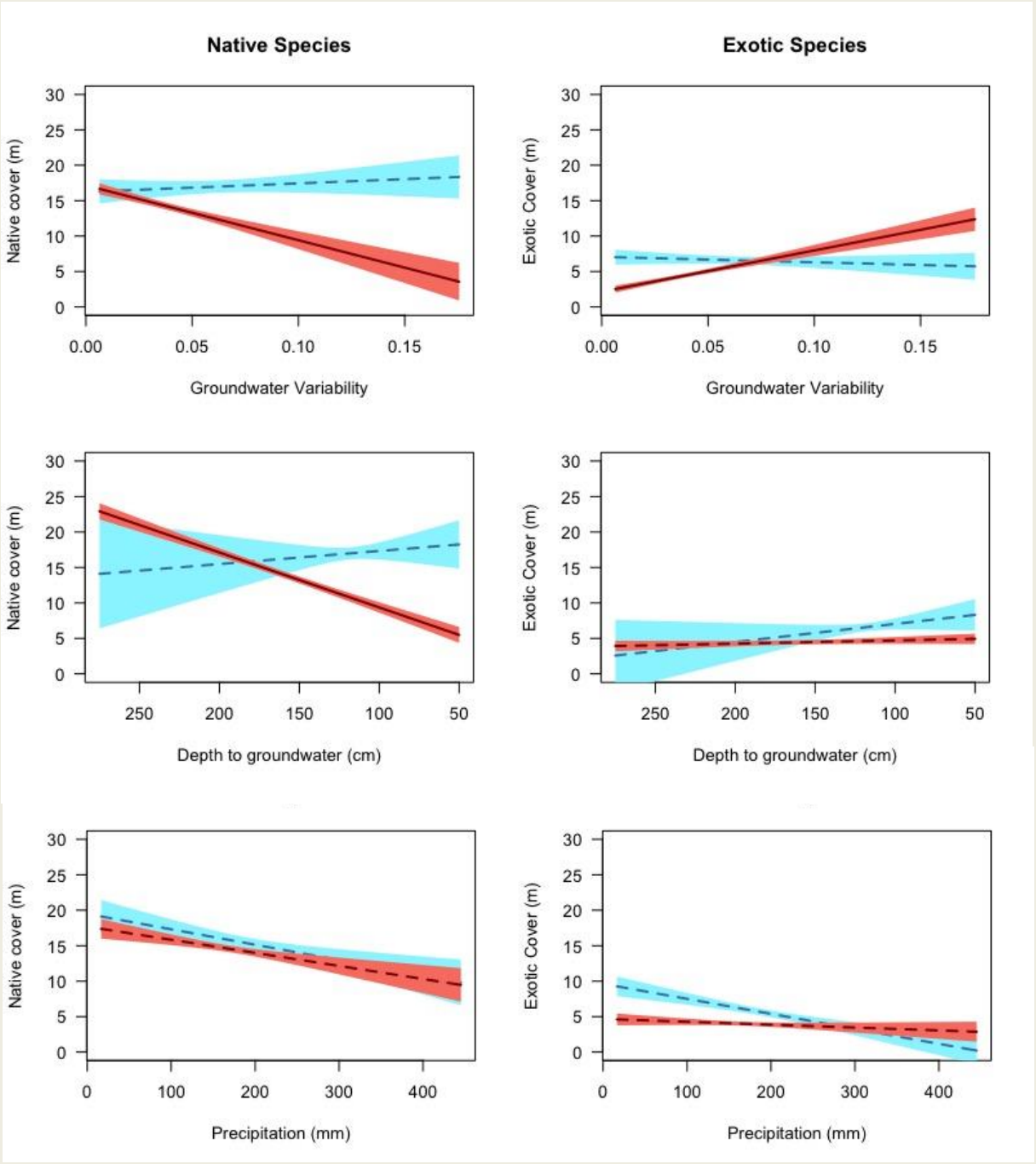
Stress 0.16

R^2= 0.16

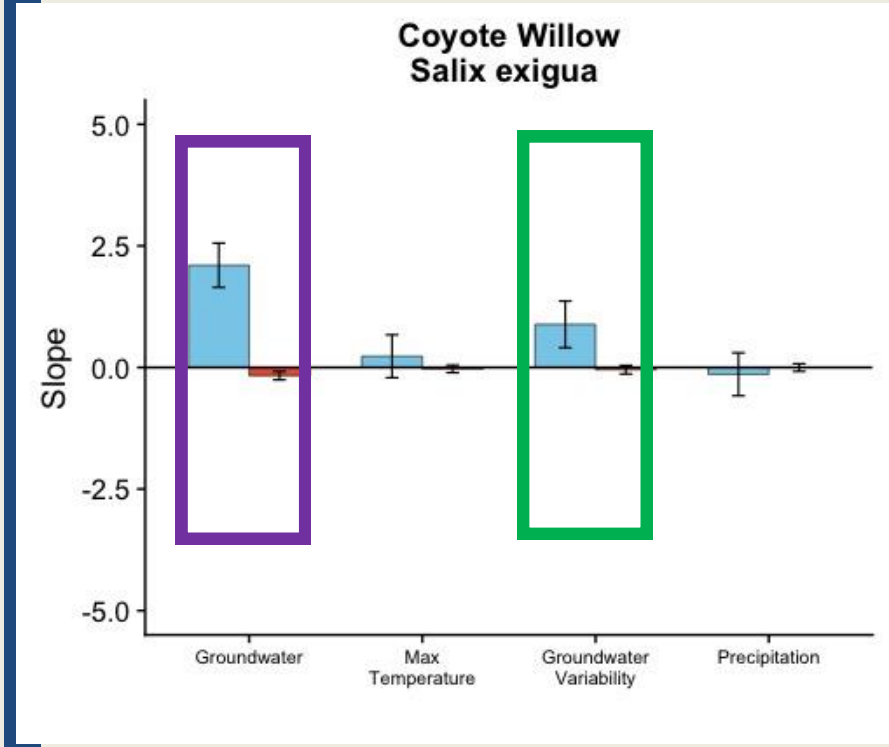


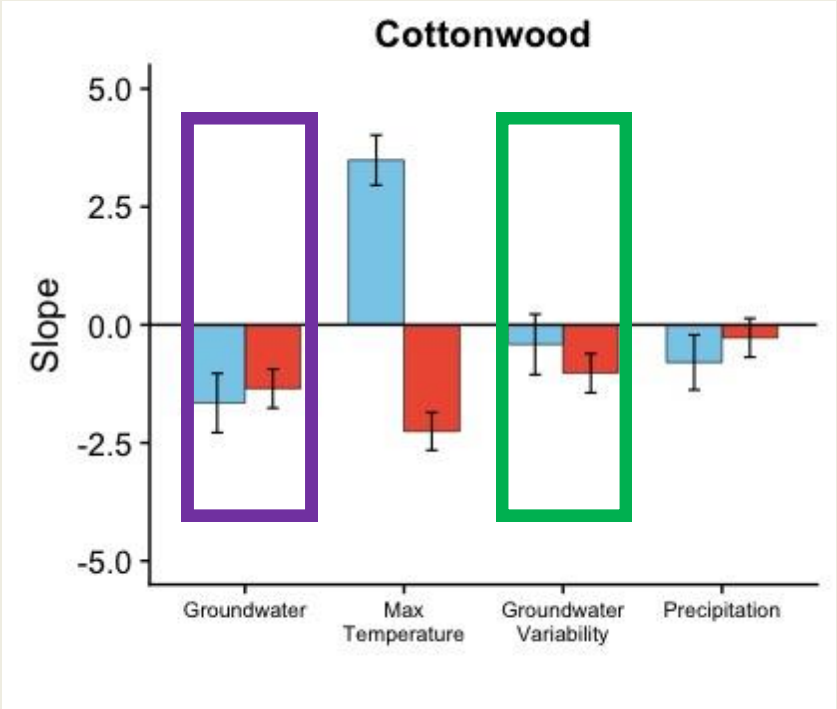
How is vegetation at flooding and non-flooding sites responding to climate?




Native Species
Exotic Species
Native cover (m)
Exotic Cover (m)
Groundwater Variability
Depth to groundwater (cm)
Precipitation (mm)
Flood regime:
Flooding
Non-Flooding
Significant
Non-significant

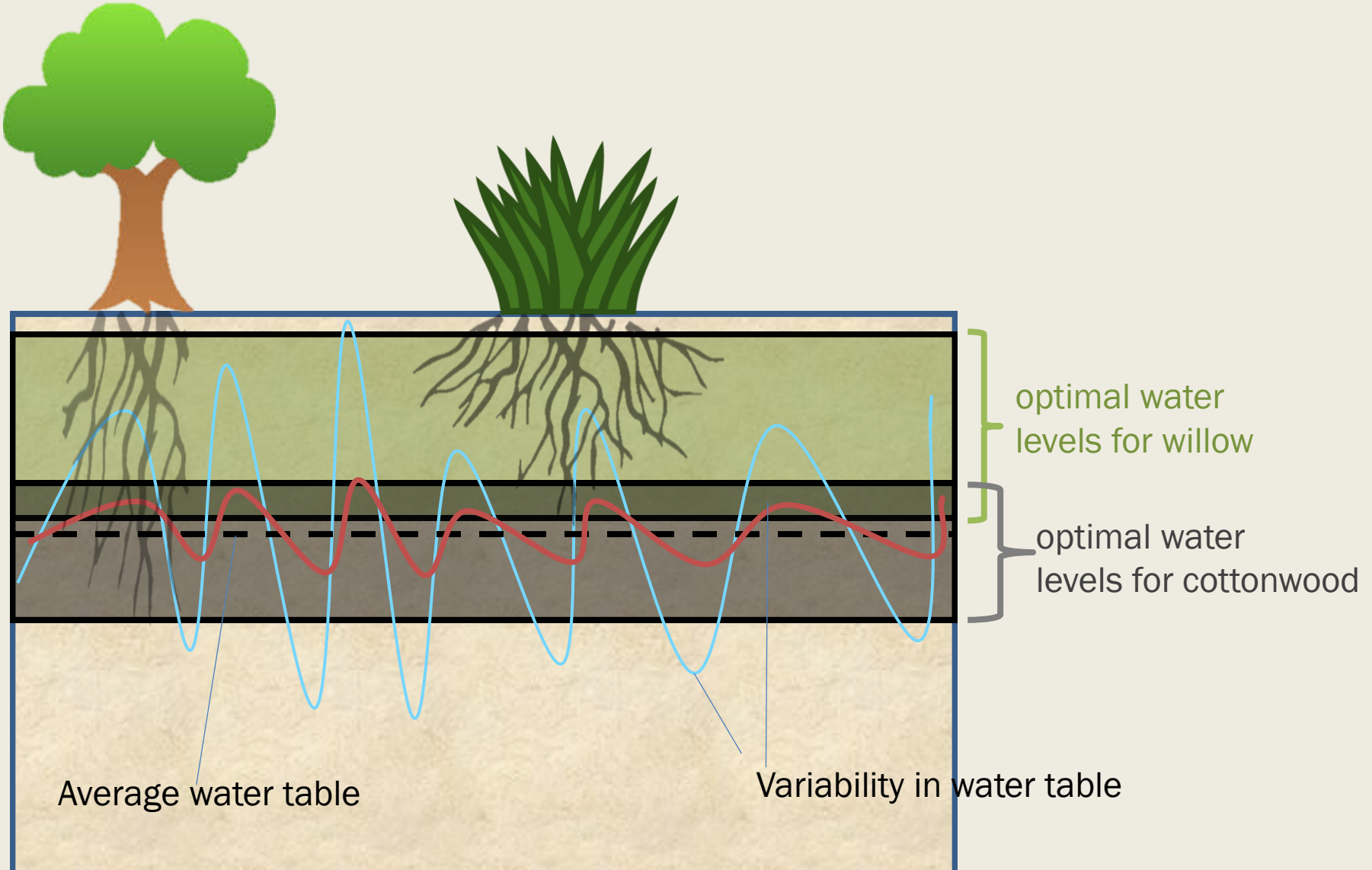
Why do we see differences in how the co-dominant species respond to groundwater and variability?





Why do we see differences in how the co-dominant species respond to groundwater and variability?

Bucket model: Knapp et al. 2008



Conclusions

- Plant communities appear to respond differently to changes in climate based on the flood regime of the site.
  - *Sites that don't flood are more sensitive to changes in water availability from precipitation and variation in water table.*
  - *Flood regime determines how plant communities respond to temperature*
- Species respond differently to groundwater variability based on root depths.

Acknowledgements

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Current BEMP Funders

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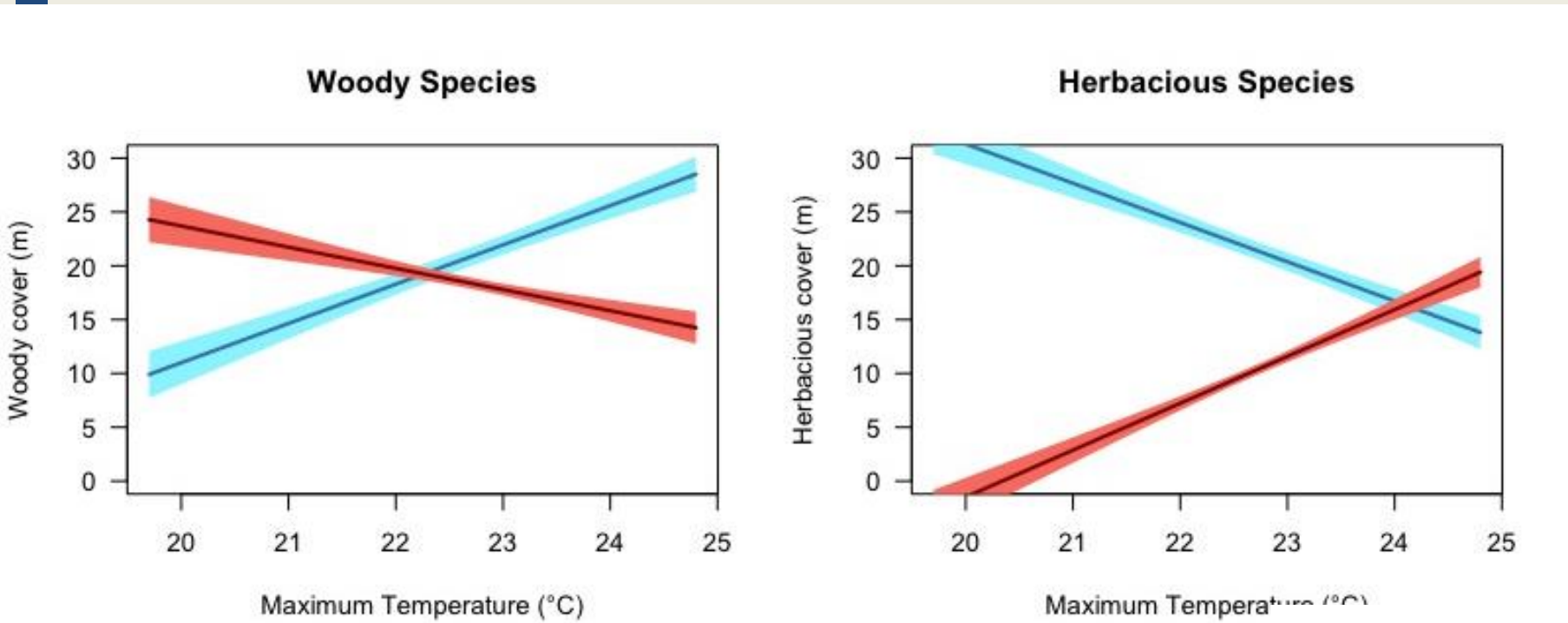
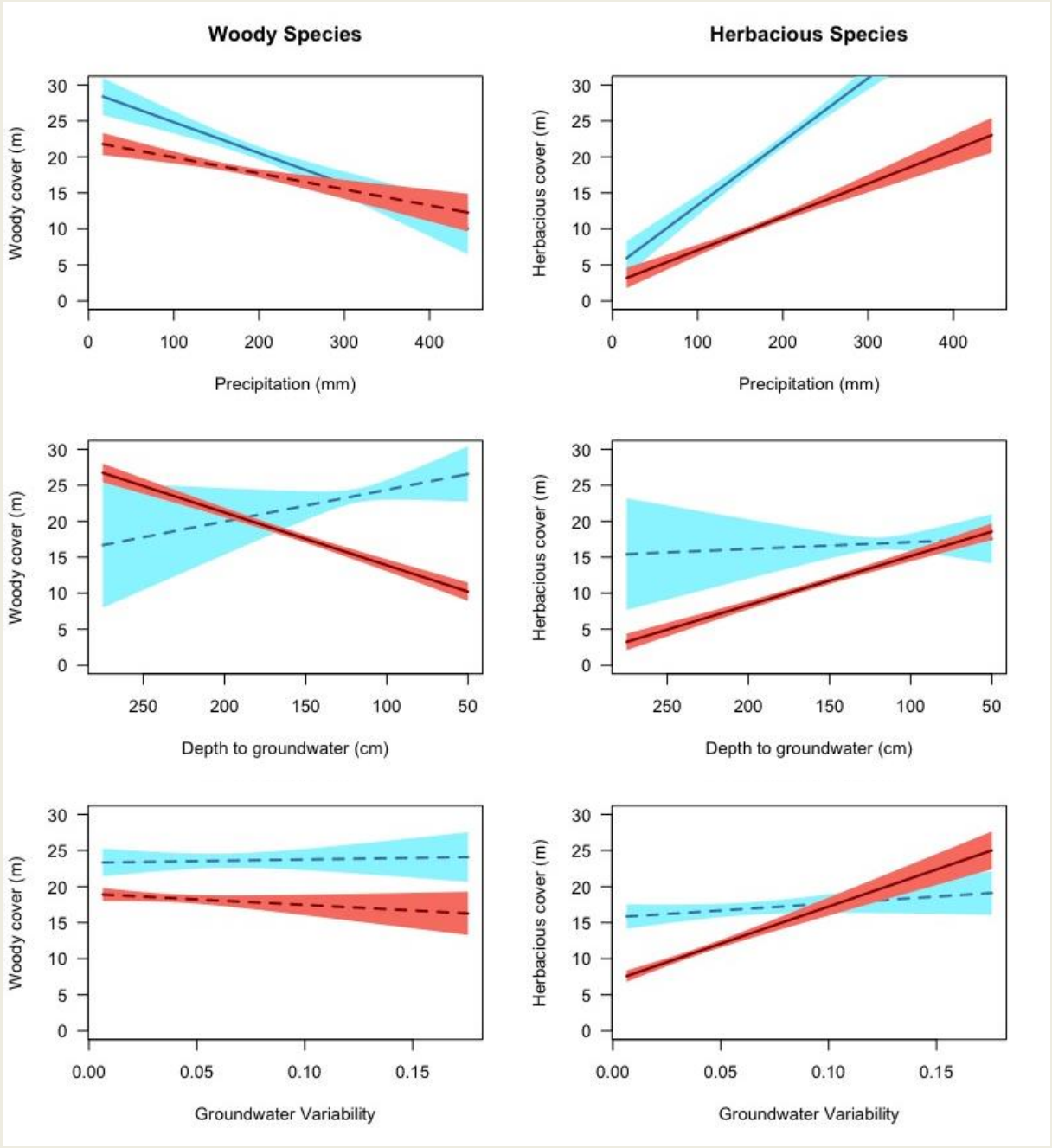
Summary

Plant group	Groundwater		Temperature		Groundwater variability		Precipitation	
	flood	non	flood	non	flood	non	flood	non
Native		-	+	-		-		
Exotic			+	+		+		
Woody		-	+	-			-	
Herbaceous		+	-	+		+	+	+

- Temperature is associated with all our plant groups
- Groundwater depth and variability are associated with cover where flooding does not occur and the water table is generally deeper across most plant groups

Q3: Which plant groups or species account for differences in community sensitivity to abiotic factors between flood regimes?





Flood regime:
Flooding
Non-Flooding

Significant
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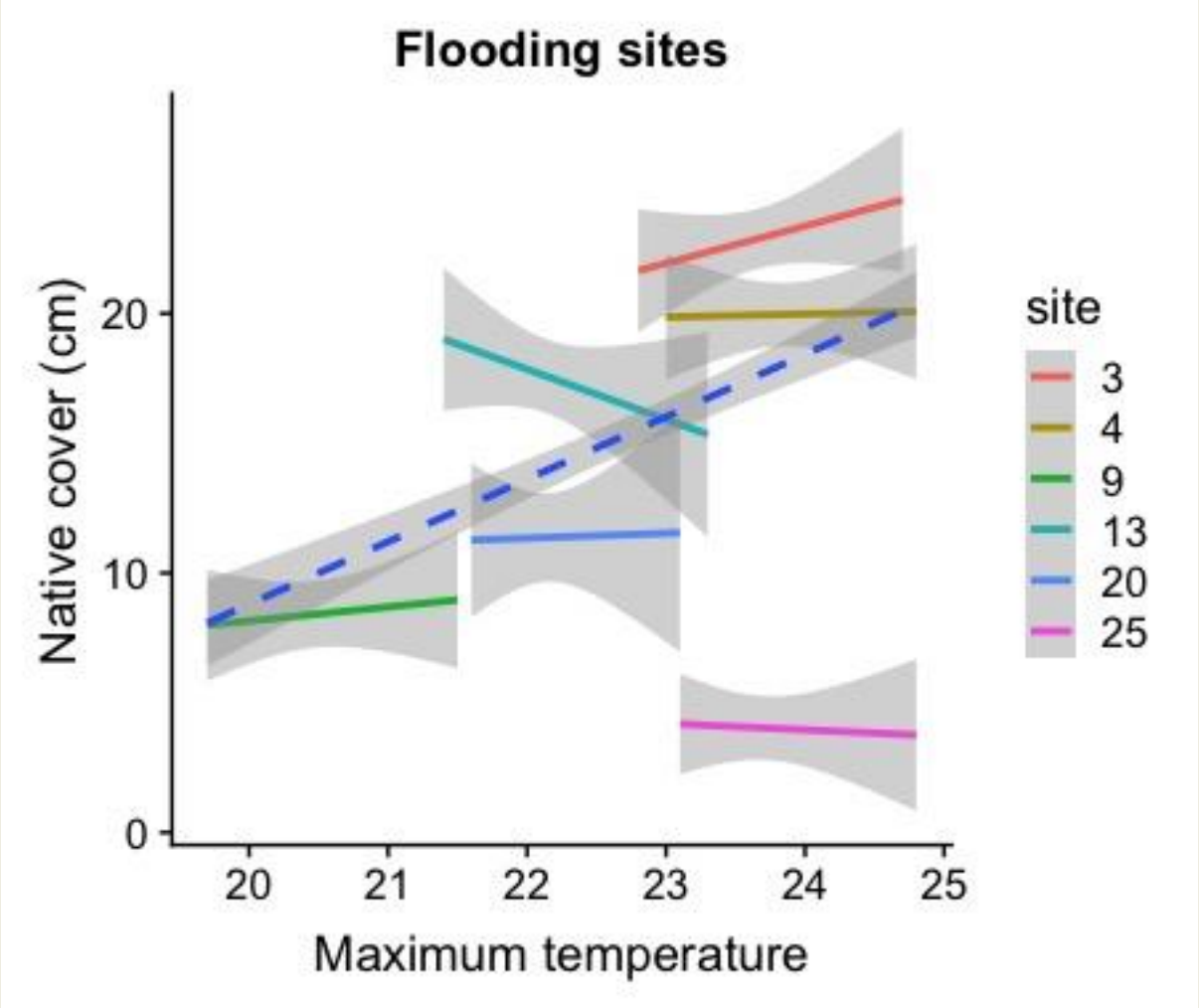
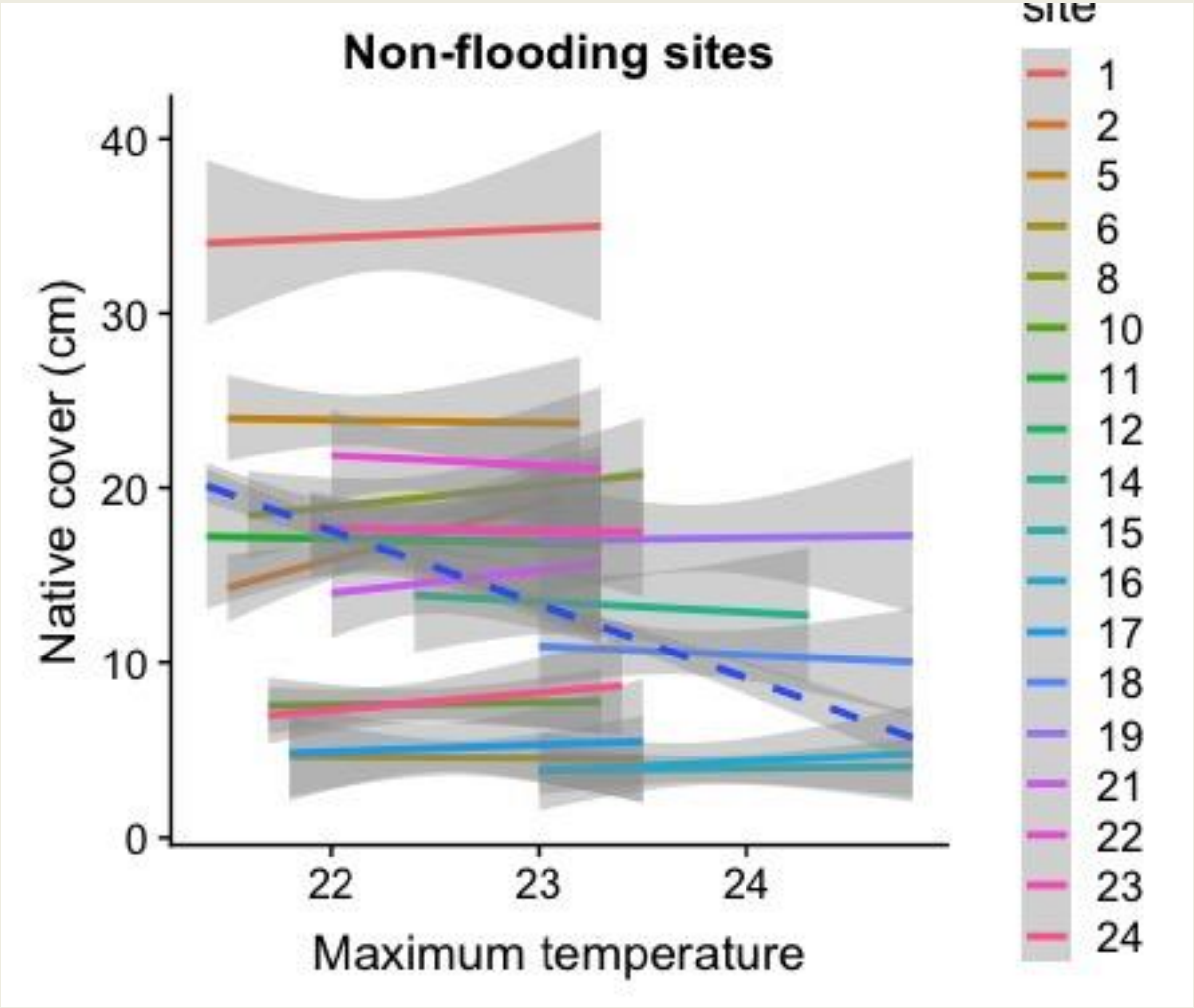

Flooding sites
Native cover (cm)
0
10
20
20
21
22
23
24
25
Maximum temperature
site
3
4
9
13
20
25


Non-flooding sites
Native cover (cm)
40
30
20
10
0
22
23
24
Maximum temperature
site
1
2
5
6
8
10
11
12
14
15
16
17
18
19
21
22
23
24