

# Willow ecology and beaver in mountain wetlands

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# Two willow species dominate Colorado mountain wetlands

- *Salix monticola*: lower montane to subalpine  
(1800 m to 2900 m)
- *Salix planifolia*: upper montane to alpine  
(>2250 m)
- Sympatric from upper montane to subalpine

# In these mountain wetlands:

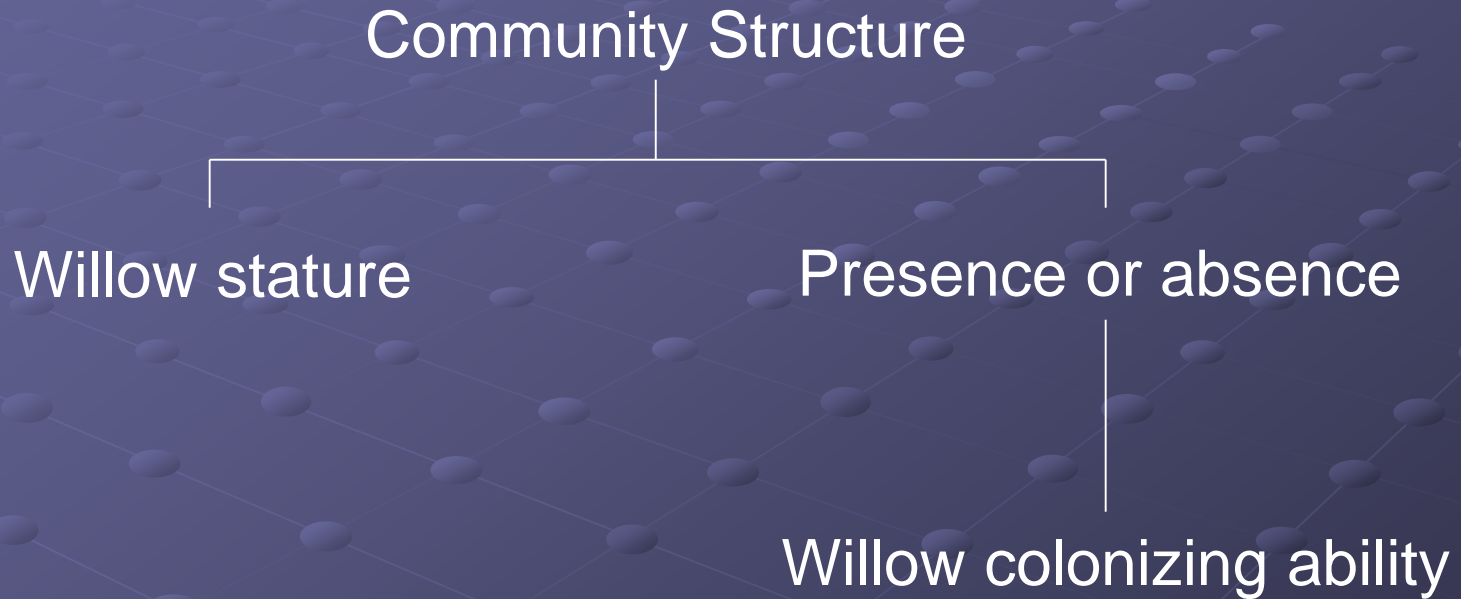
- Willow carr vegetation varies spatially:
  - Willow species composition varies across carr
  - Stature of willows within a species varies across carr







# Questions addressed

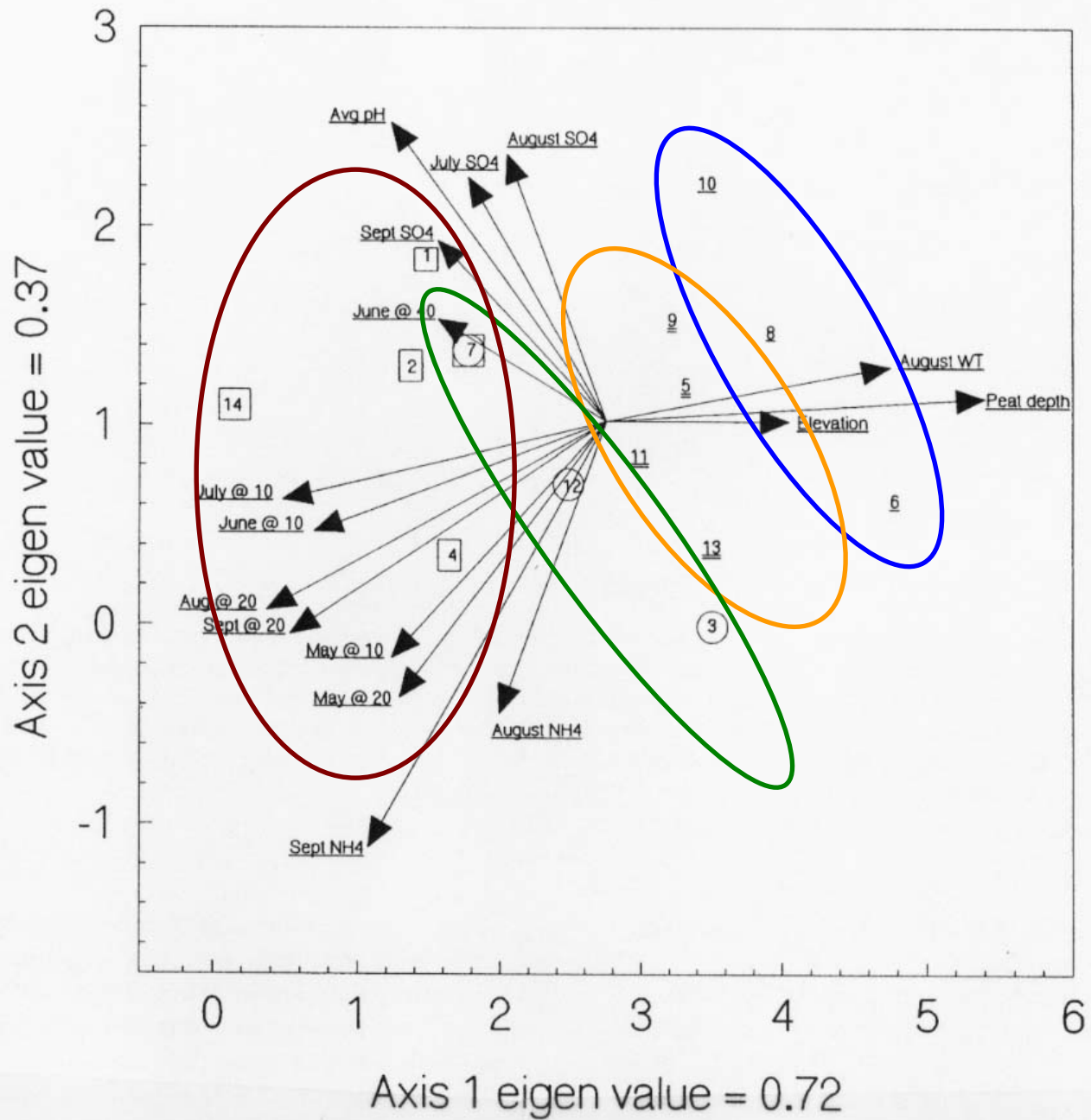


# Community description

## ● Methods of study:

- Species composition of 14 stands from 3 elevations
- Abiotic data
  - Peat depth
  - Depth to water table
  - Soil redox measurements at 10, 20, & 40 cm
  - Soil water chemistry (pH,  $\text{NH}_4$ ,  $\text{SO}_4$ )





Stand scores from Detrended Correspondence Analysis

# Summary of willow relationships

Moderate to high  
soil oxygen

Soil water  
pH increases

TALL  
*S. monticola*

TALL  
*S. planifolia*

MODERATE  
*S. planifolia*

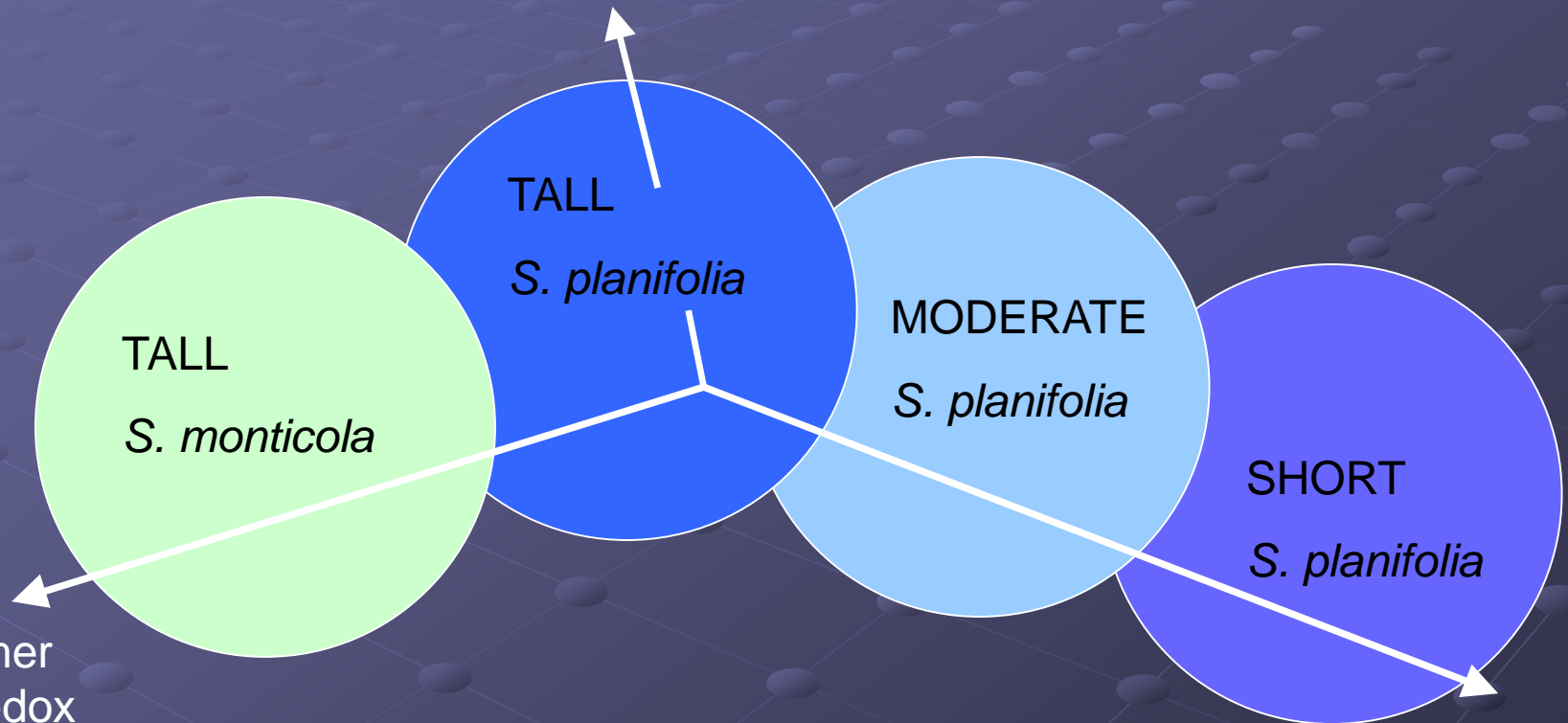
SHORT  
*S. planifolia*

Summer  
soil redox  
increases

Peat depth  
increases

Highest soil oxygen

Low soil oxygen



- Abiotic conditions show how the two species differ in adaptation

- But these conditions don't answer **how they colonize the land** –

- Question of **regeneration niche**

- Sexual reproduction?

- Asexual reproduction?

# Sexual reproduction was addressed two ways:

- are seeds viable? – germination tests (lab and field)
  - Yes, 90% or more germinate
- Are there willow seedlings? – survey peatlands
  - Yes, but..

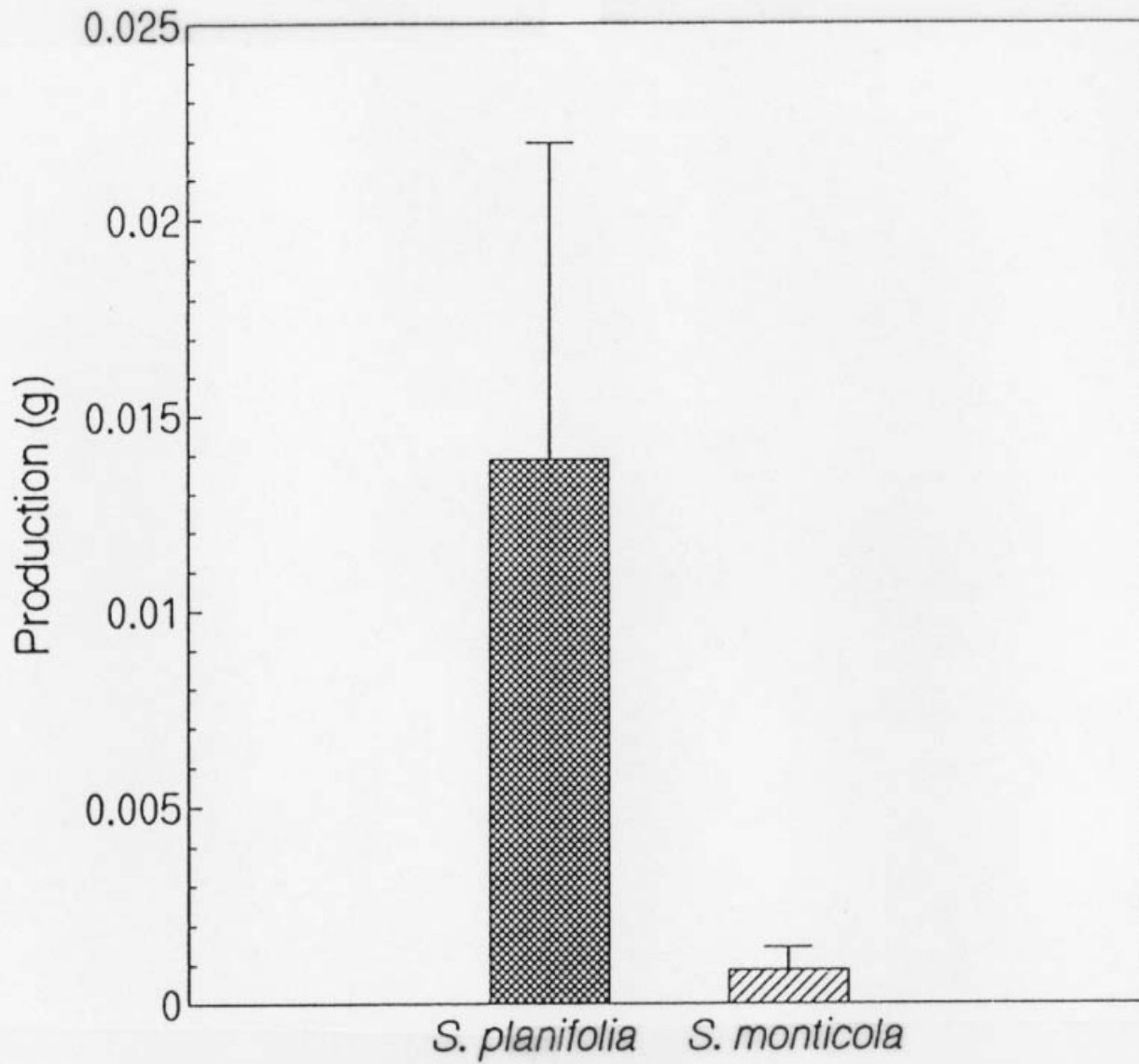


**Only a few areas of peatlands support sexual reproduction**

# Can willows grow asexually?

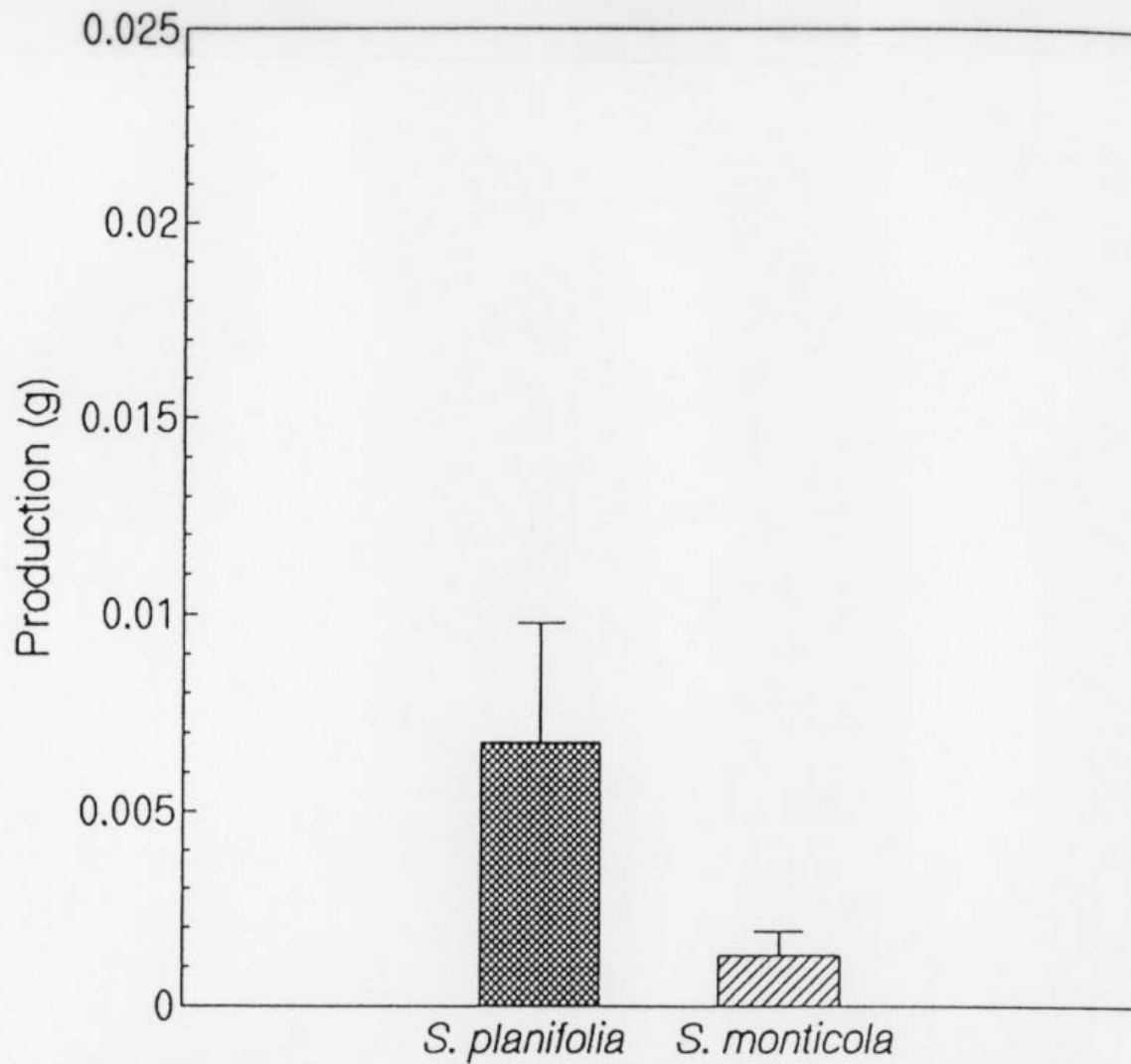
- Growth experiments using stem fragments
  - Native peat soils in pots buried into peatlands at different elevations
  - ANOVA tests of root and shoot production
- Does this help explain the patterning of the wetlands?



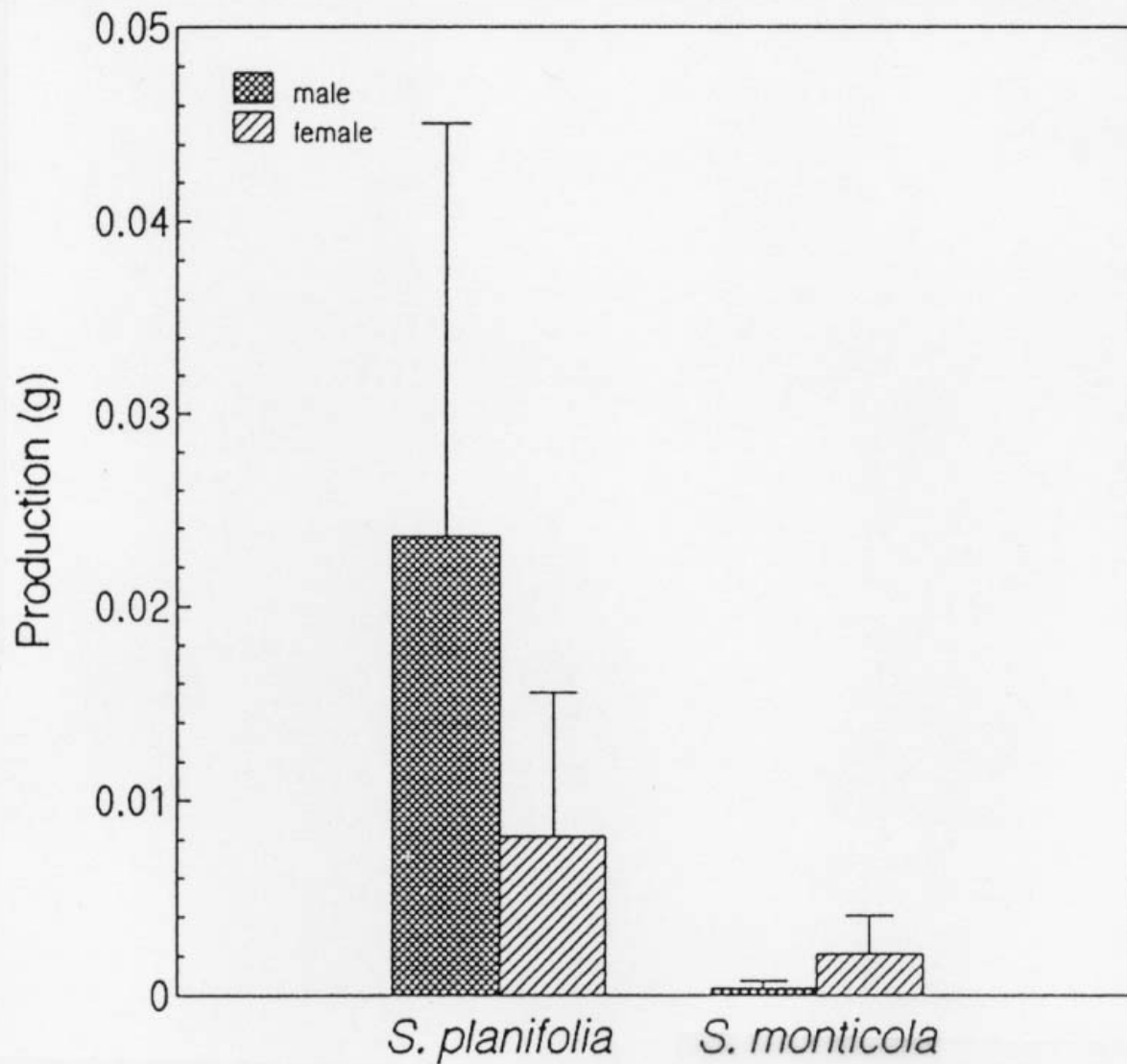


Geometric means and standard errors of shoot dry matter production ( $p = 0.0001$ )

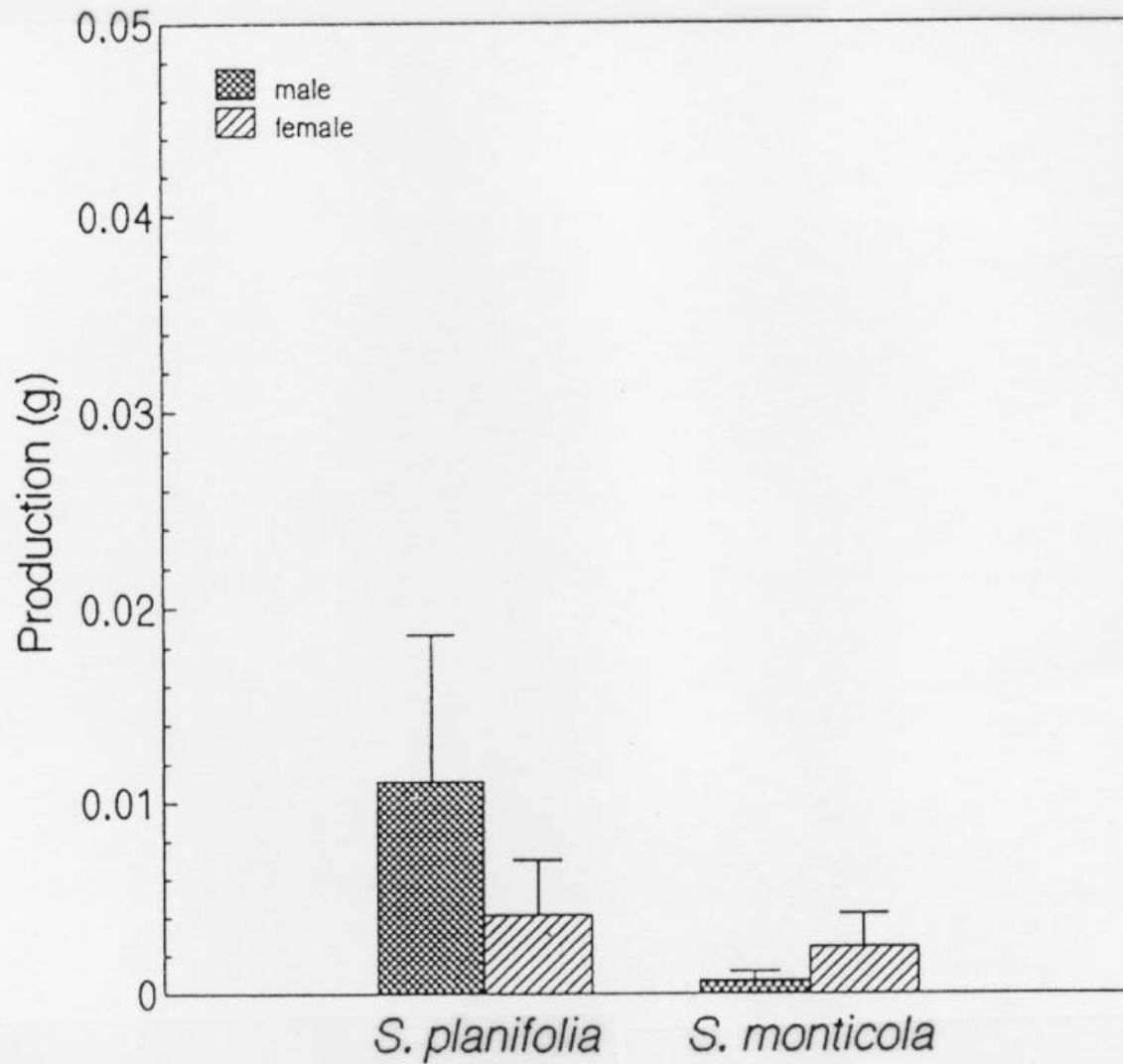




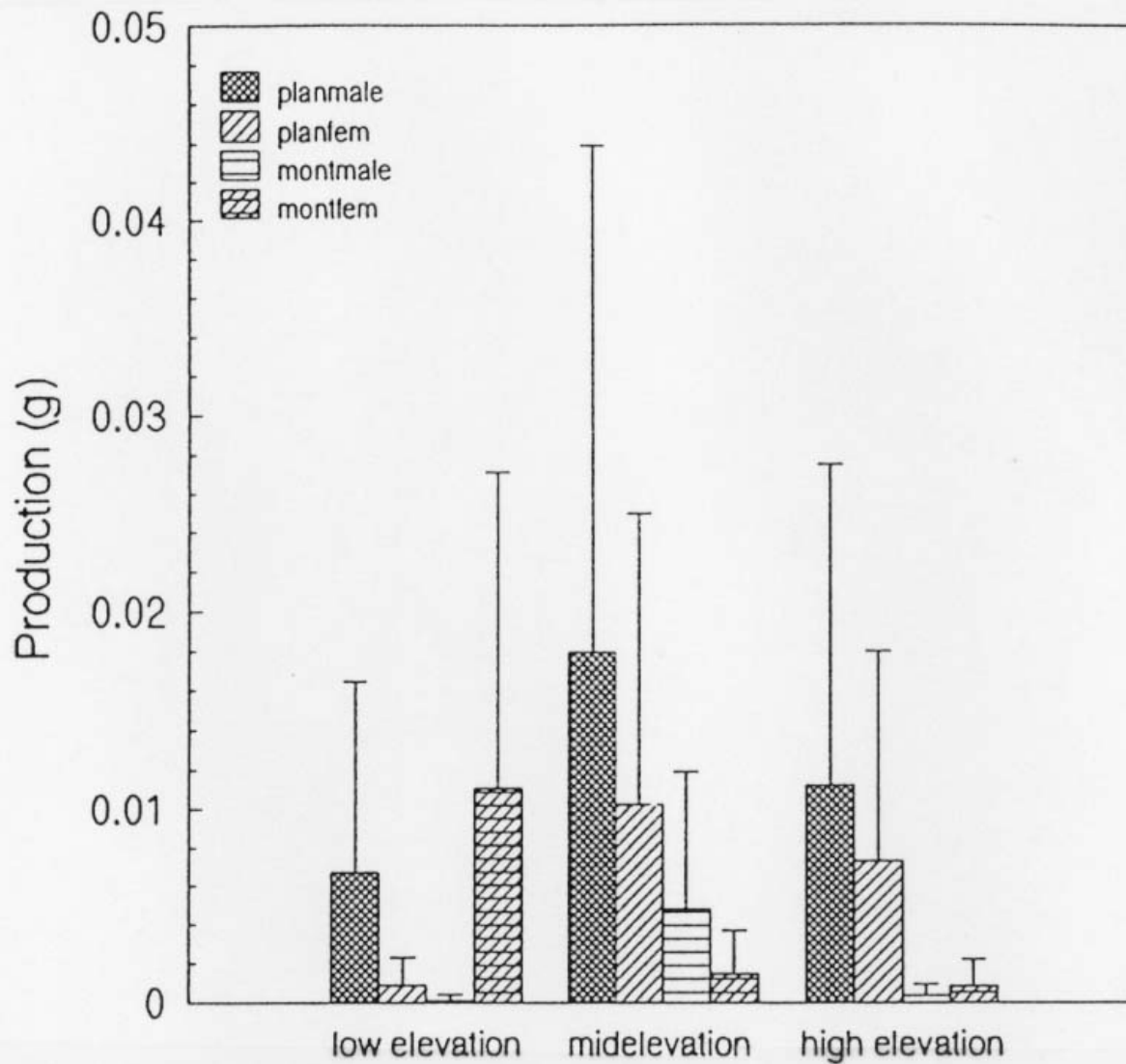
Geometric means and standard errors  
of root dry matter production  
( $p = 0.0031$ )



Geometric means and standard errors of shoot dry matter production of species X sex ( $p = 0.044$ )



Geometric means and standard errors of root dry matter production of species X sex ( $p = 0.039$ )



Geometric means and standard errors of root dry matter production (species X sex X elevation)  
( $p = 0.049$ )











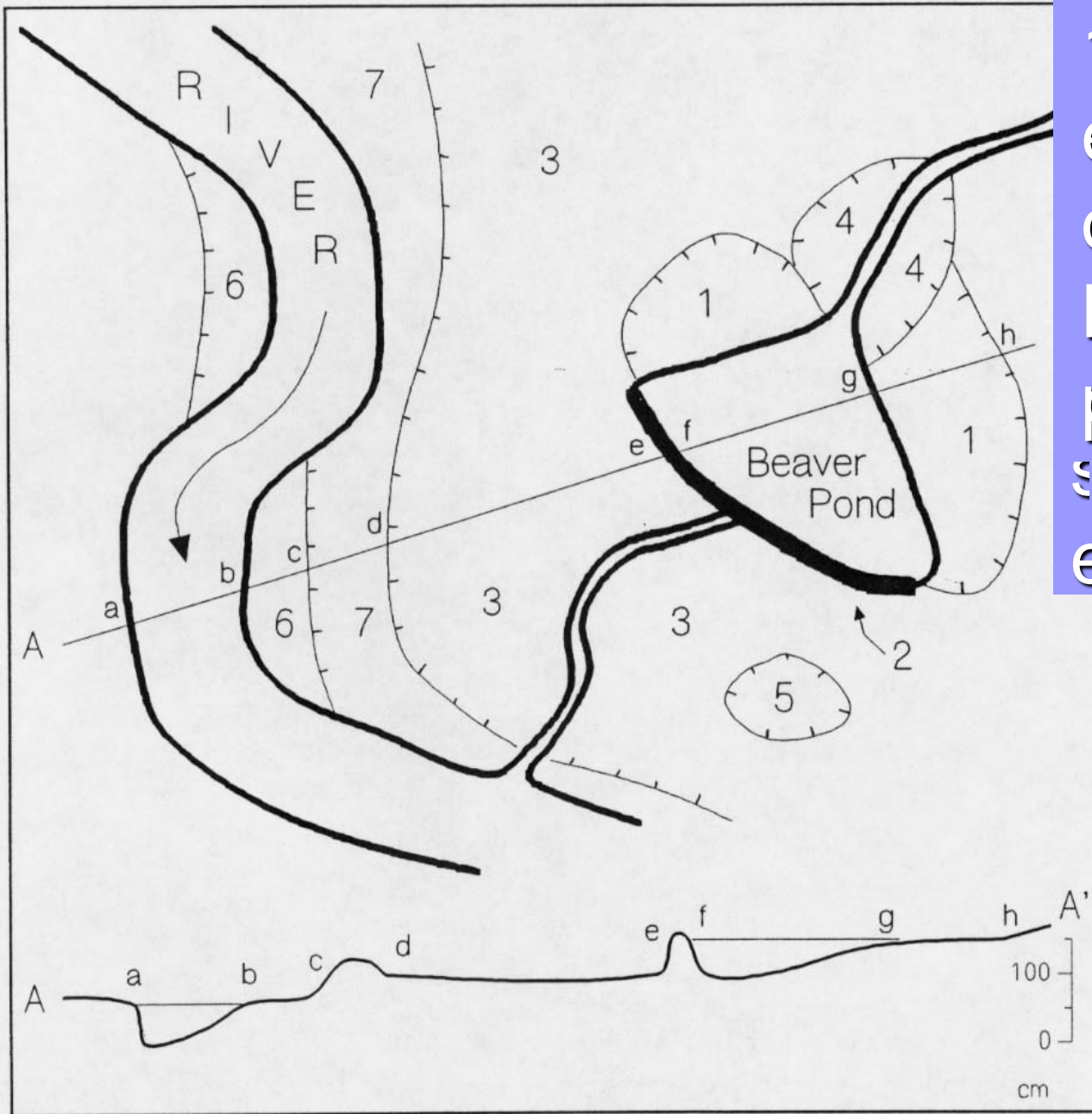






# Conclusions:

- Willow stature indicates peat depth / oxidation-reduction
- Most willow colonization of peatlands is asexual
- *Salix planifolia* is favored over *S. monticola* in asexually propagated populations
- Male *Salix planifolia* might be favored over females in deep peat
- Wetlands are patchworks of different regeneration niches



1: veg  
 encroachment  
 on pond.  
 Beaver  
 planted  
 species  
 establishment

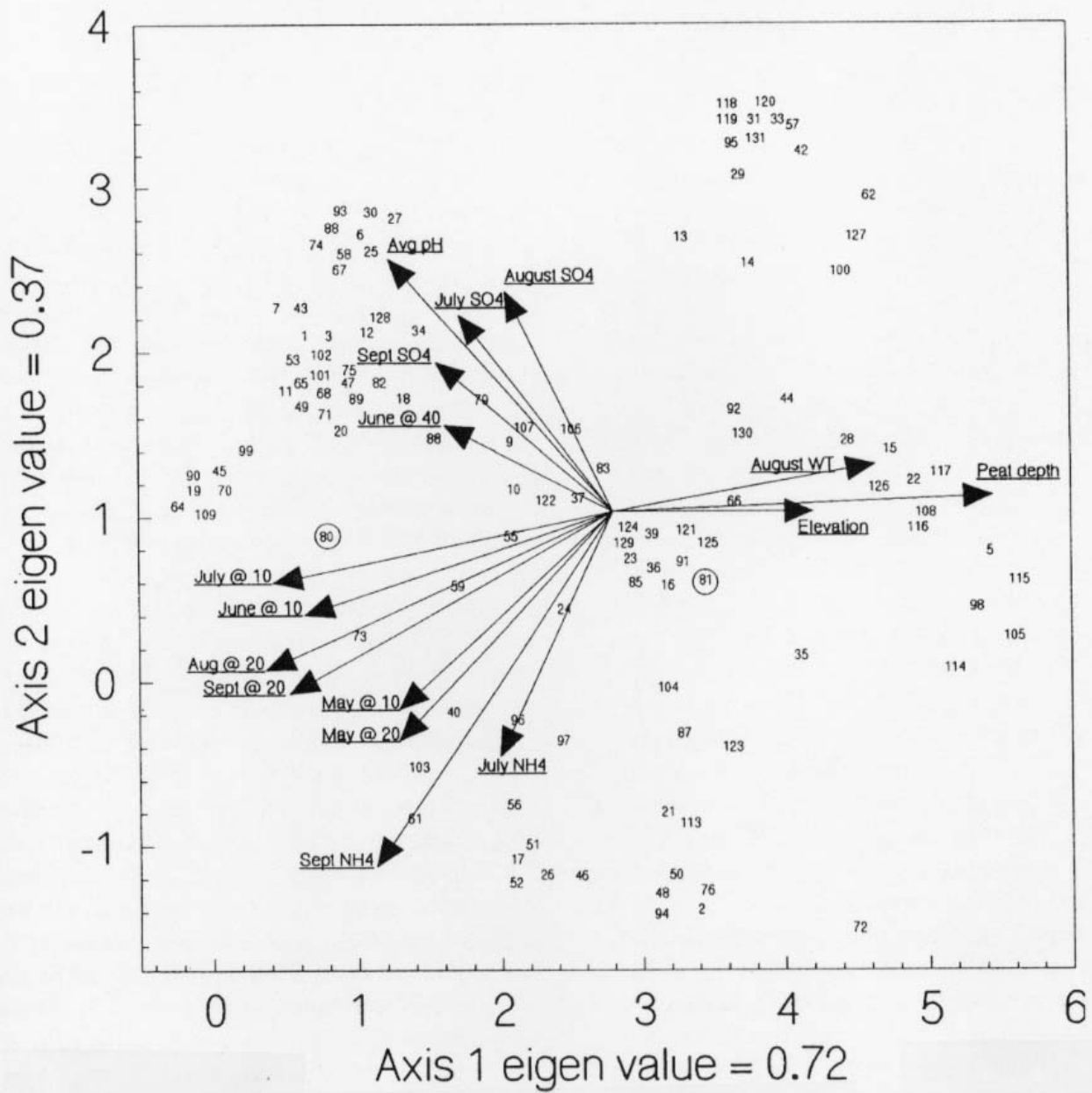
# Questions

- Acknowledgements:

Ralph Dix, David Cooper and David Steingraeber all were instrumental in this research

# ANOVA results for all statures of *S. planifolia* and *S. monticola*

Variable	P-value	<i>Salix planifolia</i>			<i>S. monticola</i>
		Short	mod	tall	tall
August redox at 20 cm	0.0082	a	a,b	b,c	c
Peat depth	0.0019	a	a,b	b,c	c



Species scores from Detrended Correspondence Analysis



