Impacts of short-term salinity intrusion and post-intrusion conditions on oligohaline wetland vegetation and soils

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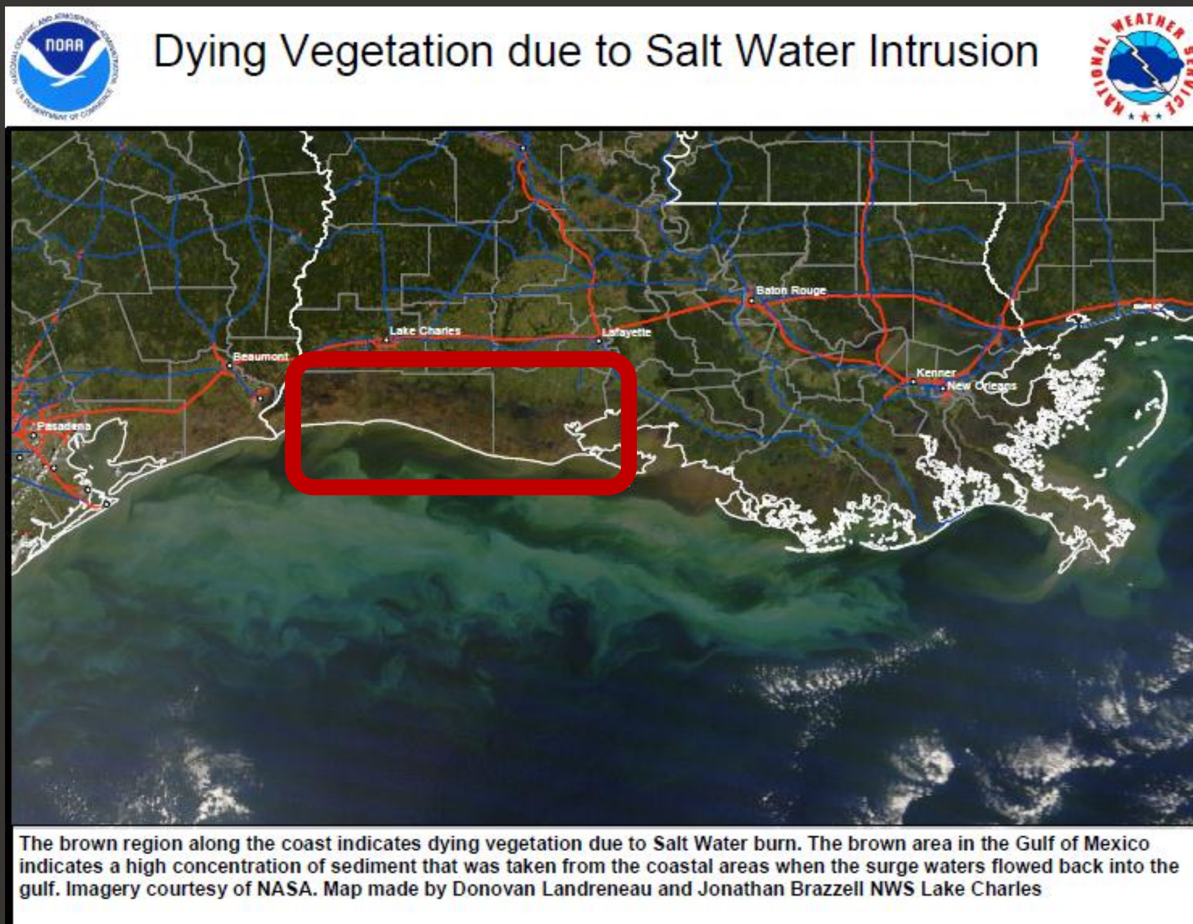
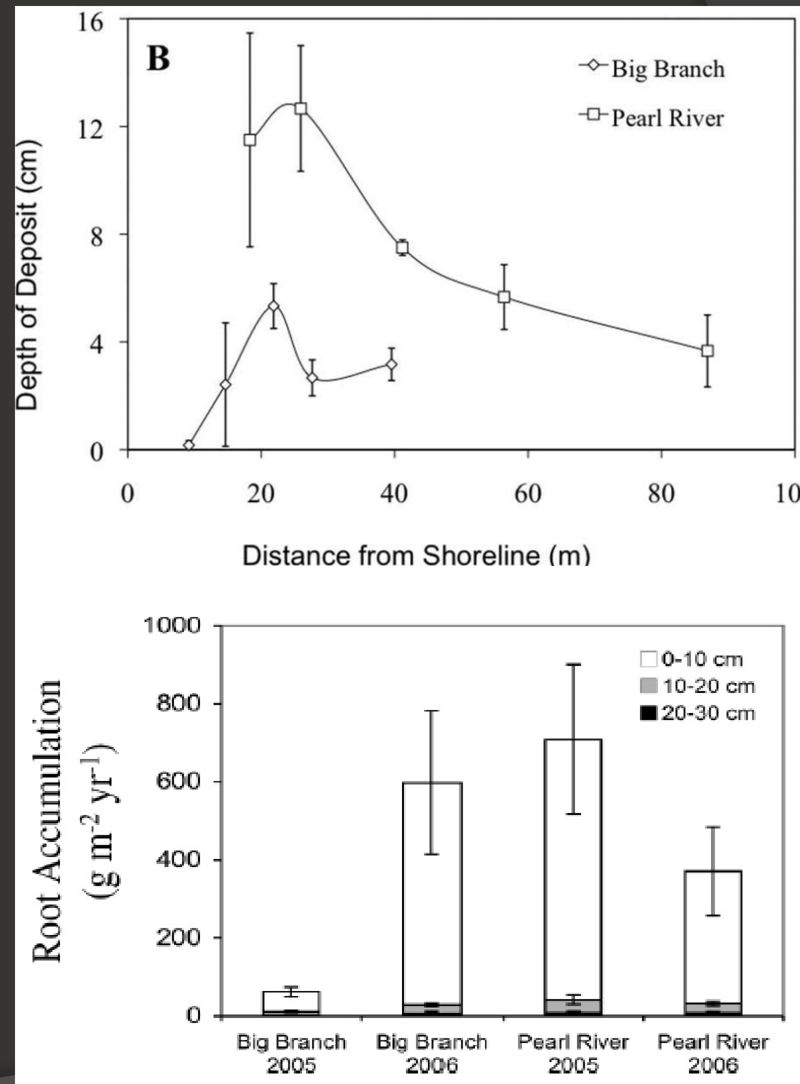
Sea Grant LOUISIANA

Hurricanes cause salt water intrusion into coastal wetlands.



Hurricanes also redistribute sediment.

photo courtesy of USGS



figures from McKee and Cherry (2009)

Herbivory causes vegetation shifts.

Photos courtesy of Guerry Holm

Nutria (*Myocaster coypus*)

Herbivory causes vegetation shifts.

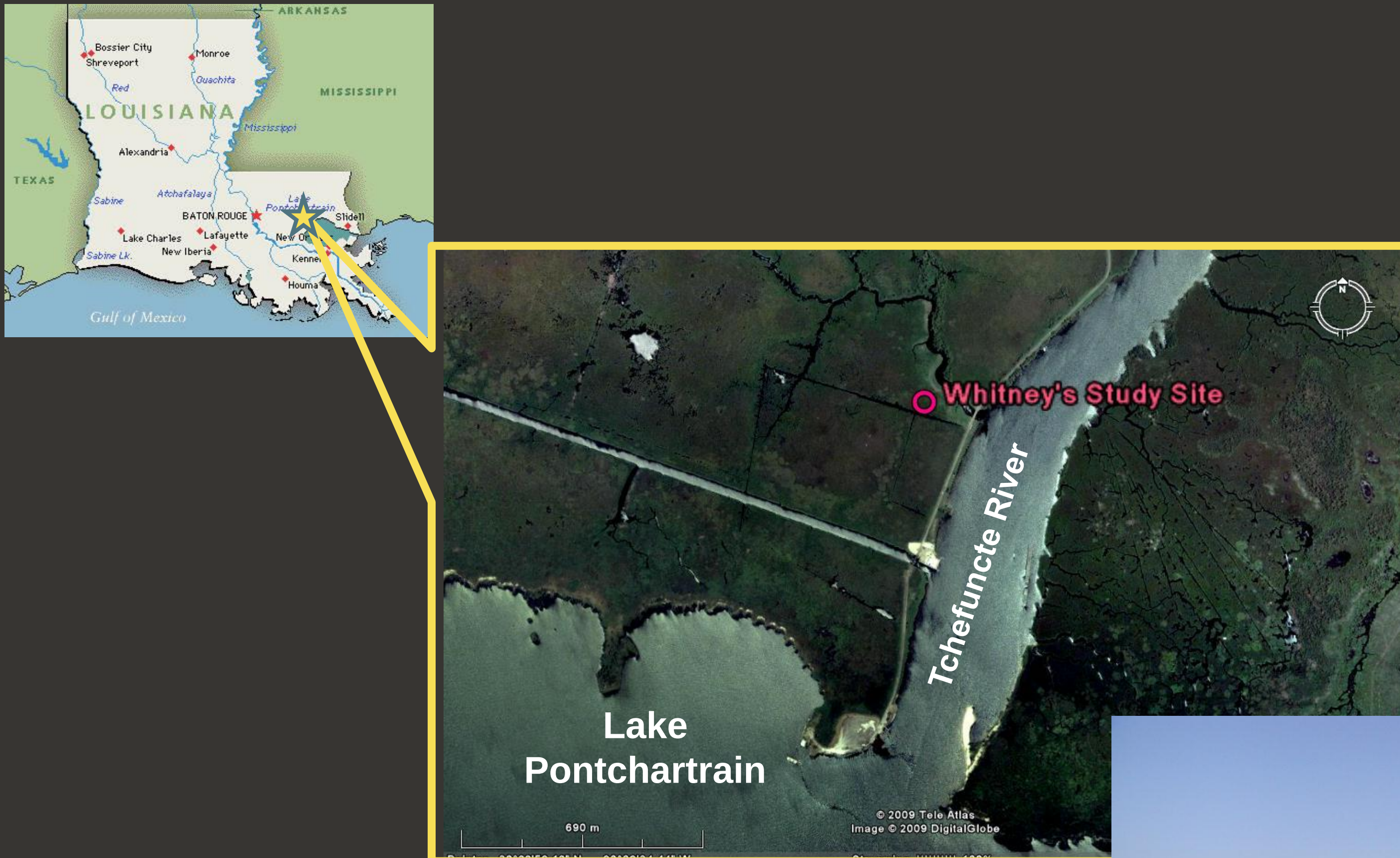
Photos courtesy of Guerry Holm

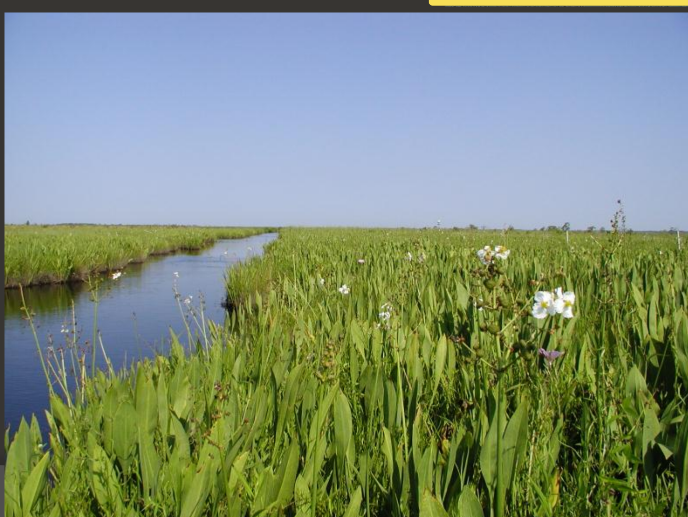
Nutria (*Myocaster coypus*)

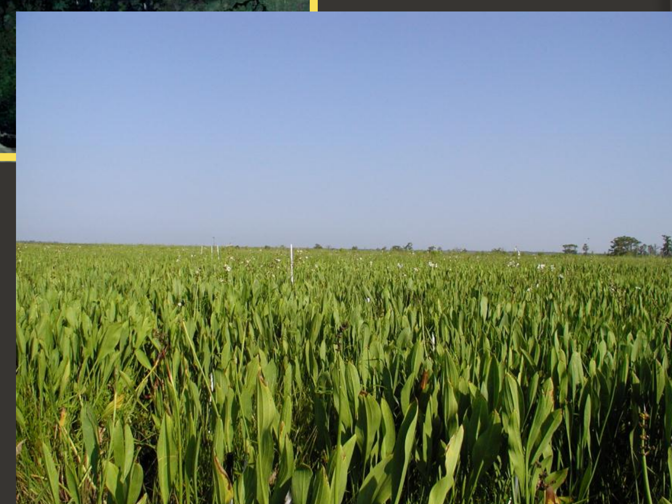
Denuding of vegetation

- Sunlight
- Temperature
- Decomposition
- Salinity
- Nutrient cycling

How do post-intrusion conditions, such as flooding regime, sediment addition, and herbivore pressure, interact to affect the recovery of wetland plants and soils following salt-water intrusion?







Photos courtesy of Chunfu Tong

April 2010

June 2010

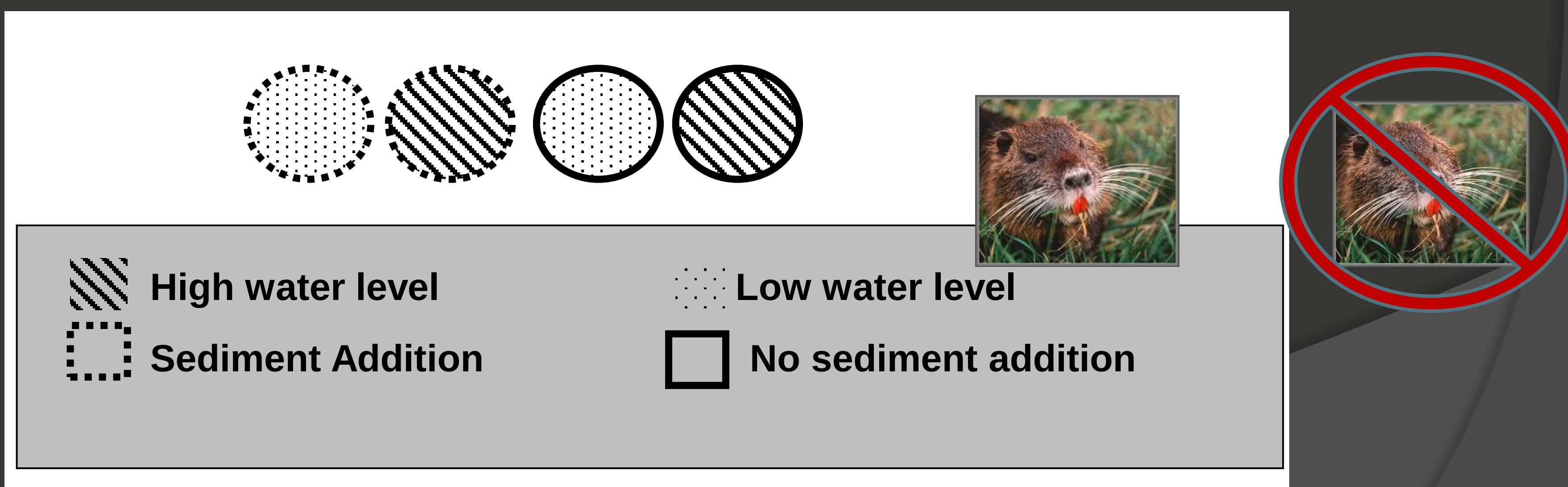
20 ppt salinity for 6 weeks

After elevated salinity exposure:

Flooding (low or high)

Sediment (no addition or addition)

Herbivory (allowed or excluded)



Response variables

% cover: ocularly estimated according to 7 cover classes; midpoint for each class used for analysis.

Relative dominance:

dominance of a single species / total dominance of all species

dominance = % cover * ave. canopy ht

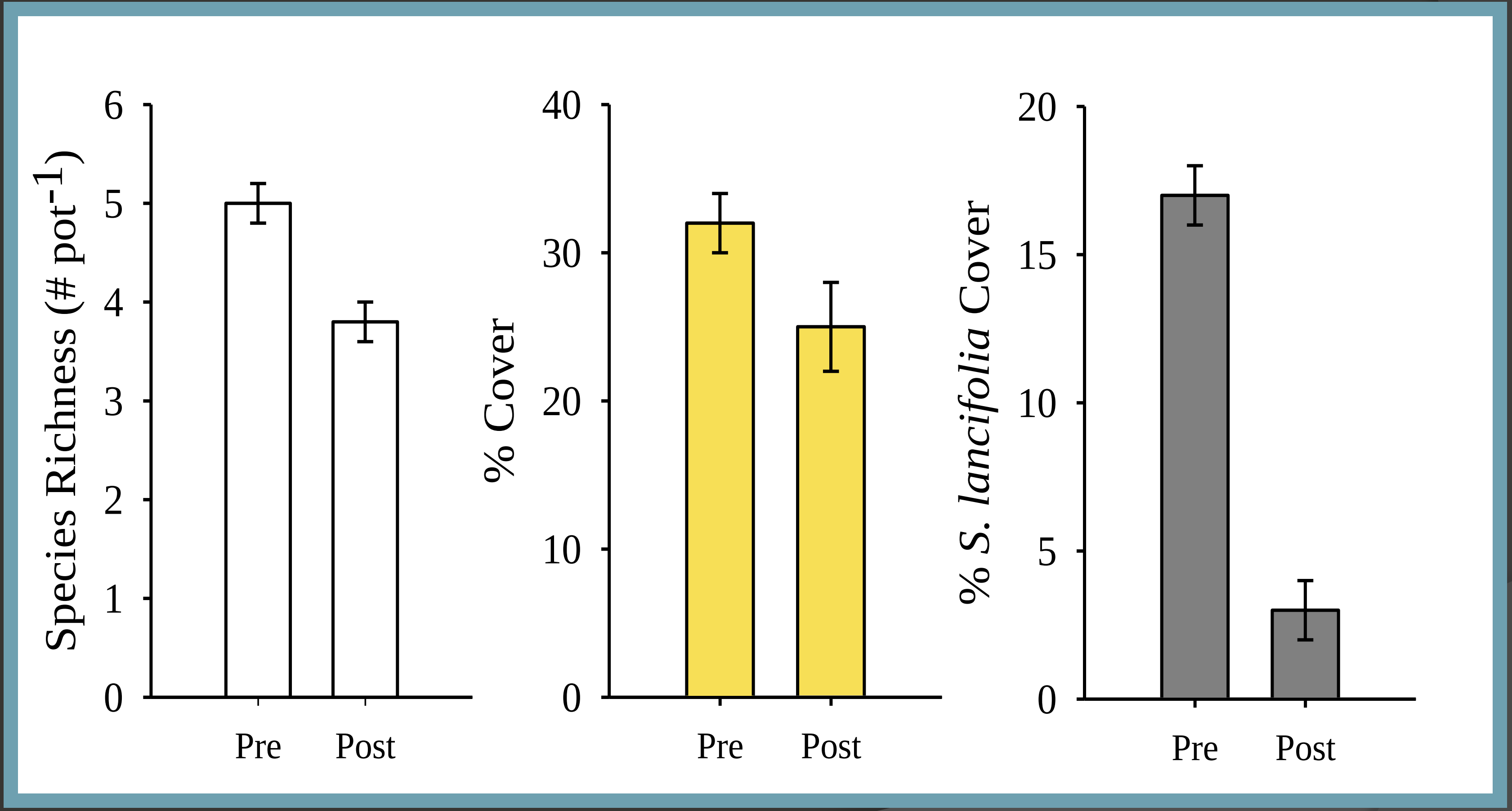
Species richness: number of species per pot

Biomass: end of season aboveground biomass, dried, weighed

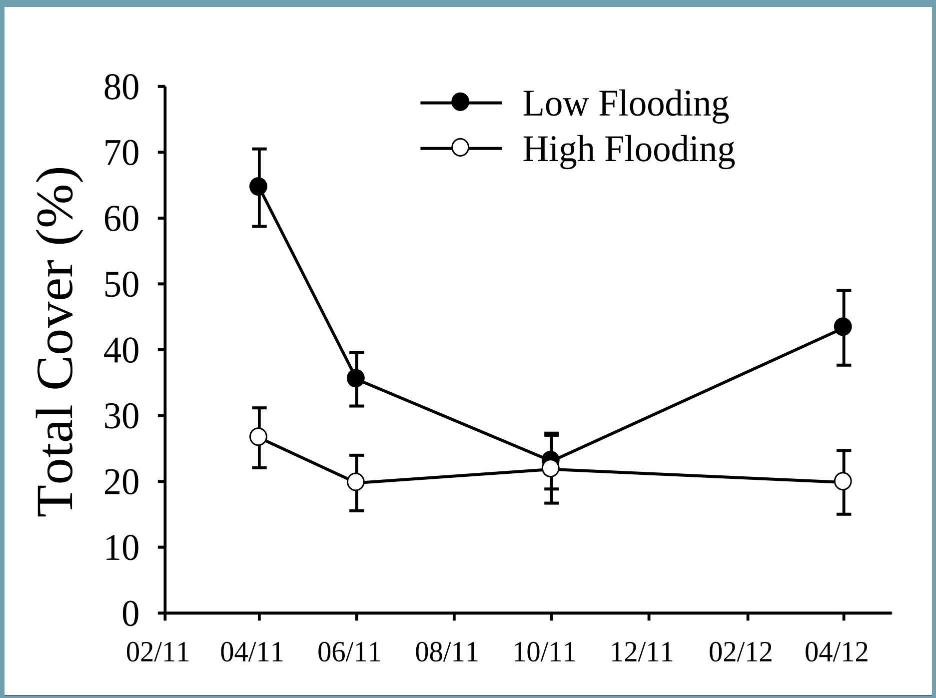
pH, conductivity, H_2S, nutrients: interstial porewater samples, 15 – 20 cm

Eh: Pt – tipped electrode @ 20 cm, calomel reference electrode

Salinity intrusion reduced species richness and plant cover.



High flooding reduced plant cover most of the time. Herbivory reduces cover sometimes.



Flooding (F) $p < 0.01$
Time (T) $p < 0.01$
F x T $p < 0.01$

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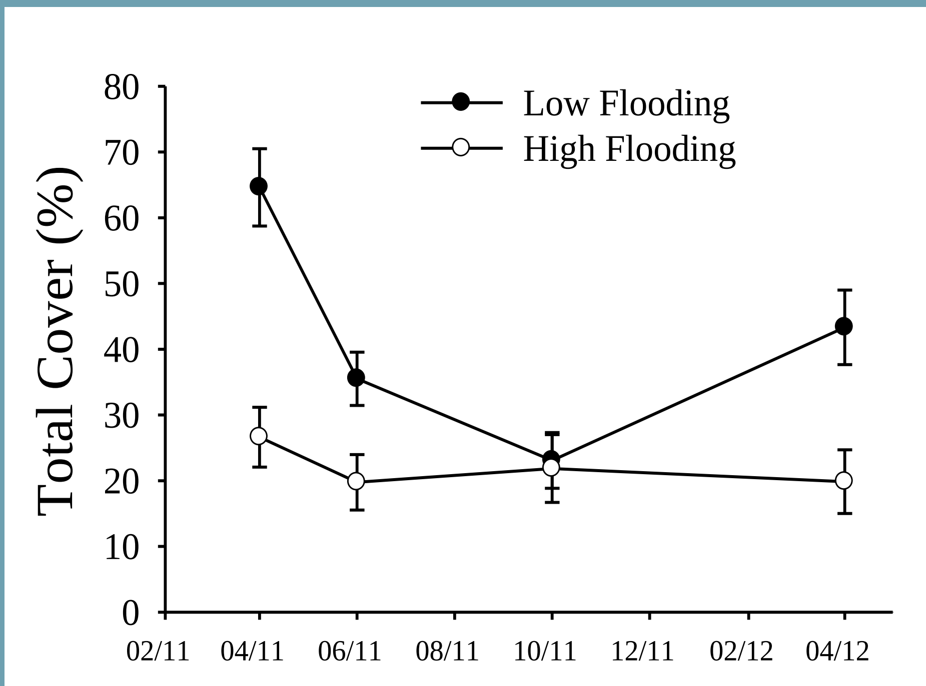
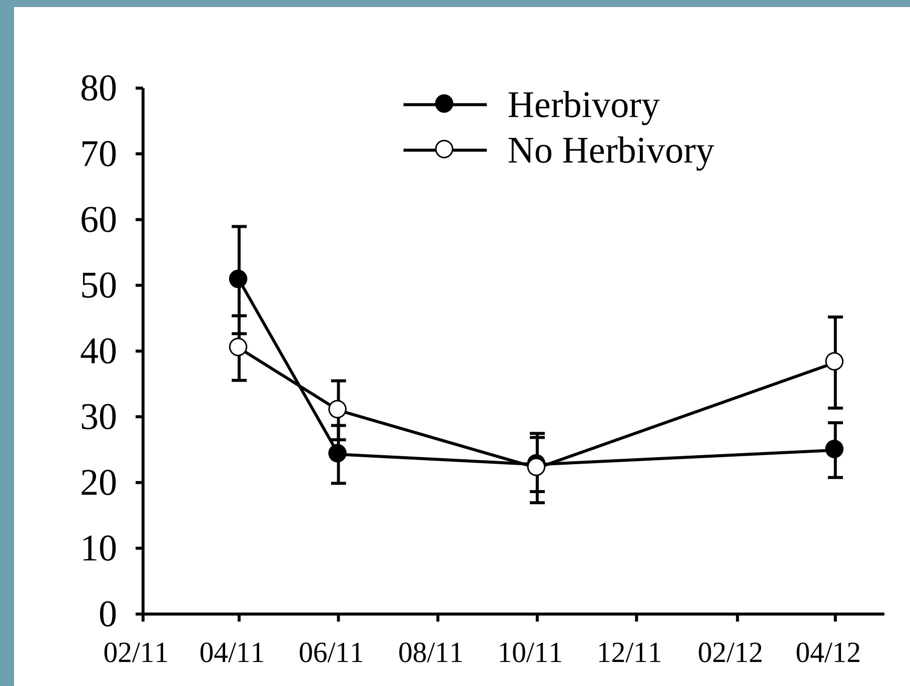
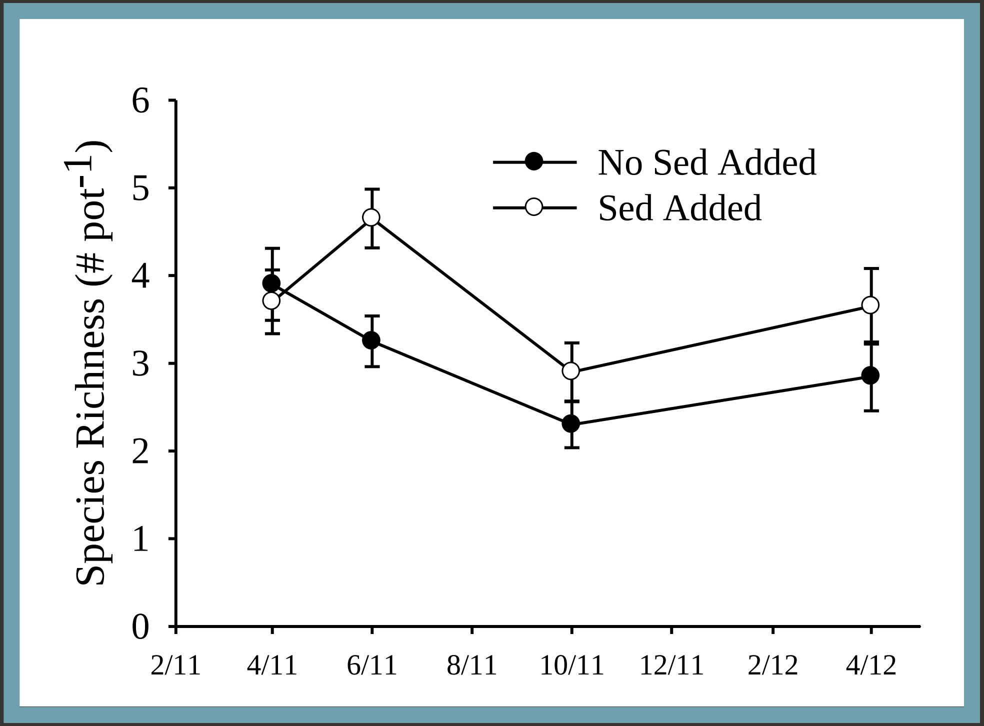




Flooding (F)	$p < 0.01$
Time (T)	$p < 0.01$
F x T	$p < 0.01$

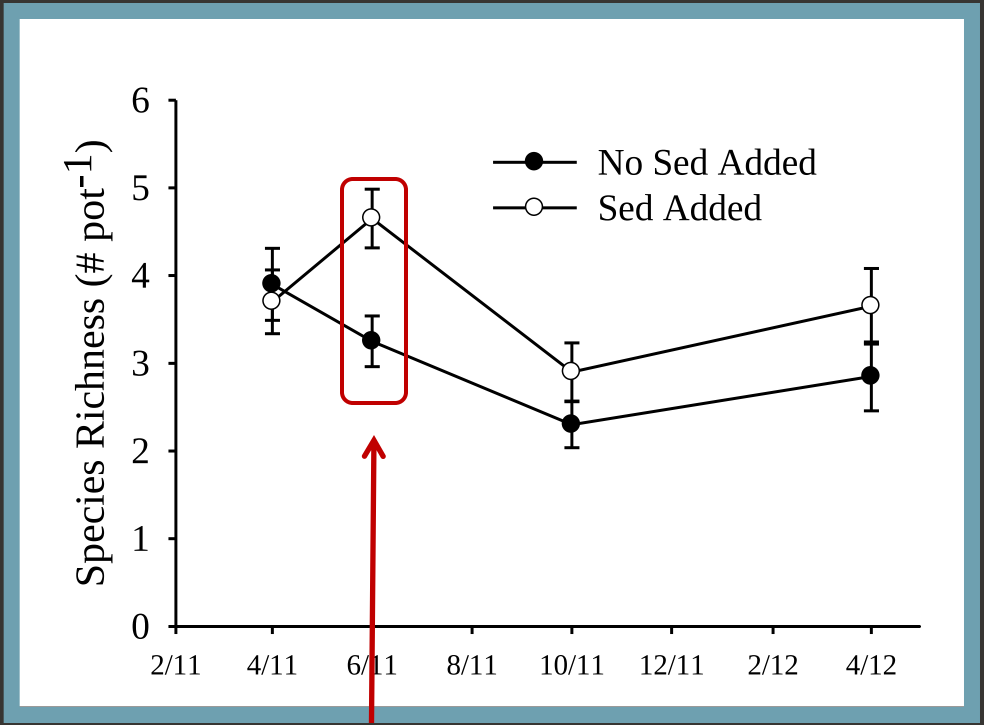
Herbivory (H)	$p = 0.65$
Time (T)	$p < 0.01$
H x T	$p = 0.02$

Adding sediment and lowering flooding elevates species richness.



Sediment (S)	$p = 0.06$
Time (T)	$p < 0.01$
S x T	$p < 0.01$

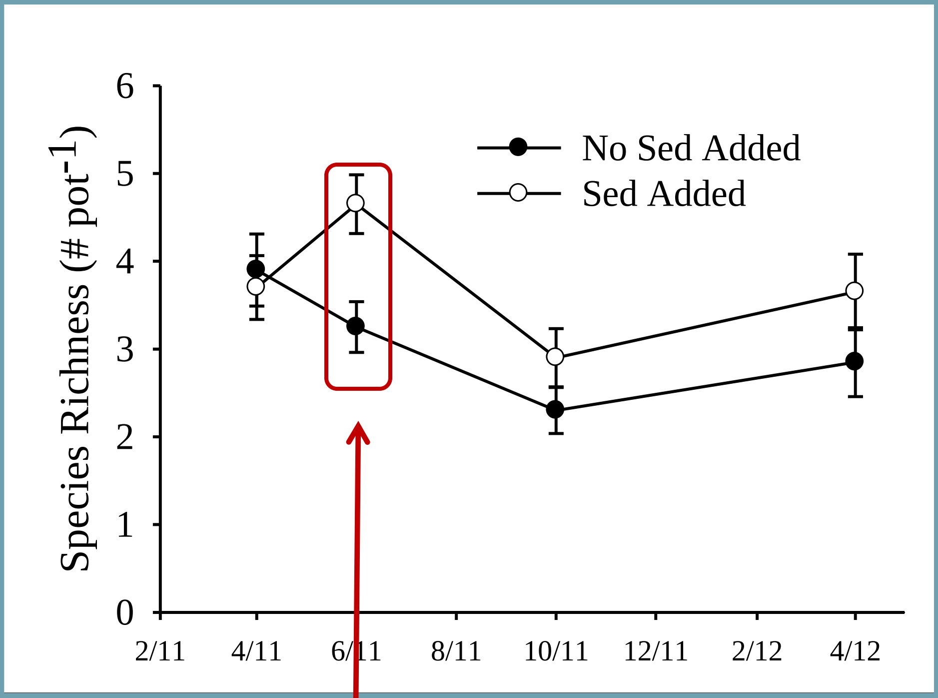
Adding sediment and lowering flooding elevates species richness.

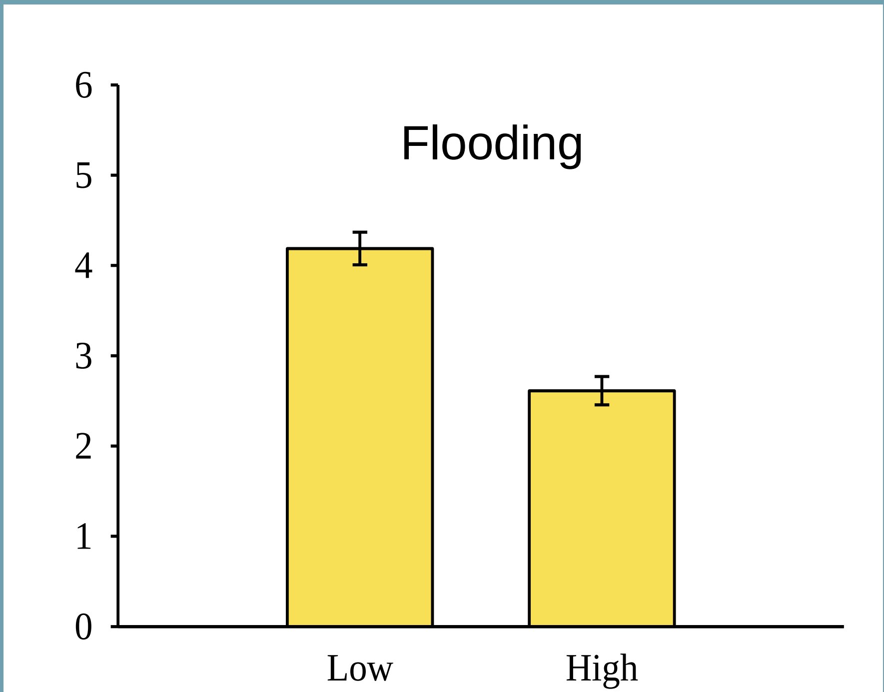


5 species present only if sediment was added

Sediment (S)	$p = 0.06$
Time (T)	$p < 0.01$
S x T	$p < 0.01$

Adding sediment and lowering flooding elevates species richness.





5 species present only if sediment was added

7 species present only if flooding was low

Sediment (S)	$p = 0.06$
Time (T)	$p < 0.01$
S x T	$p < 0.01$

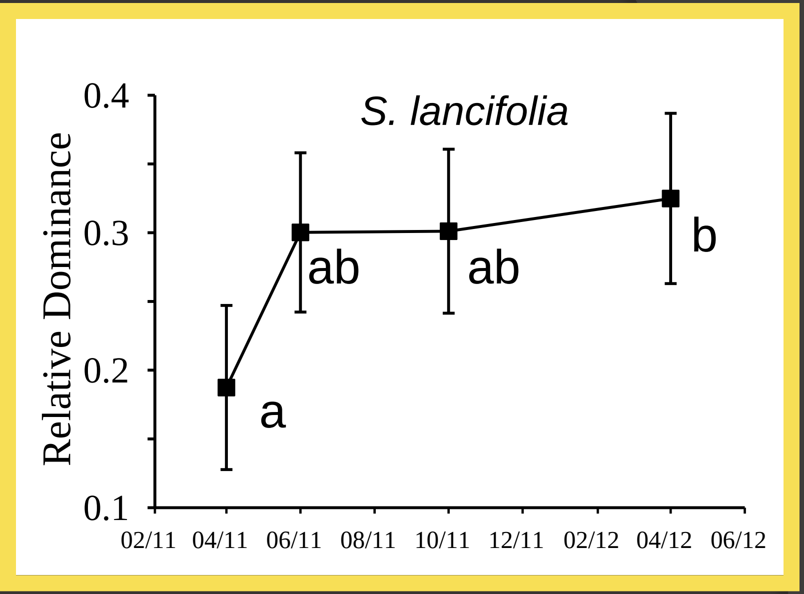
Flooding (F)	$p < 0.0001$
F x T	$p = 0.0610$

MANOVA

T p = 0.029

F x T p = 0.015

S x T p = 0.020

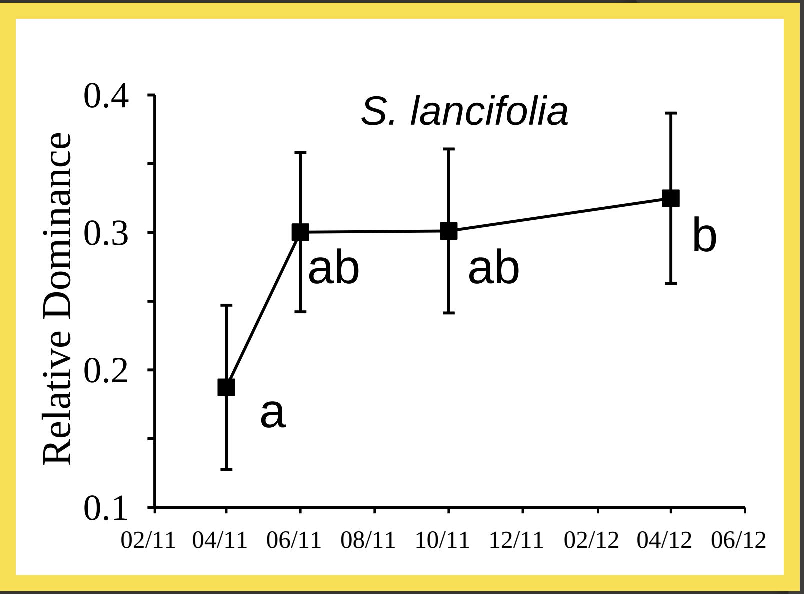


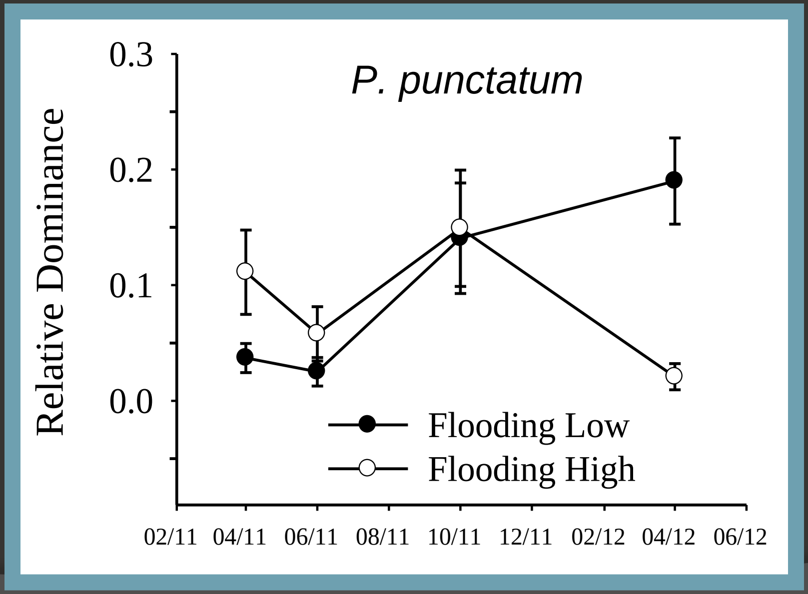
MANOVA

T p = 0.029

F x T p = 0.015

S x T p = 0.020





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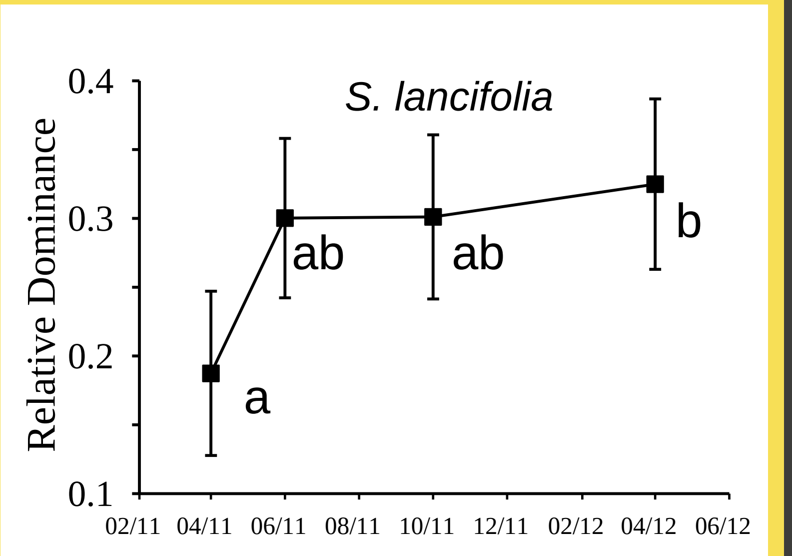
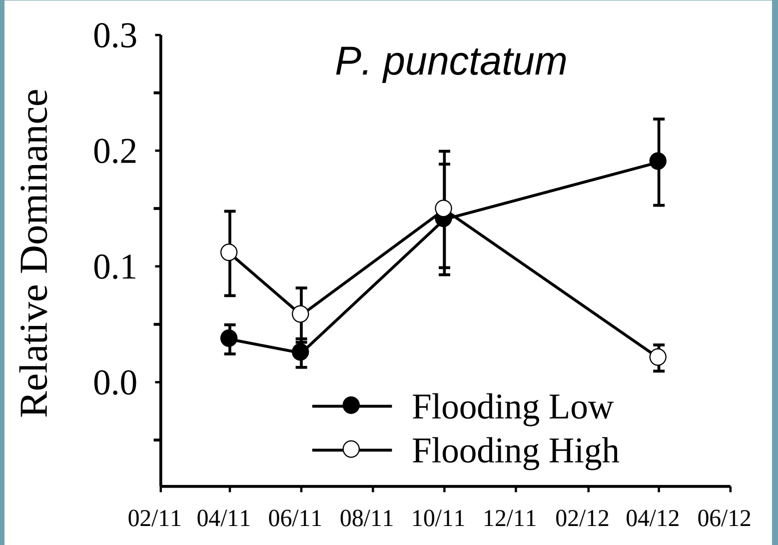
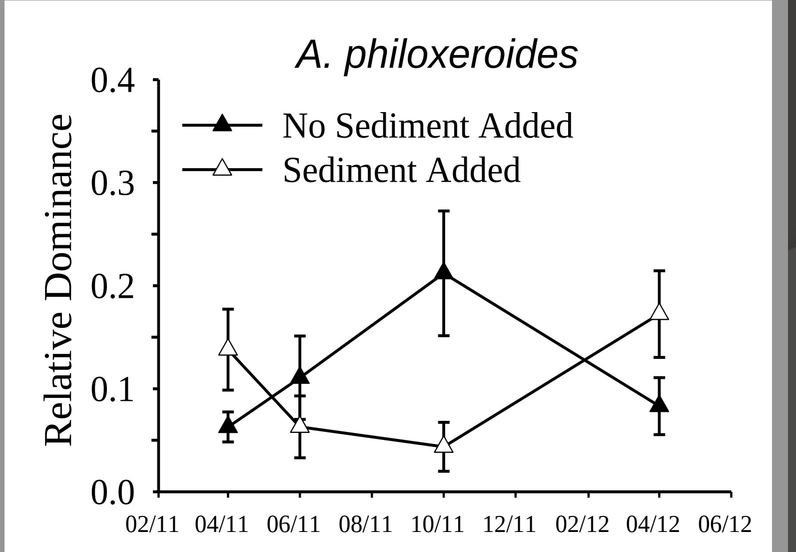
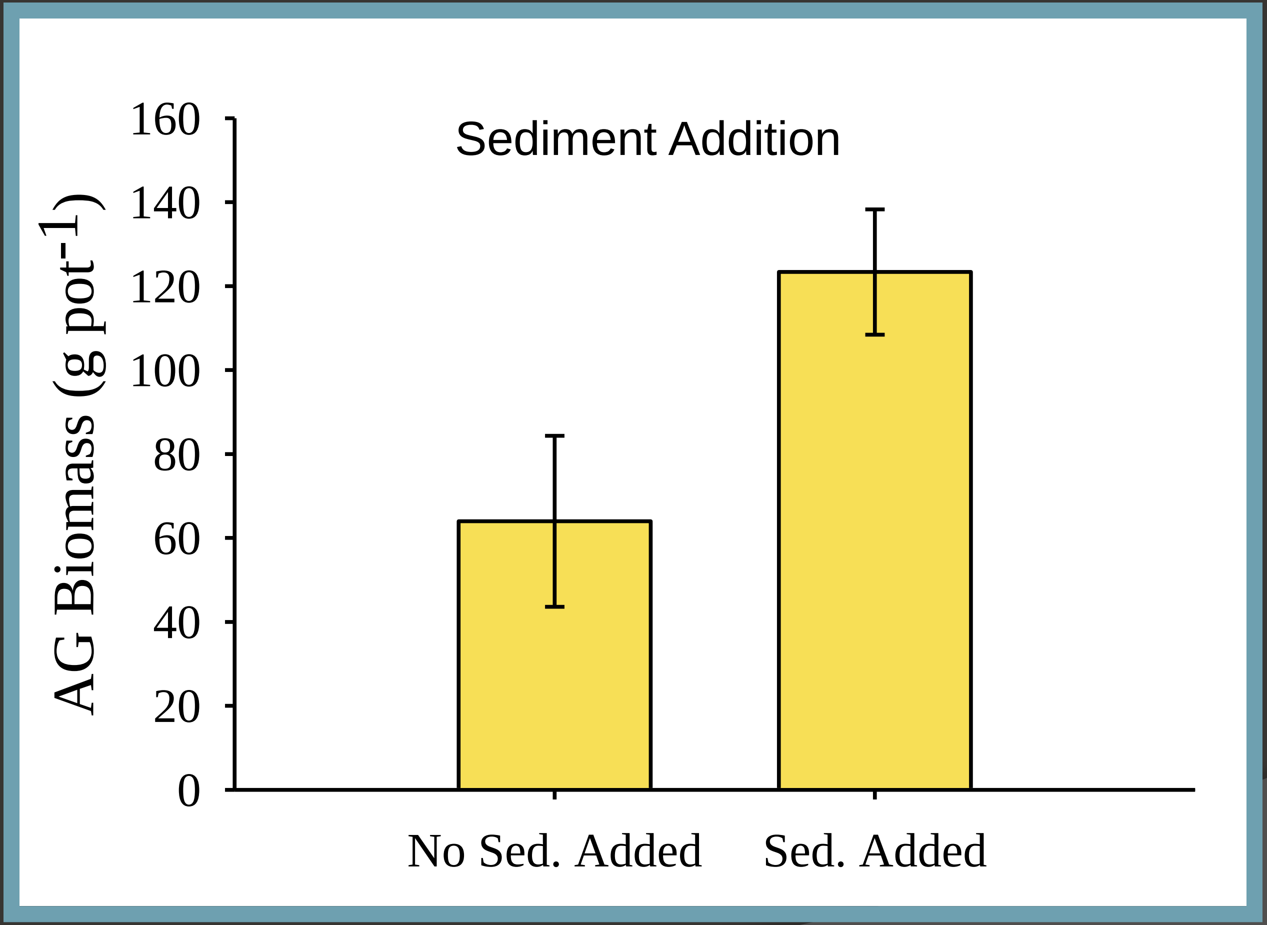


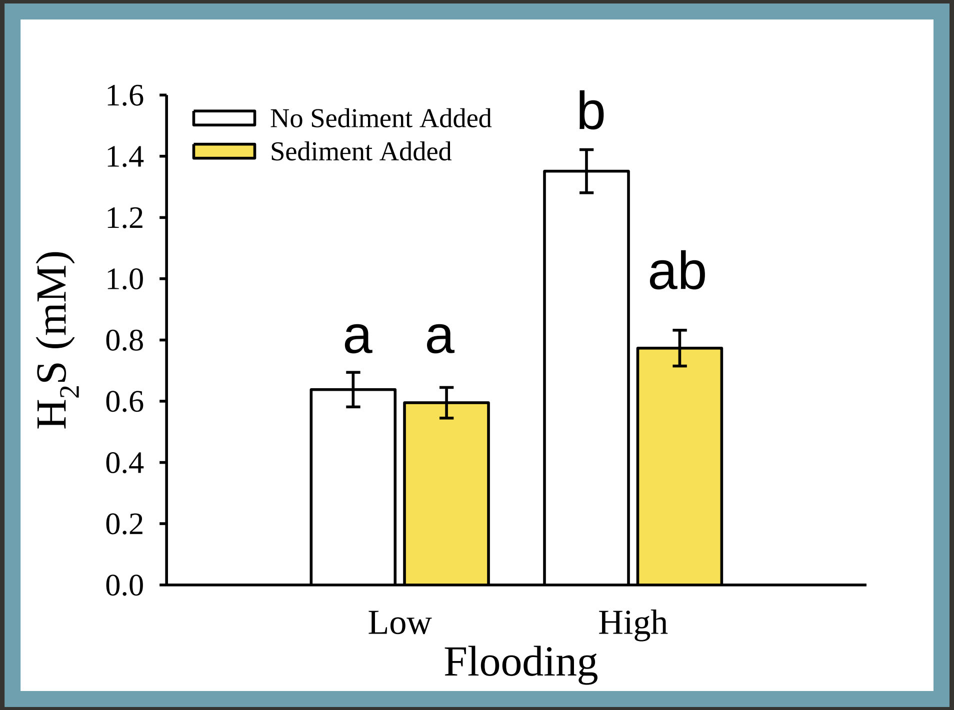




Adding sediment elevates aboveground biomass.



Sediment addition ameliorates the buildup of sulfides under flooded conditions.



Flooding (F)	$p < 0.02$
Sediment (S)	$p > 0.07$
F x S	$p = 0.04$

Flooding affects soil physico-chemical responses.

Flooding (F)	p > 0.66
Time (T)	p < 0.01
F x T	p < 0.01

Flooding (F)	p < 0.01
Time (T)	p < 0.01
F x T	p < 0.01

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Time (T)	p < 0.01
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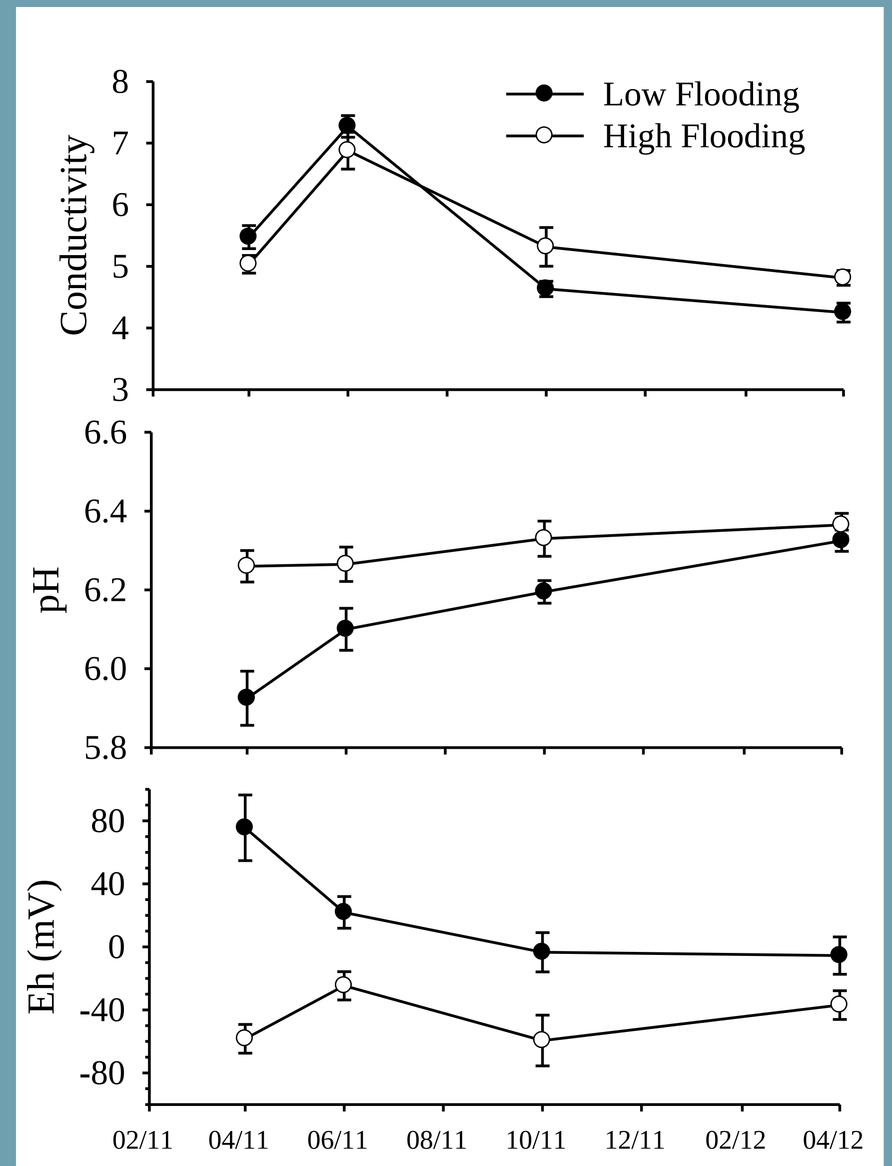
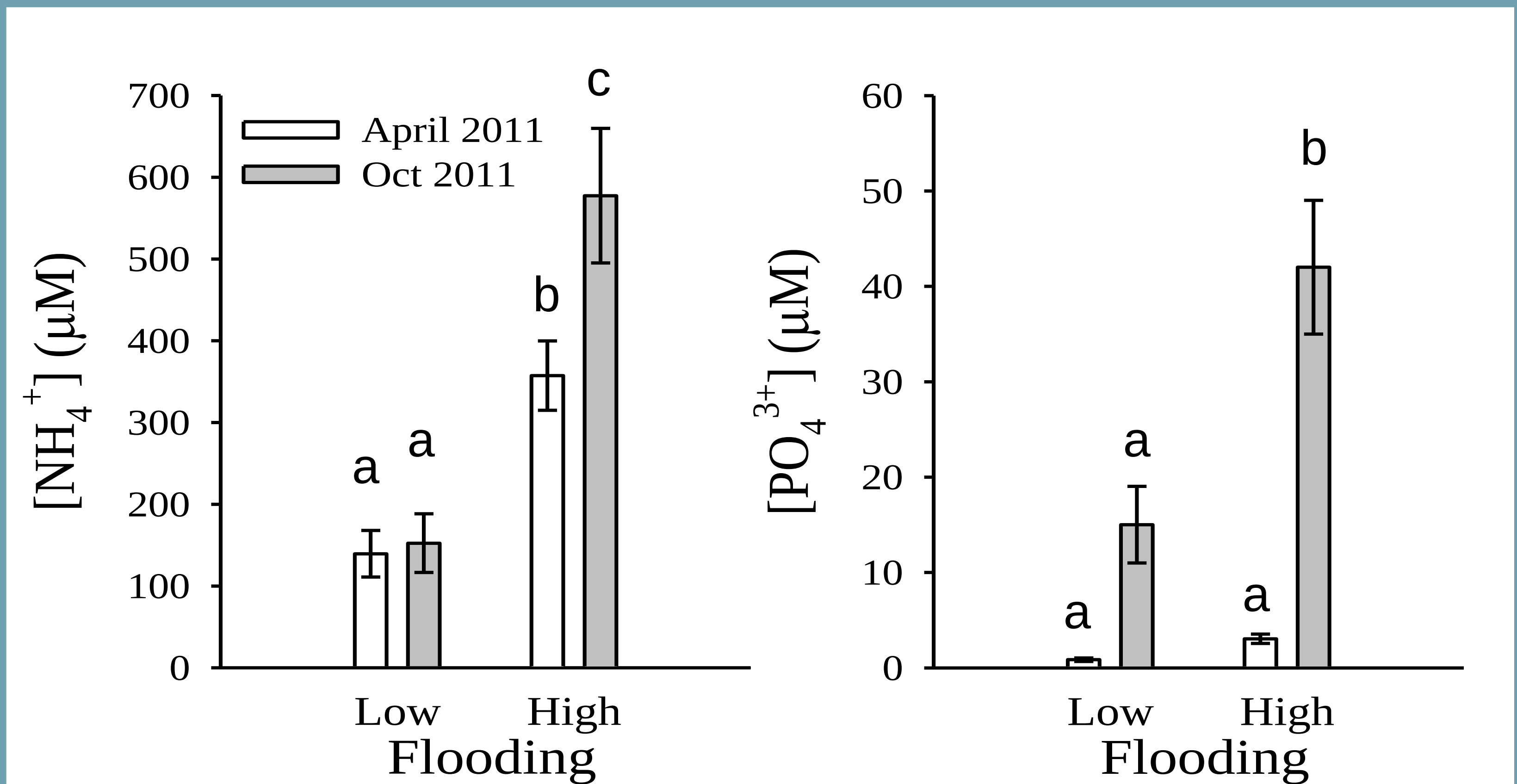
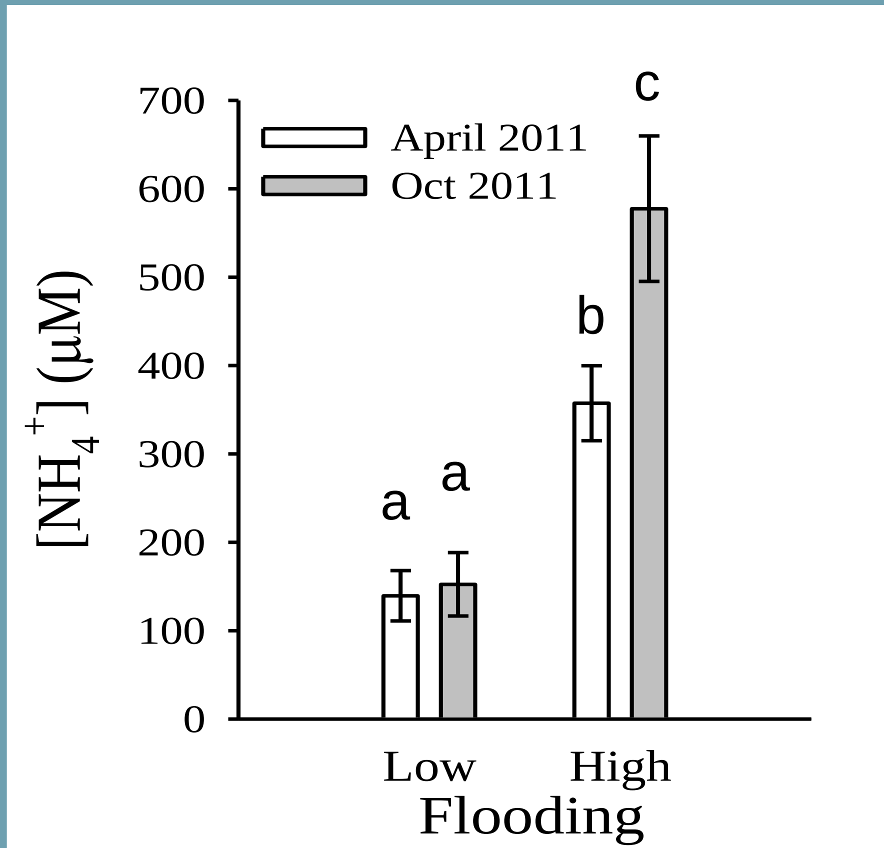
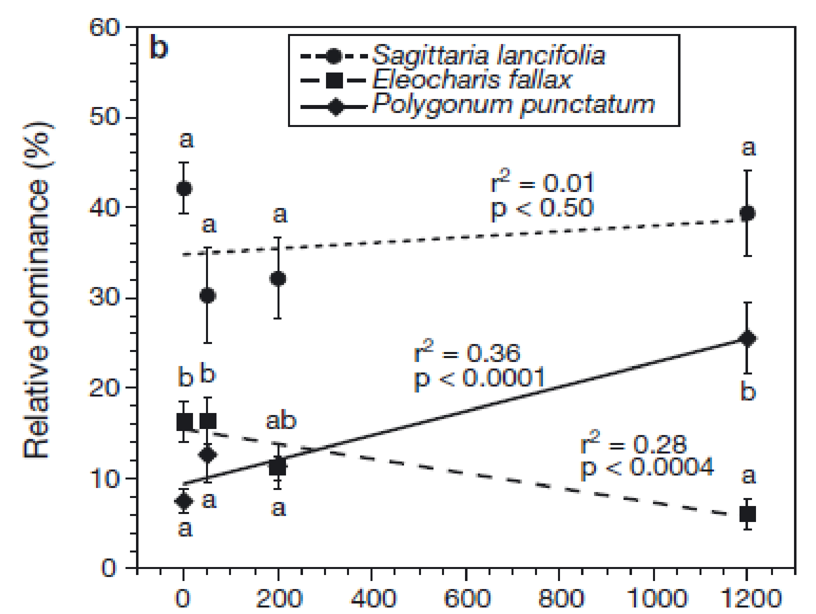


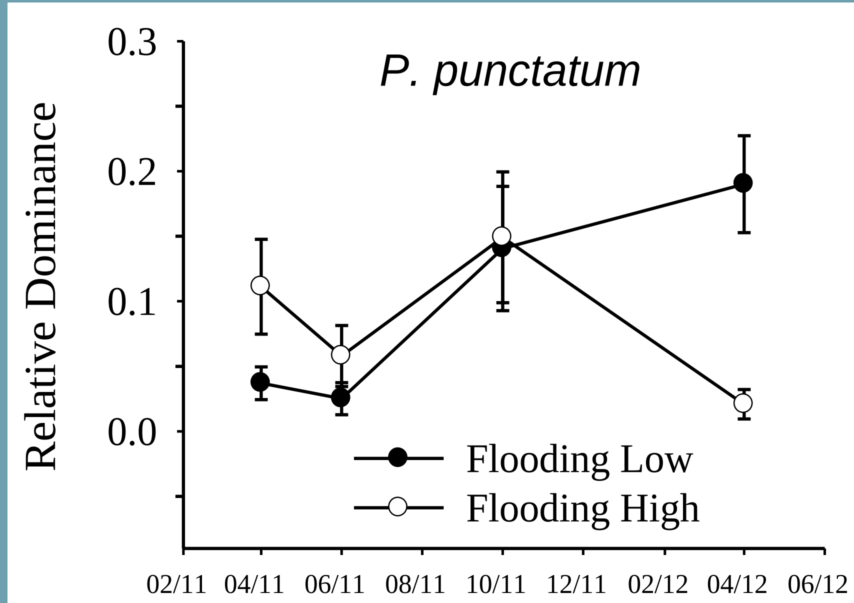
NH_4^+ and PO_4^{3-} were affected by flooding. NO_3^- was not.



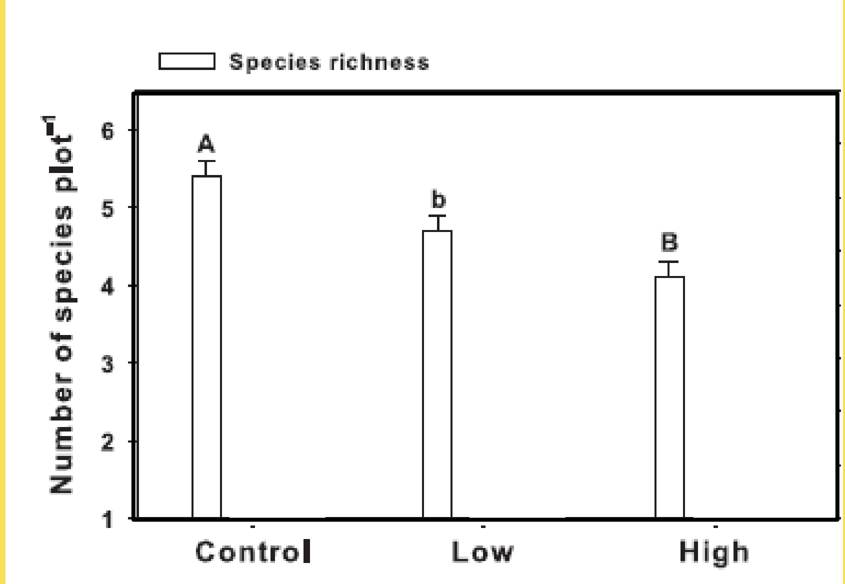
From Graham and Mendelssohn (2010)

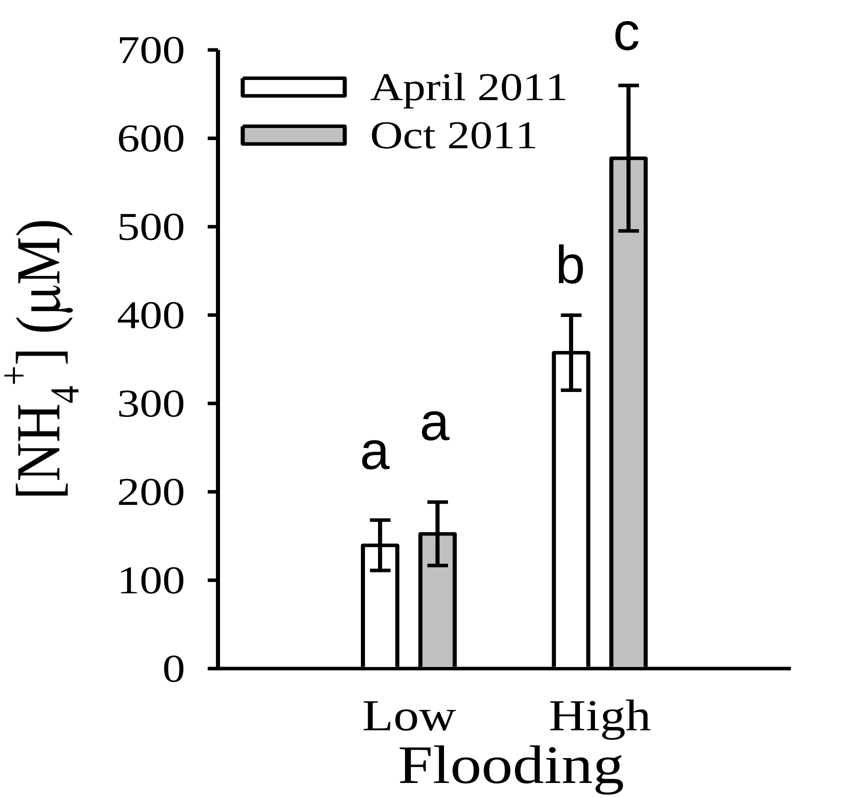


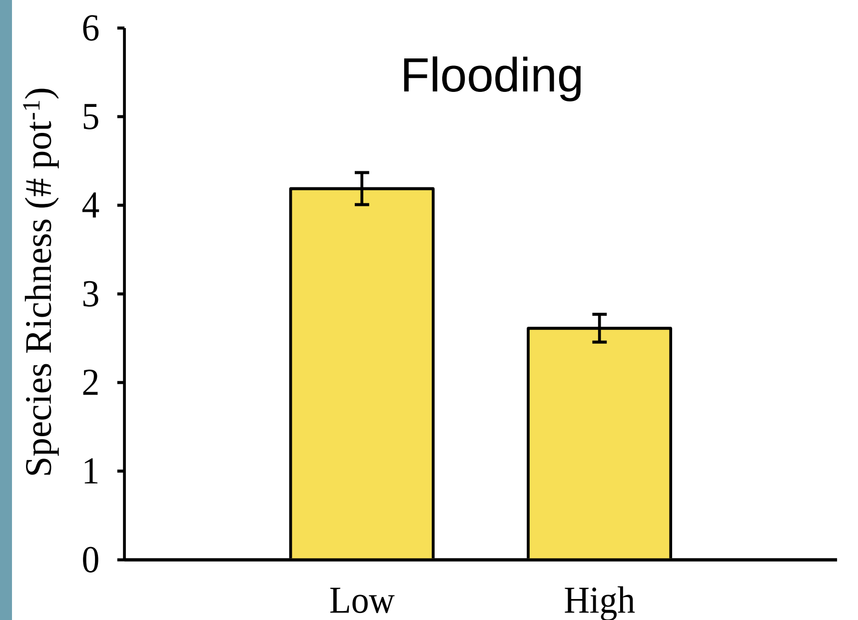




Adapted from Slocum and Mendelssohn (2008)





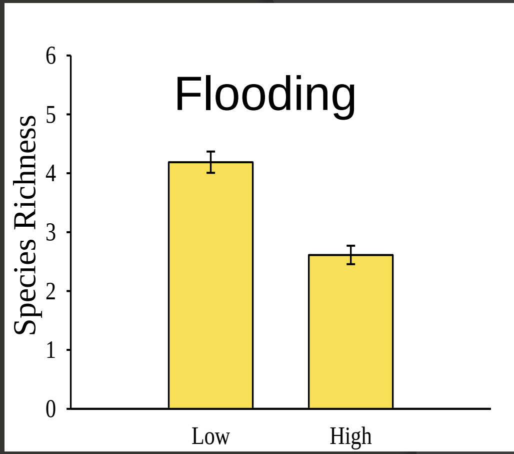


Review of impacts: flooding most important.

	High Flooding	**Herbivory Allowed**	**Sediment Added**
% Cover	**–**	**+**	=
Species Richness	**–**	=	=
Rel. Dominance	**mixed**	=	**mixed**
A.G. Biomass	=	=	**+**
pH	**+**	=	=
Eh	**–**	=	=
Conductivity	**+**	=	=
H_2S	=	=	**–**
NO_3^-	=	=	=
NH_4^+	**+**	=	=
PO_4^{3-}	**+**	=	=

Conclusions

Of the three post-intrusion conditions, flooding was most important.



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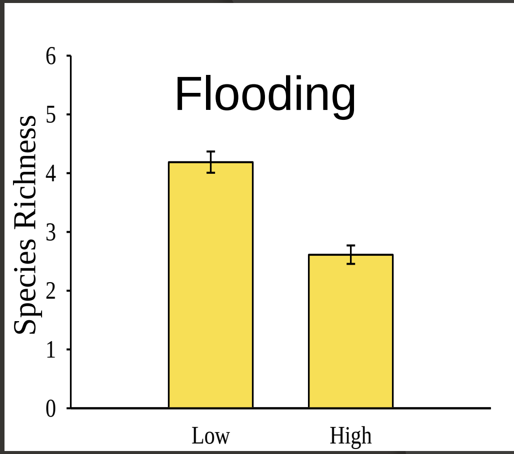

Sediment addition is of secondary importance.

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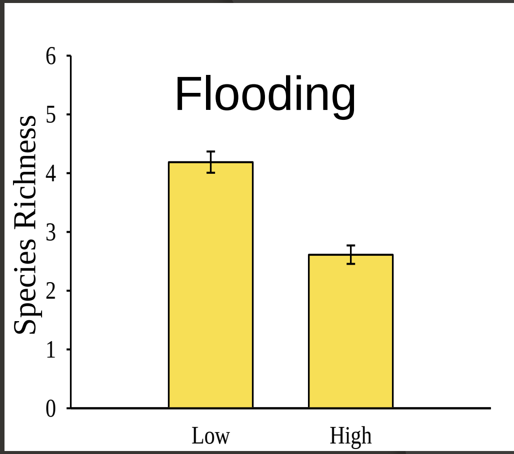

Sediment addition is of secondary importance.

Herbivory may be important.

Implications

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