# Effect of Flooding Shoreline Plants on Water Chemistry

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## Introduction

Background:

- Wetlands are "nature's filter"
- The adaptations that allow wetland plants to thrive under conditions of soil saturation mean that plants are a conduit for gas exchange between the soil and the atmosphere.
- Shoreline plants straddle the terrestrial/ aquatic interface, allowing increase oxygen uptake into plants rhizomes affecting root morphology, as well as soil and water chemistry.

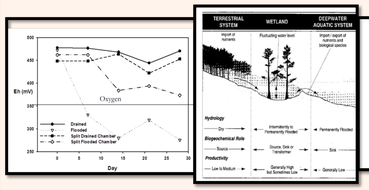


**Fig. 1. Differences in redox in wetland and terrestrial ecosystems.**




**Fig. 2. Effects of wetlands on terrestrial and aquatic systems**

Mitsch & Gosselink 2007

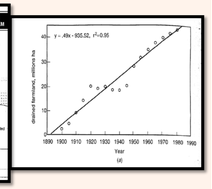


**Fig. 3. Loss of wetlands due to drained farmland.**

Mitsch & Gosselink 2007

Two studies addressing terrestrial/aquatic interface:

Split root rhizotron:

1. Leersia oryzoides- Rice Cutgrass
   - Common in eutrophic man-made ditches,
   - Influences phosphorous levels in water

Pilot Study:

2. Phragmites australis- Common Reed
   - Invasive in US, used for treatment wetlands in Europe
   - Known to transport oxygen via the rhizome

**Fig. 4. Leersia oryzoides.**

**Fig. 5. Phragmites australis.**

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## Materials and methods

Split root rhizotron:

- Leersia oryzoides plants were collected from wetland cells at the Jamie L. Whitten Plant Materials Center (Coffeeville, MS).
- Two individual ramets connected by a single rhizome were planted in coco fiber growing medium.

**Fig. 6. Two individual ramets connected by a rhizome.**

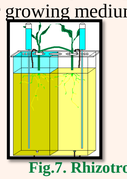

**Fig.7. Rhizotron setup.**

- 7 replicates of each of the 3 systems were set up giving a total of 21 mini rhizotrons.
  - Both ramets flooded
  - Both ramets drained
  - Heterogeneous flooding
- Measurements were taken every week.
  - Soil Redox (Eh)
  - Chlorophyll Content Index
  - Leaf #
  - Stem #
  - Stem length
- The plants were harvested after 5 weeks.
  - Above and below biomass was found by drying in oven for 3 days and weighing each
- Statistical Analysis was done to compare the difference between flooded and drained environments as well as the difference between the homogeneous and heterogeneous split systems.
  - 1-way ANOVA $\alpha$=0.05
- Images were taken of the roots and data analysis was performed using ImageJ.

Pilot Study:

- Phragmites australis rhizomes were collected from Castanea Park, Pa

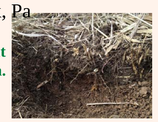

**Fig. 8. Rhizomes at Castanea Park, Pa.**

- The rhizomes were separated, cleaned.
- 15 rhizomes about 20 cm in length were each weighed and their widths were determined
- 5 replicates of each of the 3 systems were set up giving a total of 15 rhizomes.
  - Both ramets flooded
  - Both ramets drained
  - Heterogeneous flooding

## Materials and methods…

In order to setup the system:

- A single hole was drilled into each drained container and a aluminum tray was placed underneath
- A larger hole was drilled out of the middle of the containers to allow room for the rhizome
  - Each rhizome was placed in the hole connecting between the two containers
  - Plumbers putty was used to seal the hole with the rhizome intact
- Peat was used to cover each rhizome and mulch consisted of the top layer to prevent moisture loss
- Each container was given 1 L of water to saturate the rhizome

**Fig. 9. Rhizome setup.**

## Results

Split root rhizotron:

There was no significant differences:

- Chlorophyll Content Index
  3.0 $\pm$ 0.03
- Stem Length
  133.4 $\pm$ 22.6 cm

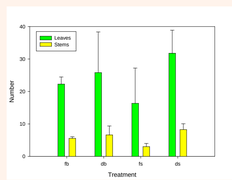


**Fig.10. Number of stems and leaves.**

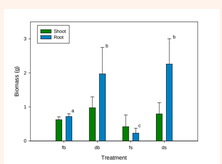


**Fig. 11. Shoot and root biomass.**

- A larger biomass was seen in the roots of the drained system compared with hat of the flooded system
- A slight increase in biomass can be seen in the split drained system indicating that the individual ramets had a positive affect on one another in that split system.

## Results …

Root morphology:

- The drained rhizomes showed less complexity than that of the flooded root morphology

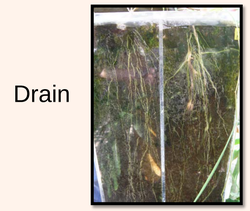


**Fig.12. Root morphology of the drained and flooded rhizotron.**

**Fig.13. Root morphology of a flooded system in the beginning.**

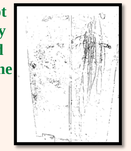

**Fig.14. Root morphology of a flooded system towards the end.**

- The root morphology increased with time.

## Future

- The plumbers putty did not create an adequate seal and caused the flooded systems to leak.
- To prevent this a flexible foam rubber was purchased and will be used to better seal the leak
- This will give data on the flooded systems that can then be compared to the drained systems as well as the Split root rhizotron.

## Literature cited

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