Controlling Saltwater Intrusion: Aiding the Recovery of Freshwater Ecosystems

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Purpose

The purpose of this study is to assess whether the installation of a water control structure affects the growth of forest wetland tree species in damaged freshwater ecosystems.

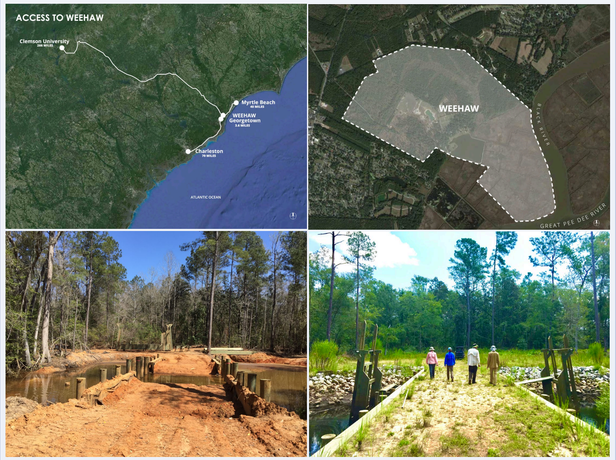
Background

Saltwater Intrusion

As sea levels rise, saltwater is pushed upstream and into freshwater ecosystems unequipped for high salinity levels. Water control structures present a management strategy that could prevent salinity intrusion and reduce mortality in freshwater forest species.

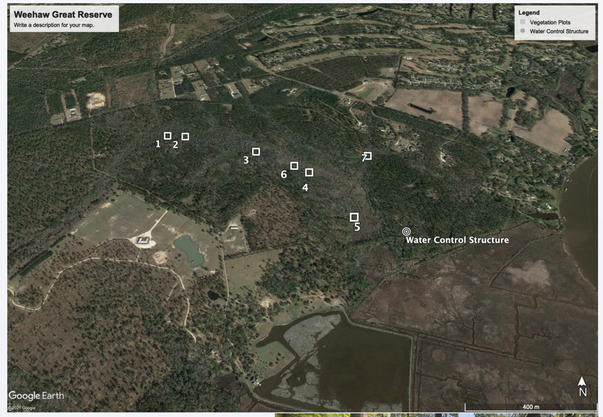
The Great Reserve

The Great Reserve, located outside of Georgetown, SC, represents a freshwater forested wetland affected by saltwater intrusion from the adjacent Black River. The installation of a water control structure in 2016 and its reinstallation in 2018 provided this project the opportunity to study how a water control structure mitigates saltwater intrusion and affects the growth of forest tree species, specifically bald cypress.



Methods

- Seven 25 m x 50 m forested plots were established in the Great Reserve.
- Trees greater than 10 cm diameter at breast height (DBH) within each plot were tagged, counted, and measured with a DBH tape.
- Yearly growth rates were calculated based on the incremental changes in DBH.



Results

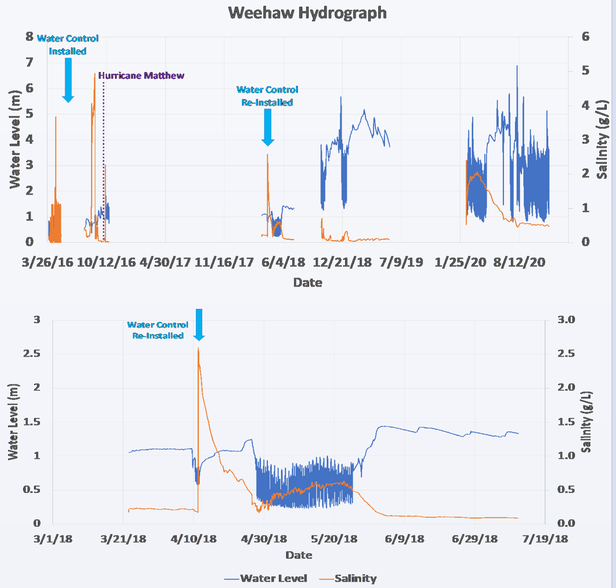


Figure 1: Hydrograph of water level (blue line) and salinity (orange line) in the Great Reserve. The top graph shows all hydrograph data. The bottom graph is the section around the date of the water control structure reinstallation.

Table 1: Total number of all tree species, average increment growth based on DBH of cypress and all trees in each vegetation plot. Plots are ordered from closest to the outflow upstream to the plot furthest from the outflow. (See map)

Plot number	Total number of tree species	Average increment growth Cypress 2017 to 2019 (cm/yr)	Average increment growth Cypress 2019 to 2020 (cm/yr)	Total average increment growth 2017 to 2019 (cm/yr)	Total average increment growth 2019 to 2020 (cm/yr)
5	1	0.09	0.26	0.09	0.26
7	3	0.20	0.35	0.19	0.32
4	1	0.21	0.23	0.21	0.23
6	3	0.41	0.49	0.38	0.44
3	4	0.29	0.31	0.25	0.27
2	3	0.23	0.46	0.15	0.31
1	5	0.27	0.66	0.21	0.65

Conclusions

- Fewer tree species and more standing dead trees closer to the water control structure illustrates the impact of salinity on the Great Reserve (Table 1)
- The increase in cypress growth rates after the installation of the water control structure is likely due to a reduction of salinity entering during the tidal cycle (Figure 1).
  - This indicates the potential recovery of these freshwater ecosystems, but more time and data is needed to determine whether the construction of water control structures should be promoted to other private landowners for the widespread conservation of freshwater wetlands.
- Strawberry Swamp, a nearby freshwater forested wetland affected by saltwater intrusion without a water control structure, is a key point of comparison. Its saline plots had significantly lower average growth rates compared to those in the Great Reserve, indicating that a water control structure enhances the growth of freshwater wetland trees affected by saltwater intrusion.

Next Steps

- Continue monitoring and collecting data.
- Determine whether water control structures should be recommended to other landowners to preserve fresh water forested wetland ecosystems.
- In-depth comparisons to other sites with and without water control structures (like Strawberry Strawberry).
- Study effects of salinity and water control structures on understory vegetation and their implications for salt-tolerant invasive species.
- Graduate high school!

Acknowledgements

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