

Experimental Wetlaculture (Wetlands + Agriculture) Mesocosm Compound Established in Naples, Florida, to Restore Wetlands, Solve Harmful Algal Blooms, and Develop Sustainable Agriculture

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We have been using ecological engineering principles to design and construct experimental mesocosm systems in Ohio, Florida and elsewhere for the past 2 years to investigate a new landscape-scale approach to integrate created or restored wetland retention of nutrients from agricultural and urban stormwater with a more sustainable agriculture. We refer to our proposed system as “wetlaculture” because it integrates wetlands and agriculture (see our Barley Prize video for a description of the wetlaculture concept at: <http://www.barleyprize.com/#/venture/0a430af4-1d11-79e4-659e-e68f05aef4ac>).

On May 3, 2018 we planted a newly constructed 28-mesocosm compound at Freedom Park (Figure 1) in Naples Florida with sawgrass (*Cladium jamaicense*). This represents the third mesocosm compound designed and created by our Everglades Wetlands Research Park scientists and the first one constructed in Florida (<https://www.naplesnews.com/story/news/environment/2018/05/04/fgcu-wetlands-researcher-starts-experiment-colliers-freedom-park/577229002/> and <http://www.winknews.com/2018/05/07/fgcu-scientists-studying-ways-to-combat-algae-growth-in-swfl-waterways/>). The research is aimed at providing insight into using wetland creation and restoration to help reduce nutrient loading in the Everglades and Florida waterways while eventually recycling the nutrients back to agriculture.

The other two mesocosm compounds are in Ohio. Buckeye Lake mesocosms (central Ohio; Figure 2) were constructed in 2016-17 adjacent to hyper-eutrophic Buckeye Lake. Defiance mesocosms (Figure 3) were constructed in 2017-18 upstream of the Maumee River in the former Black Swamp that now directs drainage-ditch phosphorus pollution into western Lake Erie (<http://www.dispatch.com/news/20170731/project-tests-whether-wetlands-can-reduce-buckeye-lake-algae>, <http://www.dispatch.com/news/20171002/could-restoring-swampland-fix-lake-erie-algae-crisis>, and <http://www.toledoblade.com/local/2017/09/22/Restoration-of-historic-Great-Black-Swamp-could-help-save-Lake-Erie.html>). This research may help

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FIGURE 1. Wetlaculture mesocosm compound, Freedom Park, Naples, Florida planted with sawgrass (*Cladium jamaicense*) in May 2018; experiment starts in June 2018. photo by L. Zhang.



FIGURE 2. Wetlaculture mesocosm compound, Buckeye Lake, Ohio planted with bulrush (*Schoenoplectus tabernaemontani*) in October 2016; experiment started April 2017. photo by L. Zhang.



plan restoration activities in the former Great Black Swamp that once covered a million acres in northwestern Ohio (https://en.wikipedia.org/wiki/Great_Black_Swamp) while reducing phosphorus pollution flowing into Lake Erie.

Our long-term research plan involves the development of interlinking physical, mathematical, and business models to optimize design parameters for wetlaculture in different climates, soils, landscapes and waterscapes. First, wetlaculture utilizes wetlands to reduce nutrient fluxes from agriculture and cities that otherwise would go directly into lakes, rivers, and estuaries. The second aspect of wetlaculture is what distinguishes it from a typical linear combination of agriculture and treatment wetlands. In wetlaculture, the wetland, in x number of years, would be “flipped” back to an agricultural field, with the idea that the food-production crop would grow well without applying any additional fertilizers over those that accumulated over those “x” years by the wetlands. Then after “y” years, the agricultural field would be “flipped” back to being a wetland. Our physical (mesocosms) and mathematical models will enable to understand what those “x” and “y” years are for different climates, soils, and nutrient loading rates.

Our mesocosm research program continues to be supported by a variety of individuals, NGOs, public agencies, and corporations in Florida and Ohio including Collier County (Naples, FL), the Judy Sproul Endowment for Habitat Restoration at the Naples Botanical Garden (Naples, FL), the College of Arts & Sciences, FGCU (Ft. Myers, FL), Buckeye Lake for Tomorrow (Buckeye Lake, OH), Dr. Doug Pooman (Buckeye Lake, Ohio), Steiner and Associates (Columbus, OH), the South Central Power Company (Lancaster, OH), the Lenhart Family (Defiance, Ohio), and Stream and Wetlands Foundation (Lancaster, OH). ■

REFERENCES

Mitsch, W.J. 2017. Solving Lake Erie’s harmful algal blooms by restoring the Great Black Swamp in Ohio. *Ecological Engineering* 108: 406-413.

Mitsch, W.J. 2017. Solving harmful algal blooms: Progress in 2016-2017 at a wetlaculture experiment at Buckeye Lake, Ohio. *Ohio Wetland Association Wetland Trumpeter Newsletter*, September 2017. pp. 8-9, 11.

FIGURE 3. Wetlaculture mesocosm compound, Defiance, Ohio (near Lake Erie) planted with bulrush (*Schoenoplectus tabernaemontani*) in October 2017; experiment started March 2018. photo by W.J. Mitsch



Support Wetland Ambassadors

The Wetland Ambassadors are kicking off a crowdfunding campaign through CrowdRise to provide supplemental funds for their Wetland Ambassadors. SWS provides \$5000 to each ambassador to complete visiting research fellowships under the guidance of some fantastic wetland scientists. However, they would like to raise supplemental funds to ensure the students are not spending any money out of pocket. Please consider donating any amount on our campaign page (<https://www.crowdrise.com/o/en/campaign/support-for-the-2018-wetland-ambassadors>).

To learn more about our Ambassadors, please either visit the campaign page, or the Wetland Ambassadors program page (<http://www.sws.org/Awards-and-Grants/wetland-ambassadors-graduate-research-fellowship.html>). ■