Presentation Outline

• Harmful Algal Blooms in the World
• Wetland LossES in the World
• My Thesis on Reversing World’s Wetland Losses
• Three Examples of Actual or Proposed Wetland Restoration/Creation to Solve Harmful Algal Blooms
• Wetlaculture
• Conclusions
More than 750 aquatic ecosystems worldwide currently suffer from degraded conditions due to urban and agricultural inflows that cause water quality degradation—often referred to as hypoxic or harmful algal blooms due to nitrogen and phosphorus.

Source: World Resource Institute
Recent estimates of global wetland losses

1. The Economics of Ecosystems & Biodiversity (TEEB) study (Russi et al. 2013) suggested that the world lost half of its wetlands in the twentieth century alone.

2. Davidson (2014), in a meta-analysis determined that the world lost 53.5 percent of its wetlands “long-term” (i.e., multi-century). with higher loss rates in inland vs. coastal wetlands.

3. 87% of world’s wetlands have been lost globally in the last 300 years (Assessment Report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, 2018)

Source: Mitsch and Gosselink, 2015
There are many opportunities to “ecologically engineer” a reversal the global loss of wetlands and at the same time mitigate, in a sustainable way, some of the most alarming pollution problems on our landscapes related to phosphorus and nitrogen (and carbon).
An unseasonable amount of precipitation (>30 cm) fell on south Florida in the “dry season” in January 2016 due to extensive frontal storms caused by El Nino.

Approximately 3.1 billion m³ of polluted Lake Okeechobee (Lake O) water was sent down the Caloosahatchee River to the Gulf of Mexico and the St. Lucie Canal to the Atlantic Ocean in 2016, severely polluting both estuaries.

The pumping of water to these outlets was deemed necessary because of high and unsafe Lake Okeechobee water levels, which were, in turn, due to the high rainfall events in January and back-pumping of even more water from flooded farmlands south of Lake O.
Florida governor declares state of emergency over 'guacamole-thick' algae

Published June 30, 2016   FoxNews.com
Look George, you can see the corrupt & immoral environmental policies from here!
Flow south to the Everglades from Lake Okeechobee will increase by 76% from 210,000 to 370,000 acre-ft/yr. A 240,000 acre-foot reservoir (23 feet deep and 10,100 acres) and 6,550 additional acres of treatment wetlands (13% increase) are proposed. (FL Dept of Environmental Protection letter of support to SFWMD, March 5, 2018).
"Nutrient impairment continues to plague Lake Erie, impacting an $11.5 billion tourism industry"
Ohio Lake Erie Phosphorus Task Force (Nov 2013)

Satellite Image from Sept 3, 2011 of Western Lake Erie (Michalak et al. 2013) PNAS
The original **Black Swamp** was combination of marshland and forested swamps that extended about 160 km long and 40 km wide in a northeasterly direction from Indiana toward Lake Erie and covered an estimated 400,000 ha. It has been completely drained.
Learning to Love the Great Black Swamp
Midwestern settlers worked for generations to tame the wicked swamplands west of Lake Erie. Can they be convinced to give some back?

https://undark.org/
Let’s Make the Black Swamp Great Again!

Goll Woods—Remnant of Great Black Swamp
Mississippi-Ohio-Missouri (MOM) Basin Restoration
Area of Gulf of Mexico Hypoxia, 1985-2015

Record size Hypoxia in July 2017 22,700 km²

Data source: Nancy N. Rabalais, LUMCON, and R. Eugene Turner, LSU
Funding sources: NOAA Center for Sponsored Coastal Ocean Research and U.S. EPA Gulf of Mexico Program
We estimated that 2 million ha of these ecosystems are needed.
Our new landscape research initiative

“Wetlaculture”

= wetlands + agriculture
Buckeye Lake, central Ohio
Wetlaculture mesocosm compound
Buckeye Lake, central Ohio
Constructed 2016-17
Wetlaculture mesocosm compound
Buckeye Lake, central Ohio

The bar graph shows the percent removal of Total Phosphorus and Total Nitrogen under high flow and low flow conditions. The removal percentage for Total Phosphorus under high flow is approximately 40%, while under low flow it is around 20%. For Total Nitrogen, the removal percentage for high flow is close to 40%, and for low flow it is slightly higher, nearing 45%.
Most of P load comes from the Maumee River Basin

Source: Scavia et al (2017)
Drainage ditch in Black Swamp region, Defiance Ohio
Freedom Park Wetlaculture Mesocosm Design, Naples, Florida
Freedom Park Wetlaculture Mesocosm Design, Naples, Florida
Scientist’s idea to save Lake Erie: Bring back Great Black Swamp

By M. HENRY

HANCE — Now is the time to save Lake Erie, many environmental organizations have been saying for years. A recent report by the Great Black Swamp Conservancy suggests that a return of the Great Black Swamp to its natural state could help reduce nutrient levels and improve water quality in Lake Erie. The conservancy is calling for a return to the “Black Swamp,” a wetland that once covered 3% of Ohio’s land area.

Great Black Swamp

The Great Black Swamp was 490,000 acres in size and was a significant part of the wetlands that helped to filter nutrients out of the Ohio River basin and into Lake Erie. The wetland was home to a diverse array of plant and animal life, including many species that are now endangered or threatened.

Looking at strategies

The conservancy has proposed a plan to restore the Great Black Swamp to its natural state. This plan includes the creation of new wetlands, the restoration of existing wetlands, and the protection of remaining wetlands. The conservancy is calling for the establishment of a Great Black Swamp Restoration Trust to fund the restoration efforts.

On the ground

The restoration of the Great Black Swamp would not be an easy task. However, the conservancy believes that it is worth the effort. The restoration of the Great Black Swamp would not only be beneficial for the environment, but it would also have economic benefits. The conservancy estimates that the restoration of the Great Black Swamp would create thousands of jobs and generate millions of dollars in economic activity.

Bill Merch, the executive director of the Great Black Swamp Conservancy, believes that the restoration of the Great Black Swamp is a necessary step in the preservation of Lake Erie. "The Great Black Swamp is a critical part of the Lake Erie ecosystem," said Merch. "We must take action now to restore the Great Black Swamp if we want to protect Lake Erie for future generations."
Editorial

Wednesday October 4, 2017
Posted at 12:01 AM Updated at 6:15 AM

Wetlands could fix pollution from farms
Persuading farmers to set aside productive land and restore it to swamp conditions will be an uphill slog, even for Bill Mitsch, an Ohio State University professor emeritus who is one of the world’s foremost experts on wetlands and the pollution that results when they’re absent. But all those who are sincere in their desire to fight the sickening, bright-green algae blooms that choke the life out of Lake Erie and other bodies of water most years should listen.

While industrial pollution and sewage contribute to the algae blooms, excess fertilizer running off of farm fields is by far the largest contributor. Mitsch believes temporarily re-establishing wetlands and returning them to cultivation after a few years can reduce the flow of phosphorus into streams by 40 percent.

Joe Cornely, spokesman for the Ohio Farm Bureau, said “I think there are a lot of other ways to go about fixing the problem that are not quite so dramatic.” If so, farmers should come forward with those solutions. Ohioans haven’t forgotten the super bloom of 2014 that invaded Toledo’s water-intake plant and left the city without drinkable water for three days. If climate change makes the algae problem worse, as expected, people will demand radical change.

Mitsch’s research project could provide a critical head start.
Conclusions

• The loss of up to half of the world’s wetlands in the 20th century is a ecological disaster with major losses of important ecosystem services including flood mitigation, coastal protection, wildlife habitat, and water quality protection. We need these ecosystem services now more than ever.

• Wetlands can be designed to remove significant amounts of nitrogen and phosphorus from agricultural and stormwater runoff. Concentrations on the order of 30 ppb of total phosphorus and 1 ppm total N are reasonable expectations but lower concentrations can be achieved.

• In the Florida Everglades, the pollution of the estuaries by Lake Okeechobee water has to stop and the original north to south flow of the greater Everglades must be achieved.
Conclusions

• To accomplish this, Florida needs to install 8 to 10 times more treatment wetlands than is currently planned with the EAA reservoir south of the Lake O to protect the downstream Florida Everglades essentially doubling the area of treatment wetlands in the EAA.

• Our *wetlaculture* approach should be tested experimentally wherever watershed management has resulted in extensive downstream harmful algal blooms.

• Wetland restoration and creation are not easy. They require attention to **Mother Nature** (self-design) and **Father Time** (these projects just take time to reach their potential).
Thank you!

wmitsch@fgcu.edu

http://fgcu.edu/swamp