November 11, 2013

Major Wetland Restorations in the World Earn Fall Semester 2013 Mid-Term Grades

In an editorial published today in the scientific journal *Ecological Engineering*, wetlands expert and *Ecological Engineering* editor-in-chief Dr. William J. Mitsch gave academic "midterm" grades to six of the longest-term, largest -scale wetland restoration projects in the world. The grades ranged from good to poor on the six projects. Mitsch used the following criteria in assigning the grades: 1) the project had to show progress, 2) the project had to provide measurable markers of improvement, 3) the basic principles of ecological engineering had to be applied, and 4) the restoration had to demonstrate sustainability. Mitsch has observed these six wetland restorations for a decade or more as they have developed, and summarized them in this editorial entitled "When will ecologists learn engineering and engineers learn ecology?"

Two wetland projects, the Mesopotamian Marshland wetland restoration in southern Iraq and the Delaware Bay salt marsh restoration in New Jersey, USA, received good grades (A's in the American grading system) because of their lack of "over-engineered" solutions and because of their reliance on self-design concepts that will make these restoration projects ultimately sustainable.

The restoration of mangrove wetlands around the Indian Ocean, started in the aftermath of the late December 2004 massive and horrific tsunami caused by an earthquake off the coast of Sumatra, Indonesia, received a midterm grade of C. Over 230,000 people were killed during that disaster that created great interest in restoring mangrove and other coastal ecosystems to "provide coastal protection in the event of future tsunamis or other tidal surges." Several studies had suggested that human impacts were lower in regions where mangroves had been protected. But the initial enthusiasm for mangrove restoration around the entire Indian Ocean has been replaced with a lot of "business as usual" in replacing mangroves with fishponds and other human developments.

Mitsch gave two projects in southern USA grades indicating poor progress (D's). The Florida Everglades restoration, considered the world's largest wetland restoration effort, earned a D+ grade. Mitsch said that the vast Everglades undertaking avoided a failing (F) grade by virtue of some successes—the creation of stormwater treatment wetlands that have significantly reduced the levels of phosphorus in water entering the Everglades and efforts to raise a highway from Naples to Miami that serves as a dam over parts of the Everglades flow path. "But," Mitsch says, "they are still sending water east and west to the Atlantic and the Gulf of Mexico. In essence the project failed its midterm exam during this wet year." The Everglades refurbishment has been complicated by the project's scale, local politics, inconsistent funding and complex hydrologic and landscape issues, Mitsch says.

The Mississippi River Delta and coastline in Louisiana in south-central USA are disappearing into the sea at rates of coastal wetland loss of between 6,600 and 10,000 ha per year. This represents a loss of 2% per decade for this vast wetland. The Mississippi River Delta restoration to offset this land loss, a multi-decadal vision proposed by some in Louisiana, has been debated and discussed extensively while being distracted by other disasters in the New Orleans and Gulf of Mexico over the past decade.

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At one time, projects, if undertaken, would have competed with the Florida Everglades restoration as the world's largest ecological engineering project. The latest plan for restoring this delta region— Louisiana's 2012 Coastal Master Plan—provides some progress, but "we have been here before, several times," says Mitsch, who assigned this long-time plan a D- midterm grade because "it really has not shown much progress for 20 years."

A sixth project, the restoration of the Mississippi-Ohio-Missouri (MOM) River Basin in central USA, primarily to reduce excessive hypoxic pollution in the Gulf of Mexico, received a grade of incomplete (I), a grade not even given in many universities in the world. This grade is reserved for students who do not regularly show up for class and have not completed their assignments. The restoration has not progressed in the last decade, "despite the fact that an interagency task force recommended that the Gulf of Mexico hypoxia needs to be reduced to 5,000 km^2, one-third of its current average size of 15,000 km^2. The scale of the watershed restoration that is needed is known and there have been several publically funded projects in the MOM basin that have had Gulf of Mexico hypoxia reduction as their raison d'être. But nobody is keeping score on the areas restored to wetlands. The only record we do have is the area of hypoxia, which continues to be the same size as it was a decade before."

Mitsch's observations over 10 to 20 years of these six projects evaluated in the editorial suggest that there is more to restoration than simply returning a system to what it was before. "It is appropriate to give a midterm grade to these projects in the hopes that the grade will encourage improvement and better attention to the course, just as we expect from students in giving them midterm grades," Mitsch says.

Mitsch is editor-in-chief of the journal *Ecological Engineering*, holds the Juliet C. Sproul Chair for Southwest Florida Habitat Restoration and Management at Florida Gulf Coast University (FGCU), and oversees research at FGCU's Everglades Wetland Research Park in Naples, Florida. The co-winner of the 2004 Stockholm Water Prize for lifetime achievements in the management and conservation of lakes and wetlands, he is also professor emeritus of The Ohio State University, Columbus, USA.

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REFERENCE

Mitsch, W.J., When will ecologists learn engineering and engineers learn ecology? Ecol. Eng. (2013), http://dx.doi.org/10.1016/j.ecoleng.2013.10.002

Report card mid-term grades for six large-scale wetland restoration projects, Fall 2013.
A = excellent; B = good; C = passing; D = poor; I = incomplete

Restoration Case Study	Ecosystem being restored	Scale of restoration, km^2	Ecosystem services sought	Mid-Term Grade
Indian Ocean Mangroves (Post-Tsunami)	Mangrove swamps	15,000	Coastal protection	**C**
Louisiana (Mississippi River) Delta	Mostly salt marshes	36,000	Coastal protection; regional ecology enhancement	**D-**
Delaware Bay Salt Marshes	Salt marshes	670	Fisheries and aquatic food chain enhancement	**A-**
Mississippi-Ohio-Missouri (MOM) River Basin	Freshwater wetlands and riparian forests	20,000 [a]	Water quality improvement	**I**
Mesopotamian Marshlands	*Phragmites* marshes	20,000	Return of lost culture and landscape	**A**
Florida Everglades	Freshwater streams and marshes	46,000	Water quality and hydrologic improvement	**D+**

[a]suggested area of wetlands needed in basin to significantly reduce hypoxia in Gulf of Mexico