Wetlands Ecology
Department of Environmental Sciences
The University of Toledo

Wetlands ecology studies the relationships between organisms and their wetland environment. It has grown from a basic science to an applied discipline, increasingly called on to help solve environmental problems. As a result, wetlands ecology combines a traditional biology approach with engineering, hydrology, geology, environmental chemistry and other disciplines. Students in the wetlands program, directed by Dr. Hans Gottgens, use this approach in their research projects. The lab is currently pursuing three research directions:

Pulse Stability in Wetlands

Succession in aquatic systems is often controlled by periodic perturbations, such as fluctuating water levels, drought, fire, grazing or tides. These perturbations remove organic matter and liberate nutrients. As such, they help maintain these ecosystems at an intermediate stage in their successional development. Water managers, however, generally aim to eliminate these disturbances, because they interfere with the use of aquatic habitat for water supply, navigation, recreation and aquaculture. Students test hypotheses relative to the long-term impact of eliminating or altering such a pattern of pulsed stability in lakes and wetlands.

Human impacts on Rivers and Streams

Rivers and streams are among the most impacted ecosystems. They are used as conveyors of pollutants and have been dredged, dammed, ditched or diked. The majority of 1st and 2nd order streams, making up a stunning 75% of the total length of U.S. streams and rivers, have communities that no longer resemble their natural condition. Moreover, they have lost their ability to provide us with 'free' ecosystem services such as water quality protection and flood control. Students research stream management methods that incorporate environmental considerations, including dam removal to restore fish migration and ditch maintenance to promote conservation.

Paleolimnological Approaches to Restoration

To understand the response of lakes, rivers and wetlands to anthropogenic actions requires long-term records of environmental data. Because such historical data are usually absent, stratigraphic analysis of sedimentary records and the mechanisms that can modify those records (i.e., paleolimnology) may be used. The lab has published paleo-limnological research on lake and wetland responses to water-level manipulations, development in the watershed, loading of agricultural non-point pollution, dam failures, and long-term contamination with toxics.

Current Projects

- Design of a wetland treatment system for arsenic. Evaluation of the fern *Azolla caroliniana* to phytofiltrate arsenic from contaminated water *(graduate research Alex Duncan - sponsor USDA)*
- Incorporating ecological principles into stream management. The effect of channel heterogeneity on fish communities in agricultural streams in the Sandusky drainage, Ohio *(graduate research Justin Selden - sponsor U.S. EPA)*
- Impact of habitat variables on the distribution of unionid mussels, with emphasis on the rayed bean (*Villosa fabalis*) *(graduate research Jeff Grabarkiewicz - sponsor Lake Erie Protection Fund)*
- Agricultural streams in Ohio as spawning habitat by native fishes: Impact of habitat heterogeneity (graduate research Nate Tessler - *sponsor U.S. EPA)*
- A multiscale analysis of *Etheostoma* darter habitat in the Ohio River Basin *(graduate research Todd Crail – co-directed)*
- Effect of a low-head dam removal on the fish community in a Great Lakes tributary *(group project – sponsor Ohio EPA)*
- Inquiry masters program advancing content for teachers (IMPACT): Providing in-service to high school science teachers in Toledo public schools *(sponsor U.S. Department of Education)*

Selected Publications

- Evans, J.E. and J.F. Gottgens. 2007. Contaminant stratigraphy of the Ballville Reservoir, Sandusky River, NW Ohio: Implications for dam removal. *Journal of Great Lakes Research* 33(2): 182-193
- Gottgens, J.F. and J.E. Evans. 2007. Dam removals and river channel changes in Ohio: Implications for Lake Erie sediment budgets and water quality. *Journal of Great Lakes Research* 33(2): 87-89
- Roberts, S.J., J.F. Gottgens, A. L. Spongberg, J.E. Evans, and N.S. Levine. 2007. Assessing removal of low-head dams: An example from the Ottawa River, Ohio. *Environmental Management* 39(1): 113-124
- Fortney, R.H., M. Benedict, J.F. Gottgens, T. Walters, and B. Leady. 2004. Aquatic macrophyte communities along inundation gradients in two ecologically-distinct regions of the Brazilian Pantanal. *Wetlands Ecology and Management*. 12(6): 575-585
- Leady, B.S. and J.F. Gottgens. 2001. Mercury accumulation in sediment cores and along food chains in two regions of the Brazilian Pantanal. *Wetlands Ecology and Management* 9(4): 349-361
- Gottgens, J.F., J.E. Perry, R.H. Fortney, J. Meyer, M. Benedict, amd B.E. Rood. 2001. The Paraguay-Paraná Hidrovia: Protecting the Pantanal with lessons from the past. *BioScience* 51(4): 301-308

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