Wetland Restoration: Dispelling Myths

Given past and ongoing stresses on wetlands, coupled with the backdrop of rising sea levels and changing climates, it's likely that ecological restoration will continue to be an important tool in preventing further degradation and increasing ecological diversity. However, too often, due to funding limits, lack of time, knowledge gaps, fatuous regulations, or any number of limitations, our efforts to restore wetland functions and services have fallen short or have resulted in unintended consequences. Our knowledge of wetland science has grown exponentially over the past 40 years, but so too has our awareness of all of the unknowns related to the complexities of the natural world.

This symposium will focus in on dispelling some myths often associated with wetland restoration, examining past projects, scrutinizing common restoration practices, and investigating some of the unplanned outcomes of our management actions. We will also delve into some of the theoretical questions regarding the management of these complex natural resources, questioning the definition of ecological baseline and levels of intervention.

The goal of this symposium is to acknowledge that even after 40 plus years of managing and restoring wetlands, ecological restoration is still a relatively new science and we do not fully comprehend the complexities of our ecosystems. But in looking at past efforts and acknowledging that we cannot control nature, particularly in a changing world with an unknown future, we have developed some ideas and approaches to how to assist in the recovery of wetlands in the future.

To Intervene or Not to Intervene: That is the Question in the Anthropocene

Metthea Yepsen, New Jersey Department of Environmental Protection, Division of Science and Research
Brittany Wilburn, Drexel University

Wetland restorations can take decades before their functions begin to look like that of natural wetlands. It may even be argued that restored sites can never replace natural wetlands. For this reason, non-intervention methods of conservation, like protection, are generally preferable to restoration. Restoration is reserved for areas where wetlands once were, but are no longer. This makes sense given that we are only just scratching the surface in our understanding of these complicated ecosystems. However, humans have a heavy impact on these "natural" systems. There is increasing evidence that tidal wetlands in the mid-Atlantic region of the United States are not keeping pace with accelerating rates of sea level rise. Large losses of tidal wetland acreage are projected in New Jersey by 2050 under moderate rates of sea level rise. The loss of marsh is expected to cause the extinction of the salt marsh sparrow, increase exposure of coastal communities to storms and reduce other valuable ecosystem services. But many of the tidal wetlands that modeling and monitoring suggest are especially vulnerable to sea level rise still look healthy, provide functional habitat for animals and are relatively intact. Do we begin to heavily manage these systems by elevating them with dredged sediment and increasing drainage to proactively increase their resilience to sea level rise *or* do we leave them alone out of a concern that our nascent understanding may do more harm than good in relatively intact habitats?

Response of biomass structure and greenhouse gas flux to repeated large-scale mechanical treatment of invasive *Typha* across variable water conditions

Olivia F. Johnson[1,4*], Abha Panda[2], Shane C. Lishawa[3], Beth A. Lawrence[1]
[1]Department of Natural Resources & Environment, Center for Environmental Science & Engineering, University of Connecticut, 1376 Storrs Road Unit 4087, Storrs, CT 06269, USA
[2]Department of Earth and Environmental Studies, University of Michigan, 428 Church St, Ann Arbor, MI 48109
[3]Institute of Environmental Sustainability, Loyola University Chicago, 6349 N Kenmore Ave, Chicago, IL 60660, USA
[4]U.S. Geological Survey, Northern Prairie Wildlife Research Center, Jamestown, ND 58401 USA

Invasive species management typically aims to promote diversity and wildlife habitat, but little is known about how these efforts affect wetland carbon (C) dynamics. Further, the interplay of hydrologic extremes and invasive species is fundamental to managing wetlands in a changing world. Recent rapid water level rise in the Laurentian Great Lakes offered an opportune time to test how mechanical treatment of invasive *Typha* × *glauca* shifts plant-mediated C metrics amidst changing water levels. From 2015 to 2017, we implemented large-scale treatment plots of harvest (i.e., cut above water surface), crush (i.e., ran over biomass with a tracked vehicle), and *Typha*-dominated controls. Treated *Typha* regrew with less biomass than controls each year, while *Typha* production in control stands increased with rising water levels across seasons. Harvested stands had total methane (CH_4) flux rates (measured using clear *in-situ* chambers) twice as high as in controls, while crushing did not change total CH_4 flux. One year after final treatment implementation, crushed stands had elevated surface water diffusive CH_4 flux rates (measured using dissolved gas in water). Two years after final treatment, floating *Typha* mats were present only in harvested and crushed stands, with higher frequency in deeper water and a positive correlation with surface water diffusive CH_4 flux. Our study demonstrates two mechanical treatments have differential effects on *Typha* structure and consequent wetland CH_4 emissions, suggesting C-based responses, variable water conditions, and multi-year monitoring can improve assessment of how management impacts ecological function.

Great Lakes coastal wetland restoration at the Shiawassee National Wildlife Refuge – planning requires adaptation

Kurt P. Kowalski, U.S. Geological Survey, Great Lakes Science Center, Ann Arbor, MI
Eric Dunton, U.S. Fish and Wildlife Service, Shiawassee National Wildlife Refuge, Saginaw, MI
Sasha Bozimowski, U.S. Geological Survey, Great Lakes Science Center, Ann Arbor, MI

The restoration of over 400 ha (1,000 ac) of coastal wetland habitat in the U.S. Fish and Wildlife Service Shiawassee National Wildlife Refuge and surrounding areas is a high priority for the region. Years of extensive planning took place to design and execute a landscape-scale restoration approach that mimics historical conditions while maximizing hydrologic connectivity and benefits to fish and wildlife. However, widespread flooding, a global pandemic, and other unanticipated events created delays and challenges that prevented planned construction, ecological research, and management approaches. Therefore, the detailed plans were adapted to both respond to the new challenges and take advantage of newly-created opportunities. The lessons learned through this project will help others prepare for and then adapt to unexpected challenges.

Ecological restoration: Restoring natural or novel and does it matter?
Joe Berg, Biohabitats, Inc. jberg@biohabitats.com

Ecological restoration is a new endeavor supported by a relatively young science that hasn't always developed with an understanding of our historical landscape modifications nor the long-term effects these modifications have had on our current natural resource condition. As a result, current resource management values and priorities may not serve society's best long-term interests in terms of ecological restoration. As an example, many of our floodplain forest communities have developed on abandoned pasture/cropland floodplains, which have degraded groundwater and surface water resources which result from stormwater dominated stream channels formed and modified during agricultural land clearing practices and left to naturalize. Protection of these 'novel' floodplain forest communities (and other misguided regulatory programs) limits the ability to restore these systems to a more functional resource with greater complexity. If society continues to understand and value only what they have learned in the last generation or two, our perspective will be dominated by a 'changing baseline' which is moving to a lower diversity, less resilient natural world. Alternatively, if we focus instead on historical landscape conditions present prior to European colonization and strive to restore resource linkages and functions present at that time, we will be diversifying our landscape resources, increasing our resilience to climate change, and protecting society against the slow loss of ecosystem services associated with our many generation 'changing baseline'.

Keeping it Simple in a Complex World
Terry Doss, NJSEA

Over the past thirty years, more than 1,000 acres of tidal marshes located within the Hackensack Meadowlands have been "restored" primarily for mitigation purposes due to past wetland impacts and loss. These wetland impacts will continue to occur in the future due to the Meadowlands' urban location and adjacency to major transportation and other urban infrastructure. This is concerning because, in general, the mitigated wetlands are not being ecologically restored but rather are being built as carbon copies of the impacted wetlands using over-simplified concepts that ignore the complexity of natural systems and future uncertainties. The underlying causes for these failures stem from outdated regulations that push for over-engineered solutions and the use of mitigation banks. Restoration approaches that have been more successful at replacing wetland services and functions tend to be smaller projects that are conducted over years, with a focus on treating the causes of degradation rather than the symptoms and allowing for adaptation as external factors change and uncertainties arise. In other words, moving from the use of simplified concepts and techniques, and instead simplifying the process and the project, and relying on nature to take the lead. Project examples from the Meadowlands will illustrate practical restoration approaches that have proven successful in restoring wetland services and functions over time.