ABSTRACT BOOK

FIRST ANNUAL MEETING OF THE MIDWEST-GREAT LAKES CHAPTER OF THE SOCIETY FOR ECOLOGICAL RESTORATION INTERNATIONAL

April 24-25, 2009 at Marian College, Indianapolis, Indiana, USA

Edited By:
Peter C. Smiley Jr., Jennifer Lyndall, Benjamin Eddy, Carl Wodrich, Pamela E. Rice, David P. Benson, and Hua Chen
PREFACE

The first Annual Meeting of the Midwest-Great Lakes Chapter of the Society for Ecological Restoration International was held Friday April 24 to Saturday April 25, 2009 at Marian College in Indianapolis, Indiana. The conference site is the location of the Marian College Ecolab urban wetland restoration project and the Riverdale Estate with its historic Jens Jensen-designed landscape. The MWGL SER Chapter was recognized as the newest regional SER Chapter in March 2008. The Chapter serves a six-state region of Ohio, Indiana, Michigan, Illinois, Wisconsin, and Minnesota. The mission of the MWGL SER Chapter is “to promote the science and practice of ecological restoration to assist with the recovery and management of degraded ecosystems throughout the Midwestern and Great Lakes region of the United States”. This meeting was a historic event because it represents the first official gathering of the Chapter members to celebrate its beginning. There is a tremendous diversity of individuals and institutions involved in ecological restoration within the Chapter boundaries. Our goal for this meeting was to highlight this diversity by holding a forum on a diversity of ecological restoration topics and we solicited abstracts from all individuals, institutions, and disciplines involved in ecological restoration within the Chapter boundaries. Ninety-eight attendees from Ohio, Michigan, Indiana, Illinois, Wisconsin, Kentucky, New York, and Ontario attended a two day meeting that consisted of a keynote presentation, 13 poster presentations, 36 oral presentations, the second chapter business meeting, a plenary presentation, and two field trips. This abstract book contains the abstracts from all meeting presentations.

ACKNOWLEDGEMENTS

We extend a sincere thank you to all of our sponsors for their generous support of our First Annual Chapter Meeting. See page 2 for a complete listing and the end of the abstract book for the sponsorship ads. We also thank Marian College for being a gracious meeting host and helping to make our first meeting a special event. We are very grateful for the support provided by the participation of the meeting presenters, moderators, field trip leaders, volunteers, and attendees for making our First Annual Meeting a success. We thank other members of 2009 Annual Meeting Subcommittee (Dave Benson, Benjamin Eddy, Jennifer Lyndall, Pamela Rice, Peter C. Smiley Jr., Carl Wodrich), the other members of the Organizing Committee (Hua Chen, Young Choi, Cody Fleece, Bob Grese, Cara Hardesty, Liam Heneghan, Jason Husveth, Wesley Ket, Anne Remek-Kominowski, John Shuey) and all who assisted with onsite preparations (Ginny Smith, Jody Nicholson, Katie Martin, Belynda Smiley, Sean Clauson) for all of their contributions.
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KEYNOTE PRESENTATION ABSTRACT

Jordan, William, R. III.  **An amazing grace: the midwestern prairies and the invention of ecological restoration.** New Academy for Nature and Culture and the Institute for Nature and Culture at DePaul University. E-mail: newacademy@comcast.net

While the practice of environmental restoration has an ancient history, until recently this activity has been self-interested, oriented basically toward the maintenance of ecological systems as resources for human use. Only very recently, beginning in the early decades of the past century, have conservationists explored the possibility of restoring whole historic—or classic—ecosystems. For a number of reasons—not least that they had little economic value and were not protected by any form of legislation—the tallgrass prairies of the North American Midwest played a key role in the invention of this new form of land management, and in recent years have also been a proving ground for the discovery and realization of its distinctive value.

PLENARY PRESENTATION ABSTRACT

Grese, R. E. ¹, and D. P. Benson ². **Marian College Ecolab: a case study of a 90 year-old environmental restoration.** ¹ School of Natural Resources and Environment at the University of Michigan. ² School of Mathematics and Science at Marian College. REG E-mail: bgrese@umich.edu and DPB E-mail: dbenson@marian.edu

Marian College is built on the country estate of Indianapolis entrepreneur James Allison, designed by the noted landscape architect Jens Jensen in the early 20th Century. Professor Bob Grese, from the University of Michigan, will provide background of the work of Jens Jensen, a pioneer in processes of ecological restoration and landscape design celebrating the natural heritage of the Midwest region. Professor Dave Benson, of Marian College, will assess the results of Jensen's "restoration," explain the contemporary restoration work that is taking place in the EcoLab, and share the history and development of the EcoLab as a center for experiential environmental and historical learning for students at Marian College and the broader Indianapolis community.
CONTRIBUTED ORAL AND POSTER PRESENTATION
ABSTRACTS (ALPHABETICAL ORDER)

Appleman, Chadwick E.* Water quality and ecological benefits of wetlands mitigation banking versus conventional permittee-responsible mitigation. Davey Resource Group, Fort Wayne, Indiana. E-mail: cappleman@davey.com

The Indiana Department of Environmental Management conducted a study of 345 wetlands mitigation sites in 1998 and 1999 which revealed serious problems associated with conventional permittee-responsible mitigation wetlands in Indiana. Inherent problems associated with permittee-responsible wetlands mitigation in Indiana degrade water quality and compromise valuable ecological resources. Wetlands mitigation banking, whereby wetlands are created before existing wetlands are impacted as part of a land development activity, offers reassurances that wetlands functions and values will not be lost. The U.S. Environmental Protection Agency developed a new wetlands mitigation rule that was published in the Federal Register in 2008. The new wetlands mitigation rule indicates that wetlands mitigation banks are preferred by the regulatory agencies over permittee-responsible mitigation. This presentation will overview the successes and challenges of mitigation banks in Ohio, preview the future of wetlands banking in Indiana, and evaluate the impact that wetlands mitigation banking can have on Indiana’s remaining wetlands resources.

Barr, Robert C.*, Bob E. Hall, and Lenore P. Tedesco. Climate change and natural areas restoration: what does predicted climate change mean for natural areas restoration? Center for Earth and Environmental Science, Department of Earth Sciences, IUPUI, Indianapolis, Indiana. Email: rcbarr@iupui.edu

In the past three decades, warming in global temperatures has been approximately three times greater than the average for the century. In the United States, 6 of the 10 warmest years on record for the contiguous U.S. have occurred since 1998. The average U.S. temperature for 2007 was 54.2°F; 1.4°F warmer than the 20th century mean of 52.8°F. The average temperature for the contiguous U.S. in 2007 was the tenth warmest on record. Data from the Union of Concerned Scientists suggests that by 2030 winter in central Indiana will be similar to that of northeastern Kentucky and summer will be like present day central Missouri. Annual average precipitation will shift to a pattern of warmer wetter winters and much warmer and drier summers. Precipitation is expected to increase 5-10% in the winter and decrease 10-15% in the summer. This seasonal shift will result in Indiana becoming drier overall because rainfall cannot compensate for the drying effects of a warmer climate, especially in the summer. Early season rains in Indiana during 2005 and 2009 may indicate that this shift in rainfall is already occurring. The predicted effect of this warmer and drier climate will be a decrease in lake levels, reduced ground water recharge, continued loss of wetlands, and the loss of possibly 50% of headwater streams as ephemeral channels are lost. The unique geographical position of Indiana makes it an ideal natural laboratory to study the effects of climate change on natural systems. Here we demonstrate what proposed climate change might mean to a natural area in central Indiana.
Bare root trees are often favored in restoration projects because their low cost and their small size and light weight make them easy to transport and handle in the field. However, the survival rate of bare root trees can often be disappointing, especially when compared to container-grown stock. This low survival rate can be attributed to a failure to recognize factors peculiar to bare root stock that can mean the difference between a successful planting and one that fails. Those factors fall under three broad categories: how the bare root stock is treated before planting, how it is handled in the field, and what natural conditions it experiences after planting. Factors in the first two categories are usually within the control of the restoration team, while those in the third category are not. Pre-planting treatments that effect survival include ordering the stock to arrive at the right time for planting, proper storage prior to planting, and planting as soon as weather conditions permit. Pre-planting treatments, such as sweating-in, are also important. Proper handling in the field involves keeping the stock shaded and the roots moist, digging a hole large enough to accommodate the roots, and firming the soil around the roots to eliminate air pockets. Natural conditions that influence survival of bare root trees after planting include temperature extremes, rainfall extremes, and herbivory. Although natural conditions lie largely outside our control, we can mitigate their effects by choosing species suitable for the site, planting early, and installing tree guards.

Traditional methods of stormwater management have caused the headwaters of many stream systems to be impounded or buried in pipes, which when combined with the increase in impervious surface of the watershed, causes a larger discharge at the outfall. The change in the discharge at the outfall causes increased erosion, degradation of the stream channel, and failure of the structures themselves. The cycle perpetuates downstream, causing further degradation of the stream system. We have found that constructing a regenerative system consisting of pools and riffle/weir grade control structures results in a positive spiraling effect on the whole stream system; creating low energy discharge, increasing groundwater-surface water interactions, enhancing riparian and wetland habitat, and improving water quality. This restoration approach has numerous applications, from stormwater conveyance to stream and wetland ecosystem restoration, and has been implemented in both settings.
Blackley, Andrew¹, Ivette Bolender², and Suzanne Hoehne*³. **Detention basin retrofit in the Nine Mile Creek watershed, South Euclid, Ohio (Case Study).** ¹ Stephen Hovancsek and Associates, Richmond Heights, Ohio. ² Biohabitats, Inc., Great Lakes Bioregion, Cleveland, Ohio. ³ Biohabitats, Inc., Ohio River Bioregion, Louisville, Kentucky. Email: shoehne@biohabitats.com

The Langerdale detention basin is an on-line flood control basin draining 7.6 square miles in the Nine Mile Creek watershed in the City of South Euclid. The basin was built in the early 1960s. Prior to retrofitting, the basin was 10.4 acres with forest, four small category one wetlands and a low flow concrete channel. The basin includes an overflow system that allows any overflow to flow directly down Langerdale Boulevard through a secondary spillway structure located inside the basin. The City has reports of at least 73 residents in the drainage basin that have experienced basement flooding during the last two majors storms in July 1995 and July 1999. The overall goals of the project are to increase the volume of stormwater runoff storage and enhance pollutant removal through the establishment of a wetlands habitat. To maximize the detention time of the first flush of runoff, Biohabitats designed a series of wetland pools separated by low crested earthen weirs. We developed this design with the parallel goals of maximizing storage volume, augmenting aquatic habitat and minimizing long term maintenance. During the summer and fall of 2008, the City completed the construction of the basin, which required excavating 14,000 cubic yards of soil, installing 14 floodweirs and open-water pools, and planting five vegetation zones. The planting zones include various habitat zones from an aquatic bed and open water wetland to a riparian deciduous forest and native mesic meadow.

Blersch, David M.* and Alan Rabideau. **A new interdisciplinary doctoral program in ecosystem restoration at the University at Buffalo.** Department of Civil, Structural and Environmental Engineering, State University of New York at Buffalo. Email: dblersch@buffalo.edu

The restoration of biodiversity in impaired aquatic and terrestrial environments is a growing national priority and is of critical importance to regions like western New York State with numerous legacy environmental and ecological disturbances. The Ecosystem Restoration through Interdisciplinary Exchange (ERIE) program at the University at Buffalo (UB) is a new and innovative educational program designed to produce an interdisciplinary environment necessary for ecological restoration research. Initiated as a collaborative doctoral program that advances ecosystem restoration science and engineering, the ERIE program focuses on advancing ecological restoration practice as it contributes to the ecological recovery of the Great Lakes and upstate NY. Collaborative partnerships in ERIE span across eight UB departments, research groups at nearby Buffalo State College, and over 20 external partner organizations, including Native American tribes, local, state, and federal agencies, and corporate and Canadian entities. Through the integration of natural and social science, engineering, and policy, ERIE addresses critical knowledge gaps in ecosystem restoration and trains students in restoration science and engineering expertise as well as policy, cultural, and ethical issues that influence restoration practice. Program interdisciplinarity is reinforced by activities that include field-oriented short courses in ecosystem restoration, leadership workshops in interdisciplinary team dynamics, professional internships with external partners, instruction and mentoring in case
study methods, exchange research opportunities with Canadian partners, and development training for the dissemination of new K-16 educational materials. Through this comprehensive interdisciplinary environment, ERIE strives to train new leaders in the rapidly advancing field of ecosystem restoration.

Brown, Jason K.* Restoring ecological function and native biodiversity at the Cincinnati Nature Center. Cincinnati Nature Center, Milford, Ohio. Email: jbrown@cincynature.org

Cincinnati Nature Center (CNC) harbors a rich biodiversity of flora and fauna within its mosaic of diverse habitats. In the face of habitat destruction and global climate change the movement to conserve this biodiversity is at a critical junction. CNC lands exist as islands of biodiversity surrounded by urbanization and agricultural land use. The biggest threat to CNC biodiversity is the loss of habitat and species in areas surrounding CNC lands. As urbanization increases habitat fragmentation in Southwest Ohio it is critical for CNC: continue to conserve biological diversity by restoring ecological function; evaluate ecological restoration methods, and foster stewardship by sharing these experiences with present and future generations. As noted in other Restoration ecology programs (i.e., The Wilds in Zanesville, Ohio) it is difficult to predict the outcome of restoration efforts, therefore the application of ecological restoration principles becomes an experiment giving us the opportunity to study ecosystem patterns and processes and evaluate their ability to recovery to an ever changing environment. The Cincinnati Nature Center Land Management Program is charged with the task of planning and implementing projects and sub-programs that will target the restoration, enhancement, and preservation of CNC lands. The goal is to provide and maintain in perpetuity a mosaic of bio-diverse habitats for education, research, and visitor experience.

Cavender, Nicole, Shana Byrd*, and Nina Sengupta. Ecological restoration for pollinator habitat on reclaimed surface-mined land at The Wilds. The Wilds, Cumblerland, Ohio. Email: ncavender@thewilds.org

The Wilds is a large-scale non-profit center for conservation research and education located on 3,700 hectares of previously coal-mined land. Although reclamation activities were largely successful at restoring ground cover, controlling erosion, and providing areas for recreational activity, questions still remain about its biological functionality. The Restoration Ecology program at The Wilds is working on understanding how the land is currently being used by wildlife and exploring ways through scientific endeavor to make further ecological improvements so that it can support maximum levels of indigenous diversity. One of the most successful projects has been the improvement of pollinator habitat. Restoration activities have included large-scale replacement of non-native grasslands with native prairie species, wetland and forest enhancements, control of invasive plants, and the use of prescribed fire. In order to track long-term changes in butterfly populations, weekly transects have been run since 2004 (April – October) following the methodology used by The Ohio Lepidoptera Society’s long-term monitoring program. At the onset of the project, an average of 653 butterflies were recorded over a 23 week period. After four years of habitat enhancements, an average of 1,926 butterflies were recorded, an overall increase of 195%. Species richness also increased 42% over the 4
years of monitoring. These results are attributed to the successful establishment of nectar and host plant species in an environment that was previously lacking these needed resources. An overview of this project and related future research areas will be presented.

Chen, Hua* and Michael Lemke. Emiquon Floodplain restoration in Illinois—implications for carbon sequestration. University of Illinois at Springfield, Springfield, Illinois. Email: hchen40@uis.edu

Emiquon Preserve is one of the largest floodplain restoration projects in west-central Illinois. This 29 km² floodplain was drained and managed as cropland from 1915 until 2006. The land was once the "Jewel of the Illinois River" because it supported the most productive floodplain ecosystem in Illinois. It was home to the greatest abundance of fish, mussels and waterfowl in the Upper Mississippi River valley. Since 2001, the Illinois Chapter of The Natural Conservancy has collaborated with federal, state, and local agencies to plan the Emiquon floodplain restoration. The restoration was formally launched in 2007. Research monitoring and assessment of the restoration project is crucial. One of the research projects is to evaluate the carbon sequestration of the restored floodplain as floodplains generally sequestrate much more soil organic carbon (C) than croplands. Floodplains also have been recognized as a net contribution of atmospheric methane (CH₄). The overall goal is to quantify how C stocks (e.g., soil organic C and plant C) and flux (e.g., CH₄) change in the restored floodplain over time. We collected soil samples in summer 2007 from the restored floodplain and one adjacent corn field. The baseline total soil organic C (SOC) in Emiquon was 49.78 Mg/ha in 2007. SOC increased at about 1 Mg/ha/yr after floodplain wetland restoration in Spunky Bottoms site since 1997. We will use static chamber and gas chromatography techniques to quantify CH₄ emission in this restored floodplain this summer. Finally, we will explore the implications of Emiquon floodplain restoration on carbon sequestration.

Coulter, Dave*. Preservation of American hedgerows: artifacts of history, habitat for the future. Osage, Inc., Oak Park, Illinois. Email: osage59@ameritech.net

Hedgerows have been used by agricultural societies for centuries to hold livestock and to delineate property boundaries. Hedgerows were often planted in the United States for the same reasons, but fell out of favor with the invention and use of wire fences. Many of these hedgerows have since been removed or left to grow wild. It is my feeling that hedgerows in the United States are worthy of greater public awareness and protection. The plants and trees in hedgerows are often seen as having little or no value, but these are features in the landscape that connect us to our agricultural heritage and may offer needed habitat and cover in urban and rural areas that need more of both. In the United Kingdom ancient hedgerows are valued as harbors of biodiversity for plants, animals and insects in landscapes that have been stressed by human activity. Such species diversity can be quantified in relation to their age - in general, the older the hedgerow, the greater the number of species present. Hedgerows in the United States could be inventoried and dated. Criteria could be developed to assess what ecological value they offer. The hand of man has greatly changed the landscape of the United States, but hedgerows are one man-made feature that merit attention and appreciation in a changing world.
Amur honeysuckle (*Lonicera maackii*) is a non-native shrub that tends to decrease native plant coverage and diversity upon invasion. Its invasiveness has been attributed to allelopathic effects. In this study we test the allelopathic effects of *L. maackii* leaves on germination and growth rate of a native and a non-native species. *Tagetes* (marigold) and *Elymus virginicus* (Virginia wild rye) seeds were watered with honeysuckle leaf extract, *Acer saccharum* (sugar maple) leaf extract, or with distilled water and the number of seeds that germinated in each treatment was recorded. We tested amur honeysuckle’s effect on growth rate over a six week period by planting marigold and Virginia wild rye seeds in potting soil mixed with a honeysuckle leaf “mulch,” a maple leaf “mulch,” or plain potting soil. We found that amur honeysuckle leaf extract has no significant impact on germination rates. However, amur honeysuckle was found to significantly decrease growth rates in both marigold and Virginia wild rye. This allelopathic effect may partially explain the rapid invasion of amur honeysuckle in the Midwest, U.S.

The Karner blue *Lycaeides melissa samuelis* is a federally-endangered species of butterfly restricted to the oak savanna-pine barrens ecosystems of the Great Lakes and Northeast regions. Within Northwest Indiana the species is geographically isolated in fragmented natural areas of the Indiana Dunes National Lakeshore and Toleston Strandplain Macrosite. The Nature Conservancy-Southern Lake Michigan Rim Project is working with select partners to ensure the continued survival of this species through habitat restoration, a captive rearing and reintroduction program and long-term monitoring to establish and maintain a viable metapopulation within the high quality remnants of dune and swale remaining in the industrialized landscape of Northwest Indiana.

Much of the North Central Till plain landscape, an ecoregion that encompasses Michigan, Ohio, and Indiana, has been converted to agricultural use, and with this massive landscape conversion has come greatly altered hydrologic functioning. The elimination of wetland storage and installation of subsurface drainage systems and agricultural ditches has caused water to drain from agricultural watersheds at greatly accelerated rates. The resulting hydrologic alterations associated with land use change include accentuated discharges and depleted base flows - both can have deleterious impacts on the health of freshwater ecosystems. In some cases, these
hydrologic alterations have also led to severe water quality problems, including accelerated rates of stream bank erosion and sedimentation problems, inadequate processing of nutrients, and turbidity increases, each of which pose dire consequences for aquatic biota. Additionally this activity has led to a loss of aquatic habitat and the degradation of remaining natural habitats. This collaborative project highlights the 2-stage ditch concept and is showing how biological, chemical, and physical monitoring parameters are leading to influence social and economic factors that dictate decisions that are made on the land. Two site level projects are currently being evaluated, one in the Tippecanoe River and one in the St. Joseph River. Using site level data that is generated by these on-the-ground projects, tools are being developed to identify future projects that will have the most dramatic impact on improvements in hydrology and aquatic biota throughout the watershed.

Dutta, Somnath. **Water sustainability: a mission for Defiance College.** Defiance College, Defiance, Ohio. Email: sdupta@defiance.edu

Sources of drinking water, both tap water and bottled water, include rivers, lakes, streams, ponds, reservoirs, springs and wells. During natural crisis such as high rain and flooding events excessive amounts of silt containing organic contaminants can run into the river posing difficulty in water treatment process. This work is focused on monitoring the levels of organic contaminant Phenanthrene at various sites along Maumee River and other water sources in Ohio. Defiance drinking water mostly comes from surface water (approximately 57%) of Maumee River and the Upper Maumee Watershed. As water runs over land surface and underground, it dissolves naturally occurring minerals substances resulting from presence of animals and human activity. Surface waters are thus readily accessible and can be contaminated by potential contaminant sources such as agriculture, home construction, industrial and commercial business, septic systems, waste water treatment plants, roadways and railways. Measures to protect Maumee River can decrease the impact on water quality and promote sustainable development of the community. This work utilized analytical methods such as Gas- Chromatography Mass-Spectrometry (GCMS) to extract, detect and quantify Phenanthrene, a poly aromatic hydrocarbon (PAH) and a potential organic contaminant in water samples obtained from various points in Maumee River, in conjunction with Maumee River watershed project. Sampling was also done in various other parts of Ohio. For water sources contaminated with Phenanthrene over and above the EPA limit, a bioremediation process will be proposed for future work.
Michigan prairie fens are unique in their plant and animal diversity. Invasive species are one of the primary threats to that diversity. Glossy buckthorn (*Frangula alnus*) is one of the most common prairie fen invasives. To quantify the impact of glossy buckthorn on native plant and insect communities in prairie fen, we measured light availability, soil nutrients, and herbaceous plant cover and diversity before and after buckthorn removal in plots at a Michigan prairie fen in winter 2008. During summer 2008 we compared plant and insect species composition in 1) cleared, previously buckthorn invaded areas, 2) uncleared, buckthorn invaded areas, and 3) high quality uninvaded reference areas. Our goal was to assess whether buckthorn clearing placed the plots on a trajectory toward characteristics typical of uninvaded reference areas. We found significant changes in plant community, light availability, and soil nutrients between pre-clearing in Fall 2007 and 2008 data from the first season of restoration. We found that hydrology, in terms of ground water levels, had broadly recovered. Insect abundance in the restored area was also comparable to that in reference areas, while insect taxa still differed between the two. Our findings indicate that clearing and managing glossy buckthorn is sufficient to restore several characteristics similar to those of reference areas within one year. Other metrics, such as plant species diversity and mean coefficient of conservativeness, may take a longer time to recover, if at all.

The objective of this study was to examine the influence of wood loading across various gradients of human land use and in-channel disturbance in sand-bedded streams. Instream habitat characteristics, large wood loading, and riparian forest structure were quantified at 26 study sites with drainage areas ranging between 0.2 and 245 km². Most streams in the study area were affected by human disturbance, either directly through bank armoring, vegetation removal, channelization, etc. or indirectly through mechanisms such as sediment loading and headward channel incision. The number of wood pieces observed at a site ranged between 0 and 52 pieces (mean = 10). Wood volumes ranged between 0 and 1.54 m³/m² (mean = 0.36 m³/m²). Large woody debris influenced channel morphology by increasing pool depth and surface area, by providing structural cover, influencing hydraulic complexity, and increasing the complexity of the bed topography. This study is further evidence in support the role of large woody debris in the formation of instream habitat. It may also assist in identifying threshold conditions that can be mimicked in degraded channels thereby restoring aspects of the structural and functional capacity of coastal plain streams.
Frischie, Stephanie*¹ and Helen Rowe ². **Replicating natural life cycle in the timing of restoration seeding results in quicker establishment of early-ripening species.** ¹The Nature Conservancy, Kankakee Sands Restoration, Morocco, Indiana. ²Forestry and Natural Resources Department, Purdue University, West Lafayette, Indiana. Email: sfrischie@tnc.org

Kankakee Sands is a high-diversity prairie, wetland, and black oak savanna restoration on sandy soils in northwest Indiana. Seeds from plant species that flower and ripen early in the growing season are part of the seed mix but as a group they have not successfully established. This may be due to the alteration in summer conditions for these seeds. Seed is stored in a cold room after harvest until winter planting. For early ripening species this practice effectively eliminates exposure to the summer conditions seeds would naturally have in the wild. In this study, we compared the effect of natural seeding (summer), and restoration seeding (winter) on establishment in field conditions. In August 2004 and December 2004 we hand broadcasted a seed mix containing seven species that ripen early (Antennaria plantaginifolia, Arabis lyrata, Carex swanii, Hymenopappus scabiosaeus, Lupinus perennis occidentalis, Phlox bifida, Stipa spartea). Each treatment was replicated in two 10’x10’ plots at three locations on the restoration. We collected data on establishment and flowering success of these species in the plots at 12 time points from June 2005 until October 2008. Results show that six out of seven species established sooner when planted in the natural seeding, although by the end of the experiment there were no differences in establishment between seeding times. Quicker establishment may have benefits such as providing early competition from weeds that may outweigh the additional work required to ensure timely planting.

Hall, Stephen D.* **Watershed assessment of river stability and sediment supply (WARSSS) demonstration project at Yellowwood State Forest.** Yellowwood Lake Watershed Planning Group (YLWPG), Brown County, Indiana. Email: stephen.hall@stantec.com

In 2009, via a 205(J) grant award from US EPA and the Indiana Department of Environmental Management, the Yellowwood Lake Watershed Planning Group (YLWPG) will begin to implement the newly established Watershed Assessment of River Stability and Sediment Supply protocol (http://www.epa.gov/owow/watershed/) as a technical framework for assessing erosion and sedimentation problems in Jackson Creek, a 7-square-mile watershed located in Yellowwood State Park in south central Indiana. The WARSSS protocol can be used to develop stream restoration strategies, watershed-scale restoration action plans or Total Maximum Daily Loads (TMDLs) for impaired streams. This project will provide the YLWPG with a basis from which to prioritize future stream restoration efforts within the Jackson Creek watershed and is intended to serve as a statewide demonstration project to increase awareness of the WARSSS protocol and natural channel design stream restoration practices. Additionally, in 2010, the YLWPG will host and facilitate a two day workshop with the purpose of providing stakeholders and interested parties with the opportunity to learn and practice stream geomorphic survey and restoration techniques which may be applied throughout the state to restored impaired waters.
Kane, Douglas D. and Spiro Mavroidis. **Restoration ecology and Defiance College’s Thoreau Wildlife Sanctuary: ecological restoration as part of the undergraduate collegiate curriculum.** Defiance College, Natural Sciences and Mathematics Division, Defiance, Ohio. Email: dkane@defiance.edu

Defiance College’s undergraduate major in Restoration Ecology is unique for a number of reasons. First, this program, initiated by David Reed (professor emeritus) in the 1990’s, is one of the <20 restoration ecology degree programs offered in the United States and Canada. Further, Defiance College, in partnership with the Diehl Family Foundation, established the Thoreau Wildlife Sanctuary in 1989 where students get extensive practical experience in the practice of ecological restoration. Over 200 acres of former farmland have been restored to prairie, meadow, wetland, deciduous and white pine (*Pinus strobus*) forest habitats with ongoing management. Restoration Ecology students have planted more than 40,000 trees on the Sanctuary property, as well as planting herbaceous terrestrial and wetland plants. Further, students have conducted research involving reintroduction of bobwhite quail (*Colinus virginianus*) and ringnecked pheasants (*Phasianus colchicus*), prairie burns, and surveys to determine distributions of amphibians, reptiles, birds, and mammals. Current projects range from control of invasive terrestrial plants to affects of cropland on water quality. The Thoreau Wildlife Sanctuary is also used for service learning programs and other courses (i.e. Field Botany and Zoology; Restoration Ecology) at Defiance College, with plans for teacher and community education in the future. Geographic Information System (GIS) techniques are also taught using data collected at the Sanctuary. We submit the examples of the Thoreau Wildlife Sanctuary and Restoration Ecology major at Defiance College as a model of integrating restoration ecology into the collegiate curriculum and providing training for future restoration ecologists while restoring degraded/modified habitats.

Kerkhof, Matthew* **Vegetated shorelines promote healthier fisheries.** Hoosier Aquatic Management, Indianapolis, Indiana. Email: MKerkhof@haminc.org

The purpose of this presentation is to outline the benefits of vegetated shorelines compared to hard armor. Hard armor consists of vinyl sea walls and/or rip-rap and results in barren shorelines depleted of habitat suitable for promoting healthy fisheries. Rip-rap buries sediment preventing native plants from establishing along the shorelines. Vinyl seawalls are often three feet or greater in depth taking shorelines completely out of the equation. These systems promote barren unproductive zones in the fisheries life chain. Vegetated shorelines promote healthier fisheries by creating a buffer zone from the land to the water. The vegetation scrubs the water removing soil particles, absorbing fertilizers, and acts as a buffer zone for pesticides and other man-made runoff. Habitat created allows for an increase in macroinvertebrates. The abundance of food source in the surrounding plants to the rich breeding areas directly along the shoreline results in increased fishery productivity. Small fry can seek refugia and feed along the diverse vegetated shoreline. The system I have found most successful uses a 100% natural design. Coir logs are installed directly along the shoreline. Native species are utilized to establish vegetation along the shoreline a minimum of three feet from the shoreline extending up the slope. Nest boxes, platforms, and perches are an excellent compliment the vegetated shoreline. The 100% natural
products used to create a vegetated shoreline and different nesting/living habitat structures that help complete the web of life.

Klein, John B.*  **The challenges of restoring White-tailed Deer populations to more healthy levels in urban parks.**  Hamilton County Park District, Cincinnati, Ohio.  Email: jklein@greatparks.org

The Hamilton County Park District began an intensive Deer Culling Program in January of 2003. With many urban parks surrounding the city of Cincinnati, many challenges were presented. The use of both sharp-shooting and controlled bow hunting has been used to reduce deer numbers. To date a total of 3,186 deer have been removed as the population has been reduced to near target levels and all resulting venison donated to feed the needy. Project success is being measured with various plant surveys and infrared deer counts. Early education of the public prevented negative reactions and has led to a smooth running program. Learn the nuts and bolts as well as the policies and protocols of such a program.

Knapp, Mary.*  **Implications of the Endangered Species Act for designing restoration projects.**  U. S. Fish and Wildlife Service, Columbus, Ohio.  Email: Mary_M_Knapp@fws.gov

For over 30 years the Endangered Species Act has functioned to help recover species which are in danger of extinction or trending toward extinction. The Fish and Wildlife Service and the National Marine Fisheries Service share administration of the Act. The Act requires a systematic coordination process with the Fish and Wildlife Service or the National Marine Fisheries Service when there are federal permits, federal funds, or other federal action agencies involved in a proposed action. This systematic coordination process is called Section 7 consultation. The Section 7 consultation process will be described from the perspective of the Ohio Field Office of the Fish and Wildlife Service and will use examples related to designing ecological restoration projects.

Lemke, Michael J.*1, Michelle. Randle 1, Felipe Velho 2, Angela Kent 3, Keenan Dungey 1, Doyn Kellerhals 1, and Melinda Usherwood 1.  **The microbial ecology of two lakes on the Illinois River floodplain: newly restored Thompson Lake and established Lake Chautauqua.**  1University of Illinois at Springfield, Springfield, Illinois, 2 State University of Maringa, Maringa, Parana, Brazil.  3 University of Illinois at Champaign-Urbana, Urbana, Illinois.  E-mail: lemke.michael@uis.edu

Aquatic microbial communities are unique in that they can simultaneously be affected by their environment while drastically altering the same environment in which they exist. The objective of this study was to relate changing water quality conditions to biotic indicators that change in step with lake conditions (bacteria, protozoa, and zooplankton) in newly restored Thompson Lake (TL) and established Lake Chautauqua (LC). TL (809 ha) on the Emiquon Preserve was converted from row crop agriculture in 2007 and is isolated from the Illinois River while LC (1416 ha) connects to the river during flood stage. Lake water was sampled weekly (March-
Nov. 2008) and physical (e.g., light, temperature), chemical (TN, TP, pH) and biotic (listed above) data were collected. In TL, clear water in spring increased in turbidity at about the same time bottom water decreased in dissolved oxygen (late June) producing the first extensive cyanobacterial bloom, presumably due to sediment phosphorus release under reducing conditions. Of the protist community analyzed to date, the both lakes had ciliates in order Oligotrichida along with order Scuticociliatida as the dominant groups through mid-September. However, LC showed overall greater diversity. Rotifers and zooplankton were about 5 times more abundant in LT than CL and copepod abundance peaked in spring in LC vs. early summer in TL. DNA “fingerprinting” of the bacterial community (ARISA method) showed sequential and directional change throughout the sampling period. The changes in lake conditions are not only reflected in water quality measurements, but in the response of the microbial community.

Lyndall, Jen*1, Tim Barber1, Suzanne Hoehne2, and Michael Lighthiser3. Stream and ditch restoration planning in southwestern Ohio. 1 ENVIRON International Corporation, Burton, Ohio. 2 Biohabitats, Inc., Louisville, Kentucky. 3 Biohabitats, Inc, Denver, Colorado. Email: jlyndall@environcorp.com

Restoration planning has been completed for a riparian buffer and in-stream restoration project in southwestern Ohio. The stream and an adjacent ditch have many challenges, including historic channelization, nearby land use, poor habitat quality, and chemical contamination. The stream and ditch will be remediated in 2009 and 2010, providing an opportunity to implement restoration to enhance system function. Different restoration approaches are used for the stream and ditch based in the constraints of the two areas. The stream restoration will create a more sinuous constructed-channel template consisting of low floodplain benches and floodplain weir riffles. The installation of various types of woody debris (large woody debris bundles, standing snags, brush piles) in the stream floodplain will aid in deposition and improve aquatic habitat. Live stakes will be installed in wetter depositional areas and containerized trees and shrubs will be installed higher up on the edges of the floodplain. Due to land use in the area, the sinuosity of the ditch cannot be significantly altered. Therefore, the restoration design of the ditch will include the construction of riffles, pools, and stabilization structures consisting of rock and logs. Containerized trees and shrubs will be installed along the ditch and further up the steeper valley slopes. Restoration maintenance and monitoring programs will be implemented for both the stream and ditch. Monitoring will focus on metrics of functionality and will be used to assess performance of the project.

Majka, Brian.* Controlling common reed (Phragmites australis) on public and private land throughout Michigan. JFNew. West Olive, Michigan. Email: bmajka@jfnew.com

Common reed (Phragmites australis) is generally considered one of the most invasive wetland plant species in the eastern United States, often threatening the integrity of state and federally rare plant and animal species in aquatic systems whenever it inhabits a site. Mr. Majka will give an oral presentation detailing various common reed control efforts that have been completed throughout the state of Michigan. The presentation will give a brief background on common reed, its biology, and methods that are typically used for control. He will then give a variety of
examples where common reed has been successfully controlled on public and private property throughout the state of Michigan.

Mason, Julianne E. ¹, Thomas E. Slowinski ², George R. Milner ², Derrick C. Martin ². Using a design-build-manage approach for the successful restoration of 500 acres of wetland, prairie and stream corridor. ¹Forest Preserve District of Will County, Joliet, Illinois. ²V3 Companies, Woodridge, Illinois. Email: tslowinski@v3co.com

The Forest Preserve District of Will County (District), southwest of Chicago, has been involved in the preservation of Spring Creek and its resources since 1930. Through successful bond referendums, the Hadley Valley Preserve/Spring Creek Greenway now consists of 1,600 acres. Few existing wetlands are present along the corridor as they had been drained and used for agriculture for over a century. Both wetlands and uplands had been colonized by invasive or low quality vegetation. In conjunction with the Illinois State Toll Highway Authority, which required wetland mitigation for the extension of I-355, and City of Chicago O’Hare Modernization Mitigation Account administered by CorLands, the District is in the process of restoring 500 acres to various types of native plant communities. Within Hadley Valley Preserve, nearly three miles of the incised Spring Creek was relocated to its former meandering course. The re-meandering increased the total stream length by about 2,000 feet. Hydrology was restored to 150 acres of former wetlands by disabling eight miles of drain tiles. Emergent wetland, sedge meadow, wet prairie, and floodplain forest community types are being restored. Approximately 350 acres were restored to prairie. The uplands will be planted with 32,000 contract-grown native trees and shrubs. Open and closed canopy oak savannas are the target community type. V3 Companies designed, constructed and is conducting management and monitoring activities on the Hadley Valley Preserve wetland, prairie and stream restoration.

Martin, Katherine L.* and P. Charles Goebel. Possible implications of hemlock woolly adelgid on forest composition and structure in southeastern Ohio hemlock riparian forests. The Ohio State University, Columbus, Ohio. Email: martin.1678@osu.edu

Hemlock woolly adelgid (HWA) is an invasive, exotic insect causing widespread mortality in eastern hemlock (Tsuga canadensis (L.) Carr) forests of the eastern United States. Eastern hemlock is thought to be a foundation species, regulating local ecosystem structure and function (e.g., microclimate, nutrient cycling). Prior to any possible invasions by HWA, we are sampling the vegetation composition and structure of hemlock forests of the unglaciated Allegheny Plateau region of Ohio. This data will provide a baseline for planning and prevention, which may be particularly valuable to a region with a significant tourism and recreation investment in hemlock-dominated ravine systems. Initial analyses indicate that hemlock forest ecosystems in southeastern Ohio may respond to large-scale disturbance associated with HWA differently than models developed for the northeastern United States. In southeast Ohio, eastern hemlock is associated with short, steep slopes or cliffs and does not seem to be limited by aspect. Hemlock is particularly dominant at lower slope positions adjacent to streambeds, where few other woody species are found in either the overstory or sapling layers. Unlike New England and some areas of the southern Appalachians, sweet birch is not a significant forest component in the overstory.
or sapling layers. Rather, species such as red maple and American beech (*Fagus grandifolia* Ehrh.) present in the sapling layer may be more likely to replace hemlock if HWA reaches these forest stands.

Middleton, Elizabeth L.*, James D. Bever, and Peggy A. Schultz. **Does planting method matter? A comparison of two tallgrass prairie restoration methods.** Indiana University, Bloomington, Indiana. Email: ellporte@indiana.edu

The Nature Conservancy owned Efroymson Restoration at Kankakee Sands is the largest prairie restoration in Indiana. Because the area is actively being restored, we were able to ask questions about how the method of restoration affects the resulting prairie plant community. The first method, employed by the Nature Conservancy involves distributing seed over fallow fields. The second method, developed by Drs. Peggy Schultz and Jim Bever involves planting established seedlings as well as seed into a fallow field. These two restoration methods were compared to a naturally colonized post-agricultural field and two prairie remnants. We found that the naturally colonized field is more similar to the restorations than to the remnants. We also found a significant improvement in the restorations’ resemblance to a remnant prairie with the introduction of seedlings. We noted an interaction between native plant diversity and the density of exotic plants in the restoration. As native plant diversity increased, exotic plant density decreased; an unnecessary relationship because exotic plant density is not manipulated in either restoration method. These findings imply that native plant seedlings were able to out-compete exotic seedlings in this restoration site.

Miller, Don*. **Indianapolis Parks land stewardship operations.** Indy Parks and Recreation, Indianapolis, Indiana. Email: dmiller@indygov.org

Indianapolis is certainly a challenging landscape for natural area restoration. Plant species now known to be invasive were commonly planted in Indianapolis parks by the early 1900's. In the mid-1980’s well-meaning wildlife management plans called for planting Amur honeysuckle and Autumn olive. Despite the challenge of invasive plants, Indy Parks has been managing 926 acres of woodlands and high quality forested remnants along with the with planted prairies, reforestation plots, open woods plantings and wetland restorations. The photos depicting the results before, during and after restoration are encouraging given the challenge invasive plants pose. Even though costs for natural area maintenance may seem high to some, they are still lower than traditional grounds maintenance. Plans for expanding the capacity of the Land Stewardship operation are on the horizon as city planners are driven to cut costs and implement strategies for a healthier environment. Of specific interest is the cost savings for managing native plant communities over turf maintenance. This presentation will focus on how we plan and coordinate our invasive species control in the different stages of restoration. The costs of preventive care in natural area maintenance will be highlighted along with the pictures showing transformation of heavily degraded sites. Mapping and tracking are a part of the field and desktop activities. Land Stewardship uses the data for planning and budgeting post-care treatment cycles. The data management is demonstrated through the charts, graphs and maps that are included with the photographic records in the presentation.
Moore, Jesse R.*, Chad Bladow, Mike Everidge, and Fiona Solkowski. **Canebrake restoration at Ohio-Wabash confluence.** The Nature Conservancy, Nashville, Indiana. Email: jesse_moore@tnc.org

The Ohio-Wabash Confluence area, which includes portions of Indiana, Illinois, and Kentucky, is biologically special. It consists of rich bottomland hardwood forests, cypress sloughs, and other wetlands habitats near the northern edge of their ranges in the Midwest. Canebrakes once covered hundreds of acres and supported a wide variety of animal species are missing as a result of agricultural land conversion. A 220-acre agricultural field was purchased by the Conservancy in the confluence area to restore into hardwood forests and canebrakes. An experimental cane planting was established within a larger tree planting in May 2007. Fifty-four large clumps of native cane were obtained from south of the Ohio River in Kentucky and transported to the Indiana site. Once the plants arrived at the site, holes were dug, and they were transplanted. The restoration site is a floodplain adjacent to the Wabash River. To determine what level of the floodplain is best for the plants' survival, we planted the cane in a transect from the high to low elevation. Cane was planted in nine soil types with six clumps of cane placed in each. Due to extensive flooding in 2008, survivorship was low except for the cane that was on the highest parts of the field. Based on what was learned in 2007, we greatly expanded the original cane planting in 2008 with over 300 cane clumps planted. The vision for the site is that it eventually will be bottomland hardwood forest with cane brakes scattered throughout the site.

Reeve, Tom A.* and Philip M. Tevis. **Riparian restoration along the White River in Anderson, Indiana.** FlatLand Resources, LLC, Muncie, Indiana. Email: tomreeve@flatlandresources.com

Riparian restoration is often fettered by flooding, erosion, wildlife, and invasive species introduction. As such, on-the-ground restoration activities can provide much needed insight into the most appropriate methods of restoration. This presentation will chronicle the restoration work that has been occurring at the Riverbend Park and Grandview Golf Course in Anderson, Indiana since 2005. Riverbend Park is a frequently flooded, restored agriculture ground, located on the banks of the White River. This site has had both prairie and woodland restoration activities implemented in the floodplain. Grandview Golf Course is across the river from Riverbend Park. In 2006, a streambank restoration was constructed after concerns over severe erosion on the banks of the 10th hole were raised. Since then, the area has been in active management for planted prairie and restored floodplain woodlands. Both projects have had major difficulties that have called for changes in restoration tactics. Both projects were funded by the White River Fish Kill Settlement from the Guide Corporation.
Retzer, Michael E.*1 and Douglas A. Carney2. **Status of stream restoration projects in Illinois.** 1Institute of Natural Resource Sustainability, University of Illinois, Champaign, Illinois, 2Division of Fisheries, Illinois Department of Natural Resources, Springfield, Illinois. Email: retzer@illinois.edu

Stream restoration is increasing across the United States in an attempt to stop or reverse the decline in the quality of streams. In an attempt to better understand stream restoration in Illinois, we reviewed 272 projects that were completed from 1990 to 2007. Following restoration goals as defined and categorized by the National River Restoration Science Synthesis, we found that the most important goal in Illinois was bank stabilization followed by water quality management and aesthetics/recreation/education. These goals are not exactly the same as those in other Midwestern states or in other regions of the country. Locations of projects in Illinois are not evenly dispersed across Illinois with the Chicago region having the highest number of projects. We estimate that the total expenditure spent over 17 years for 272 Illinois projects was $48,867,988.

Rothrock, Paul E. **Sedges of the Great Lakes region.** Taylor University, Upland, Indiana. Email: plrothroc@taylor.edu

Sedges (family Cyperaceae) comprise approximately 10% of the Great Lakes native flora. They form a significant part of habitat matrix in many high quality wetlands, indicate specific habitat conditions, and are diverse in the wet, mesic, and dry woodland herbaceous layer. Because of the large diversity of sedges and their reputation as technically difficult, land managers, restorationists, and botanists often lack needed skill with this group of grass-like plants. This presentation will review currently available print and electronic resources. A forthcoming book (summer 2009), “Sedges of Indiana: the Non- Carex Species”, will be introduced. The picture-rich volume will treat over 125 sedge species, including identification tips, their ecology, and natural history.

Rowe, Helen Ivy*. **Tricks of the trade: lessons learned From 28,600 hectares of prairie restoration.** Forestry and Natural Resources Department, Purdue University, West Lafayette, Indiana. Email: ivy@purdue.edu

Tallgrass prairie has been severely compromised by conversion to agriculture, making it among the most endangered ecosystems in North America. Expanding remnant tracts with restoration is key to conserving self-sustaining prairie. Although restoration managers rarely have the opportunity to perform large-scale replicated studies, experienced practitioners gain important insights into the effectiveness of management practices over time. By synthesizing expert knowledge, we can identify techniques with a proven record of on-the-ground success. Using two surveys, managers of 39 tallgrass prairie restorations covering 28,600 hectares in 12 states were asked to describe the effectiveness of site preparation, seeding techniques, and management (fire, grazing, mowing) and to list top threats and impediments to restoration. The most effective technique identified for restoring previously tilled land is to initiate glyphosate resistant soybean-corn rotations so that weeds can be controlled prior to native planting. Managers prefer to end on a soybean crop, and plant native species without tilling. In cases with native remnant
vegetation, interseeding techniques are employed, but results indicate improvements are needed. Most managers use high diversity, forb rich, local ecotype seed mixtures. Managers use fire, mowing and grazing primarily to increase native plant diversity. Invasive plants are a major threat to restorations and a majority of managers (67%) devote at least 25% of their total restoration effort on this issue. Economic (land acquisition and labor) and seed availability limitations most constrain restoration management. Increased efficiency of seeding and invasive plant control could help alleviate barriers to restoration.

Salazar, Kara. A., Robert C. Barr, and Lenore P. Tedesco. **Fostering environmental restoration and stewardship through service-learning.** Center for Earth and Environmental Science, Department of Earth Sciences, IUPUI, Indianapolis, Indiana. Email: salazark@iupui.edu

To fully understand environmental subjects it is important to get outside the classroom. To achieve this, several service learning projects were developed by the Center for Earth and Environmental Science (CEES) at IUPUI. Many students have expressed a desire to learn how to actively address some of the problems discussed in environmental science lectures. To meet this desire the University Departments and Schools that teach environmental science courses partner with a number of state and local agencies to provide students with the opportunity to work on applied field projects. A primary partner since 1998 has been the Office of Land Stewardship, Indianapolis Department of Parks and Recreation. Since 1998 CEES scientists and service learning students have collaborated with restoration professionals from the Office of Land Stewardship on natural areas restoration and maintenance at 17 sites throughout the City of Indianapolis. Service learning students return to the sites regularly to maintain and expand earlier work. The projects are tracked online so that students can follow the progress through the years of a project they worked on. Working on these projects provides the students with an opportunity to see firsthand many of the topics discussed in their courses as well as the opportunity to see how a community can work together to solve problems. To date CEES in-kind contributions to environmental restoration in Indianapolis total nearly $4,000,000 and over 20,000 student and staff hours. Here we will discuss the service-learning collaboration with the Office of Land Stewardship and review some significant projects.

Schloesser, Don W. *, Chuck Madenjian, Mike Bur, Ken Krieger, and Fred Soster. **History and early recovery of mayflies (Hexagenia spp.) in western Lake Erie.** 1 U.S. Geological Survey, Great Lakes Science Center, Ann Arbor, Michigan, 2 U.S. Geological Survey, Lake Erie Biological Station, Sandusky, Ohio, 3 Heidelberg University, Tiffin, Ohio, 4 DePauw University, Greencastle, Indiana. Email: dschloesser@usgs.gov

Burrowing mayfly nymphs were abundant in nearshore waters of the Great Lakes in the 1930s. Then, in the mid-1950s, mayflies disappeared from most of the Great Lakes. This pattern is true for western Lake Erie but in 1992, swarms of adult mayflies were observed in open waters and in 1993 nymphs were found in open waters. In 1995-1996, nymphs were present at low densities (ca. 50-130/m2), although adults were so abundant they disrupted electrical power generation and created automobile hazards. Between 1997 and 2005, densities fluctuated between 204 and
539 nymphs/m² which approached historical high densities. At present, annual densities indicate a four-year cyclical pattern of abundance of mayflies. This pattern consists of steady increases followed by a steep decline in abundance. Such a cyclical pattern may indicate the existence of a density-dependent mechanism that, in part, may regulate mayfly abundance. The self-regulating mechanism may be related to densities as well as residual lingering pollution in the basin. Therefore, caution is recommended when evaluating progress toward restoration programs based on monitoring of indicator species in western Lake Erie and possibly elsewhere in the Great Lakes.

Shuey, John A.* Restoration is a strategy, not the goal, at high biodiversity sites. The Nature Conservancy, Indianapolis, Indiana. Email: Jshuey@tnc.org

SER defines restoration as an “attempt to return an ecosystem to its historic trajectory”. Typically, restoration goals are to move highly disturbed sites towards a semblance of natural communities. Common measures of restoration success hinge around measures of botanical community establishment and stability, similarity to reference communities and ecological attributes and services provided by the restoration. Under SER definitions and criteria, the traditional goal of restoration is to improve conditions within the restoration site itself. In contrast, within The Nature Conservancy restoration is generally viewed as a strategy to alleviate stresses that degrade in-situ biodiversity in the vicinity of the restoration. The desired restoration outcome is threat abatement (as opposed to improved restoration-site condition), and restoration success is evaluated based on threat-specific performance criteria. Examples of threats that are commonly abated include reduced habitat size for individual species, fragmentation of ecosystem remnants, hydrologic disruption, altered nutrient dynamics, and increased susceptibility to invasive species. As strategies, we often pursue restoration approaches that maximize the ratio of threat abatement relative to cost, and these efforts could well succeed as strategies, while failing to meet SER’s defined attributes for successful restorations.

Simpson, Barbara E.*1, Lee W. Sterrenburg2, G. Bradley Feaster3, and Daniel R. Luczynski4. Restoration of historic Goose Pond: one of the largest NRCS Wetland Reserve Program restorations has significant impact on migratory birds and presents unique research opportunities. 1 Indiana University Purdue University, Indianapolis, Indiana. 2 Indiana University, Bloomington, Indiana. 3 Indiana Department of Natural Resources, Division of Fish and Wildlife, Linton, Indiana. 4 Natural Resources Conservation Service United States Department of Agriculture, Bloomfield, Indiana. Email: barbsimp@comcast.net

Rarely is there a wetland restoration on a scale large enough to immediately impact migratory bird patterns and wildlife, but that is exactly what is happening at Goose Pond Fish and Wildlife Area. Goose Pond is one of the largest Natural Resources Conservation Service (NRCS) Wetlands Reserve Program (WRP) restorations; 7,138 acres of wetlands, prairies, and bottomland forest. Historically, the land was a shallow glacial basin, an expansive thriving wetland that was cleared and drained for farming beginning in the late 1800’s. The WRP restoration of Goose Pond began in 2000 and will be completed in 2009. The wetland provides a
natural resting site for waterfowl and shorebirds during spring and fall migrations, and a significant nursery for a variety of waterfowl and other wetland-dependent species. Ecological restoration research to date has focused on the response of migratory and resident bird species. Additional research interests include fish and wildlife biological response, water quality, habitat design and function, nutrient cycling, monitoring using remote sensing technology, and socio-economic impact. The uniquely large scale of this restoration presents unprecedented research opportunities to assess restoration methods, management practices, and the magnitude of wildlife and vegetation responses that occur when the habitat is large enough. Academia and citizen scientists play an important role in establishing research programs that the NRCS and DNR are neither funded nor staffed to do. It is important to conduct research and develop a scientific body of knowledge that demonstrates the importance of large-scale restorations such as Goose Pond.

Smiley, Peter C., Jr.*, Kevin W. King, and Norman R. Fausey. Use of unchannelized agricultural streams as a guiding image for restoring agricultural drainage ditches. USDA ARS Soil Drainage Research Unit, Columbus, Ohio. Email: rocky.smiley@ars.usda.gov

Agricultural drainage ditches or channelized headwater streams are a common landscape feature in the midwestern United States. These streams have been channelized and maintained for removal of excess water from agricultural fields without regard for the aquatic biota. The use of pristine forested watersheds as a guiding image for restoring drainage ditches has been perceived as unrealistic. We explored the potential of using unchannelized headwater streams with predominately agricultural landuse in the watershed as the guiding image for restoration of drainage ditches in a central Ohio watershed. We sampled geomorphology, riparian vegetation, hydrology, water chemistry, and fishes in two channelized and two unchannelized headwater streams in the Upper Big Walnut Creek watershed from January 2005 to December 2006. We compared abiotic and biotic characteristics of channelized and unchannelized streams to identify potential restoration strategies. Channelized streams contained greater cross-section area and top bank width than unchannelized streams. Unchannelized streams had a greater density of woody vegetation and woody to herbaceous vegetation ratio than channelized streams. Unchannelized streams had greater water velocity and wet width during baseflow conditions than channelized streams. Loadings of nutrients and pesticides were greater in channelized than unchannelized streams. Channelized streams had a greater percentage minnows (Cyprinidae) and less percentage darters (Percidae) than unchannelized streams. Our results assisted with developing restoration strategies for agricultural drainage ditches that incorporated agricultural land use within the watershed. Additionally, our use of unchannelized headwater streams as a guiding image identified potential goals typically not considered when designing restoration strategies.
The Indiana Co-Trustees entered into a natural resource damage assessment Consent Decree with Waste Management and several other settling defendants in the summer of 2000. As part of this settlement, Waste Management agreed to implement restoration of a 75 acre farm field in the floodplain of the Maumee River, just east of Fort Wayne, Allen County, Indiana. The restoration plan detailed the goals, objectives, and success criteria of the project and the management/implementation plan necessary to accomplish these goals. Monitoring of the reforestation work was required for 5 years. In the first 3 years of monitoring, it was clear that the reforestation efforts had exceeded all criteria relating to survivorship stems per acre, and species diversity per acre. In January 2008, approximately 18 months after the Trustees had certified that the restoration was complete, there was a significant flooding event, followed by several days of extremely cold weather. Floodwaters froze several inches thick in this flood-prone area and significant damage (but not mortality) occurred at the restoration site. An evaluation of the success of this restoration effort and the effects of naturally occurring events will be presented.

John M. Craddock was the founder of the Muncie Bureau of Water Quality and livelong expert on water quality issues. To honor his efforts, a degraded wetland site located in the industrial section of Muncie was donated to become a naturalized outdoor recreation area. The site that now bears his name is involved in a multi-year restoration and enhancement project. The project combines money received from a wetland mitigation project with private grant monies to create a habitat sanctuary and education destination. Included in this project is excavation to benefit wetland hydrology, invasive species control, native plant enhancement, and boardwalk design and construction. This project illustrates how through the use of broad-based partnerships, protection and enhancement of natural areas can happen in any location.

The Lilly ARBOR Project is an experimental riparian restoration project along the White River in downtown Indianapolis, IN. The site has been undergoing ecological restoration since 1999 through the reforestation of 3.2 hectare of riparian corridor along a one kilometer reach of a highly engineered urban stream. The experiment is designed to test the relative success of three
commonly utilized reforestation strategies: a) three gallon containerized stock planted in a grid; b) bare-root stock planted along random tracks; and c) bare-root stock planted in rows with weed control strategies (3’ X 3’ geotextile mats and Canada wild rye (*Elymus canadensis*) planted as a cover crop). A total of 1332 trees were planted with two acres planted in each style. Two additional acres are unplanted control plots. The 12 tree species selected for planting were derived from historical floodplain composition studies and included those native species whose geographic range occurs within the riparian forests of the Tipton Till Plain Natural Region of central Indiana. Site preparation included treating mowed turf grass with glyphosate (Rodeo™).

All plantings utilized the same species composition, 12’ spacing, similar numbers of each species, and between 204 and 240 trees per plot. Tree species were randomly distributed throughout plots to determine whether hydroperiod had an impact on either species or planting style. Here we present the results of 10 years of regular monitoring.

Thrash, Joel P.*, Michael L. Adams¹, and Michael Enright². **Innovative wetland restoration techniques in an urban metropark - Woodman Fen, Dayton, Ohio.** ¹ JFNew, Cincinnati, Ohio. ² Five Rivers MetroParks (FRMP), Dayton, Ohio. Email: jthrash@jfnew.com.

The Woodman Fen Restoration Project is an unprecedented example of public and private partners joining in the restoration of a rare alkaline fen in southwest Ohio. Prior to Clean Ohio Fund acquisition in 2004, Woodman Fen had been severely impacted by private residential dumping, subsurface drainage manipulations, and overgrown exotic vegetation. To accomplish restoration at the 38-acre site, JFNew and FRMP assembled an interdisciplinary team to develop holistic restoration plans. The primary objective was to restore natural fen hydrology by working with, not against, numerous site constraints. The innovative design/build solution involved installation of a unique groundwater interception wall extending eight feet below and 1,150 linear feet around the perimeter of the fen. The resulting challenge was to establish native communities appropriate to restored water depths. This was met by three methods of invasive species control and an extraordinary seed collection and amplification effort whereby 120 locally native and historic fen species were identified and harvested from State Nature Preserves with permits by JFNew botanists. Through local genotype seed collection efforts and plant plug amplification, JFNew Nursery and restoration teams were able to collect and post-process over 80 pounds of locally native, highly conservative wetland seed and 6,500 amplified plugs for the restoration effort. Seed was installed in winter 2008 using clay-encapsulated seed methodologies. Continued data collection, monitoring and maintenance will be performed by FRMP and JFNew to evaluate project success. Future plans include amphibian translocation, educational programming, trail systems, and converting the urban oasis into an award-winning MetroPark.
Tungesvick, Kevin*¹ and John Shuey*². **Hydrologic and plant community restoration at Prairie Border South.** ¹ Spence Restoration Nursery, Muncie, Indiana. ² The Nature Conservancy, Indianapolis, Indiana. Email: kevin@spencenursery.com

The Prairie Border South property consists of 320 acres of sand savanna, restored prairie, and wetland situated in Jasper County, Indiana. The adjacent Jasper-Pulaski Fish and Wildlife Area and other Prairie Border tracts form one of the richest botanical sites in the state. Further, they are home the numerous rare plants and animals, including many disjunct species from the Atlantic coastal plain. The Nature Conservancy wished to enlarge this habitat by restoring the agricultural fields to prairie and wetland. The restoration was designed to recreate habitats for these rare organisms that prefer sandy wetlands with fluctuating water tables. The property was enrolled in the Wetland Reserve Program administered by the Natural Resources Conservation Service which provides funds for both hydrologic and botanical restoration. The agricultural fields had been drained by an extensive network of ditches. The main ditch channel was reconstructed into a meandering, slow flowing wetland with a water control structure. Other ditches were filled or re-sculpted to create a complex pattern of shallow wetland depressions. Following hydrologic restoration, Spence Restoration Nursery provided three local genotype seed mixes, for wet, mesic, and dry prairie to reestablish the native plant communities in these fields. Establishment has been excellent with nearly every species in the seed mix appearing in the restoration. Further, conservative plant species have began to appear in substantial number from the seed bank or dispersal. Grassland birds and amphibians have also quickly colonized the site.

Umek, Lauren G.* and Liam Heneghan. **Integrating soil ecological knowledge into restoration practice: a case study for restoration following invasion by Rhamnus cathartica.** DePaul University, Chicago, Illinois. Email: lume@depaul.edu

European buckthorn (*Rhamnus cathartica*) invades woodlands and forests in the Northeast and upper Midwest of the US. Once established, this large shrub often forms dense thickets and significantly diminishes native plant species diversity. Ecosystems inundated with buckthorn are associated with elevated soil N, altered ecosystem processes (accelerated decomposition and nutrient cycling) and greatly modified soil food webs and these effects persist following buckthorn removal. We hypothesize that successful prevention of buckthorn re-invasion and restoration of native plant communities will be promoted by reducing buckthorn’s legacy effect of elevated soil N by employing management techniques that reduce soil N concentrations after buckthorn removal. We report results from a field–scale experiment conducted in a heavy invaded old-field site in Mettawa, Illinois, examining several best management and novel management strategies on ecosystem processes and vegetation outcomes. Our results indicate that reinvasion by *R. cathartica* was significantly reduced when woody mulch (using mulch composed of *R. cathartica* wood, or a commercially available mulch) was incorporated into the soil. Mulch incorporation also resulted in higher decomposition rates, higher earthworm populations and lower primary productivity of the first year vegetation. Bioavailable plant nutrient supply rates, measured using PRSTM-probes were altered in all treatments. Plant diversity was not significantly different in any of the restoration treatments. This work is
discussed in the context of more general efforts to incorporate soil ecological knowledge into restoration practice.

Vogelsang, Keith M.*  **Stockpiling topsoil for use in restoring a coastal sage habitat: are there limits to mycorrhizal inoculation?**  Indiana University, Bloomington, Indiana.  Email: kvogelsa@indiana.edu

Topsoil is essential to the structure and functioning of terrestrial habitats. Thus, reapplying mined topsoil is recognized as an important restoration practice following construction and mining activities. In a two-year field study using salvaged topsoil from a native coastal sage/scrub habitat in San Mateo county California, soil aggregate stability declined and bulk density decreased under test conditions. Live and sterile forms of a commercially available soil inoculant containing arbuscular mycorrhizal fungi (AMF) and a soil erosion seed mix were set as levels within a two-way restoration experiment consisting of 20 stockpiles of sandy loam topsoil. One year after treatment implementation, aggregate stability remained in a degraded state and was significantly lower in plots receiving live amendments. These same live amendment plots also exhibited lower soil bulk density. After this first year, AMF-induced benefits were significant for total plant productivity in all plots receiving live AMF. The plots were re-disturbed after this one year conditioning period to test the performance of seeded native species. All native species improved slightly (but not significantly) in response to the previous year’s AMF amendment, and two of the native species responded positively (but not significantly) to the previous year’s seed amendment. AMF-induced growth benefits were greatly reduced in the second year. The legumes and one native shrub (*Eriophyllum confertiflorum*) exhibited significant growth suppression from the seed amendment. These results suggest the physical condition and the plant community composition of topsoil during storage is highly sensitive to management.

Wodrich, Carl J.¹ and Michael J. Tosick².  **Restoring the White River: progress through partnerships.**  ¹Indiana Department of Natural Resource, Indianapolis, Indiana.  ²Department of Interior – U. S. Fish & Wildlife Service.  Email: cwodrich@dnr.in.gov

Fifty seven miles of river were impacted by the release by Guide Corporation in December 1999 killing an estimated 180 tons of fish. As a result of the fish kill, Guide Corp. settled with the United States of America and the State of Indiana for $14 million. The natural resources damage claim in the settlement in the amount of $6 million was to be used to, “conduct or finance restoration projects designed to restore, replace, or protect natural resources in the White River Area, or natural resources equivalent to the resources that have been injured in the White River area of impact, and to defray administrative costs and expenses associated with the selection and performance of restoration projects” as stated in the Consent Decree which was reached in June 2001. A Citizen’s Advisory Council was set up per the consent decree to advise the Natural Resource Trustees on selection and implementation of restoration projects. In order for the trustees to accomplish their restoration goals outlined in the restoration plan, the Trustee agencies partnered with a variety of local project partners on various projects to restore, replace and/or protect the injured resources and their services to the public.
In a study funded by U. S. Steel Corporation, the purple loosestrife (Lythrum salicaria) biocontrol agents Galerucella calmariensis (a leaf-feeding beetle) and Hylobius transversovittatus (a root-mining weevil) were released at four wetland sites along the Grand Calumet River in Gary, Indiana in 2004. The goal was to have the sites colonized by the biocontrol agents within five to seven years of release. Success criteria for the sites included a general trend over a five-year monitoring period of decreasing percent cover and increasing percent defoliation of purple loosestrife, and successful establishment of G. calmariensis at each release site at the end of five years (2009). Monitoring of introduced insect populations and purple loosestrife response has occurred annually since 2005. All life stages of beetles and weevils are counted each spring, and parameters used to assess purple loosestrife performance and reproductive success are measured each summer. Results were inconsistent across the four sites until 2008, when populations of G. calmariensis increased substantially at all sites and leaf damage on purple loosestrife plants increased substantially at three of the sites. Root damage that was likely a result of H. transversovittatus feeding has also been noted. We believe that G. calmariensis has now been successfully established at the sites and anticipate documenting increasing leaf damage and decreasing cover of purple loosestrife in 2009.

Fort Custer Training Center (FCTC) conducted prescription burning to restore woodlands, savanna and prairie habitats in several management units as part of an integrated resource management plan. DLZ Michigan, Inc. (DLZ) supported the effort by producing the resource management plans, an Integrated Wildland Fire Management Plan (IWFMP) as well as providing prescription burn services to support the landscape restoration activities. Over the past six years, DLZ conducted prescription burns in addition to baseline floristic inventories and post burn monitoring of the management units. Prescribed fire was used to control invasive exotic species and to reintroduce fire as an ecological influence in the conservative habitats. In 2006 FCTC expanded the burn program to all training areas to capitalize on fire effects that promote the training functions of the facility. Control of multiflora rose and general thinning of woody undergrowth supports land navigation and other military training in the maneuver areas. Landscape scale management units were designed to capitalize on transitional effects of fire between habitat types. Post burn monitoring indicated the target habitats responded well to the effects of burning. Grass species flourished and summer flowering forbs also displayed vigorous growth. Where fire pushed into oak savannas, rank sapling growth was reduced, exotic woody growth was controlled and savanna forbs responded positively to the increase of light at the herb layer. Successive burns will be required to counter the previous long period of fire cessation.
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