1997 Project Abstract
For the Period Ending June 30, 1999
This project was supported by the MN Future Resources Fund (MS 116P.13)

TITLE: Wetland Ecosystems Monitoring
PROJECT MANAGER: Susan M. Galatowitsch
ORGANIZATION: University of Minnesota, Departments of Landscape Architecture and Horticultural Science
LEGAL CITATION: ML 1997, Chap. 216, Sec. 15, Subd. 14(e).
APPROPRIATION AMOUNT: $160,000

Statement of Objectives

Wetland restoration success is affected by which prescriptions are chosen for hydrologic modifications and revegetation and how effectively implementation occurs. While the importance of proper planning and implementation to wetland ecosystem recovery is generally understood, specific information of how to improve restoration practices (design, revegetation, maintenance) to maximize success is lacking. This study addressed two major aspects of this issue: (1) To what extent does revegetation stimulate overall ecosystem recovery in restored wetlands? And (2) How do the habits and expectations of those responsible for restoring and maintainng wetlands and of the neighboring pbulic affect recovery? Wetland restoration success was evaluated on 7 wetlands currently being restored and compared to 4 reference wetlands.

Overall Project Results

Revegetation success of planted sites ranged from 25% (West Phalen) to 64% (Spring Peeper), based on planted species observed the year following planting. In general, floristic diversity of planted sites was greater than unplanted sites. Planted sites were considered to be more attractice than unplanted restorations in all comparisons. In addition, wetlands that were designed to make a place for people to walk through and sit were perceived as more attractive than those that did not. Soil temperatures of both planted and unplanted restorations were consistently higher than reference sites, especially in the spring. These temperature differences were large enough that they could alter seed germination, invertebrate emergence, and nutrient cycling. Water chemistry analysis suggests that restorations near roads (Botker, Spring Peeper) are receiving high salt loads. The water level fluctuations recorded during the first year after construction indicate that most sites included in the study have a hydrologic regime comparable to reference wetlands. West Phalen is an exception, frequently experienceing extreme water level fluctuations (greater than 1 m). Among restored wetlands, breeding bird diversity was highest at Carpenter, Botker, and Big Dog and lowest at West and East Phalen. Amphibian diversity was highest at Spring Peeper and Carpenter restored wetlands and lowest at East and West Phalen. Control of invasive species is the most intensive management issue facing all wetlands studied. Management strategies differ markedly among sites, with some under the stewardship of a single individual and others with no staff specifically assigned this role. Sustaining and improving conditions will likely be contingent on the level of ownership and commitment of managers and administrators.

Project Results Use and Dissemination

The long-term monitoring methods were developed in coordination with staff from the Minnesota Department of Transportation, Minnesota Board of Water and Soil Resources, and the U.S. Fish and Wildlife Service. A copy of the full report is being provided to these cooperators and to others who request it. We also anticipate making this information available on the web.

Date of Report: July 1, 1999

LCMR Final Work Program Update Report

I. PROJECT TITLE: Wetland Ecosystems Monitoring
Project Manager: Susan M. Galatowitsch
Affiliation: University of Minnesota, Departments of Landscape Architecture and Horticultural Science
Mailing Address: 305 Alderman Hall, St. Paul, Minnesota 55108
Telephone Number: 612-624-3242
E-mail: galat001@maroon.tc.umn.edu Fax: 612-624-4941

Total Biennial Project Budget:

$LCMR:	$160,000
-$LCMR spent	$160,000
=$LCMR Balance	0

A. Legal Citation: ML 1997, Chap. 216, Sec. 15, Subd. 14(e).
Appropriation Language: WETLAND ECOSYSTEMS MONITORING.
This appropriation is from the future resources fund to the University of Minnesota to monitor wetland restorations for their ecological success and develop a long-term monitoring database.

B. Status of Match Requirement: No match is required for this project.

II. PROJECT SUMMARY AND RESULTS

Wetland restoration success is affected by which prescriptions are chosen for hydrologic modifications and revegetation and how effectively implementation occurs. While the importance of proper planning and implementation to wetland ecosystem recovery is generally understood, specific information on how to improve restoration practices (design, revegetation, maintenance) to maximize success is lacking. This study addressed two major aspects of this issue: (1) To what extent does revegetation stimulate overall ecosystem recovery in restored wetlands? and (2) How do the habits and expectations of those responsible for restoring and maintaining wetlands and of the neighboring public affect ecosytem recovery? Wetland restoration success was evaluated on 7 wetlands currently being restored and compared to 4 reference wetlands. Aspects of ecosystem function and structure were used to characterize recovery. Plants, birds, fish, and amphibians were used to track ecosystem structure; water chemistry was the primary measure of ecosystem function. Descriptors of landscape maintenance and indices of perception were used to characterize cultural challenges to ecosystem recovery. We now have a long-term monitoring system in place that is being implemented for the assessment of ecosystem recovery.

III. PROGRESS SUMMARY

The following was accomplished during the 24 months of the project. Details of each of these activities can be found in the attached report:

- Eleven wetlands were selected for monitoring activities. Four are natural reference wetlands, four are unplanted wetland restorations, and three are planted wetlands restorations.
- Planting lists were developed and wetland plantings implemented for revegetation sites.
- The topography of each site was mapped and each site was instrumented with groundwater wells and transect poles for repeated surveying of soil, water, vegetation, and animals.
- Methods were developed for collecting field data and monitoring biological and cultural communities.
- Data on initial recovery of amphibians, birds, and vegetation was collected and summarized to make comparisons.
- Data on soil and water composition was collected and summarized to make comparisons.
- Data on cultural preferences was collected from visitors, administrators, managers and neighbors of each wetlands. Data was summarized.
- Coordination of long-term monitoring of these wetlands was arranged with the Minnesota Department of Transportation.
- Information from this project was presented to staffs of the USFWS and Mn/DOT.
- Information from this project was presented at the American Society of Limnology and Oceanography/Ecological Society of America meeting in St. Louis, MO.
- All information gathered in this initial phase of monitoring was compiled into a guidebook that describes methods in detail, provides site descriptions, and synthesizes all data collected.

The monitoring plan that we are implementing entails collecting some biological and cultural data annually. Every fifth year we plan to sample more intensively and to synthesize results from the previous years. The University of Minnesota and Mn/DOT will cooperatively accomplish the annual monitoring. We anticipate jointly pursuing additional funding every fifth year for the additional data collection and analysis.

IV. OUTLINE OF PROJECT RESULTS:

Result 1. The eleven wetlands to be evaluated include six in the Minneapolis-St. Paul metropolitan area and five in agricultural areas of southern and western Minnesota. Four of the twelve wetlands will serve as reference sites, the remainder are restored wetlands. Three of the restored wetlands have been planted and four have not (only hydrologic modifications). Three of the eight wetlands are being restored as part of 1995-1997 LCMR projects (Phalen, Arboretum) and the remaining four are being restored by private landowners, the US Fish and Wildlife Service, and the Minnesota Department of Transportation for mitigation banking. Three of eight wetlands have been designed to include public use. During the two years of the project, bioassessment monitoring was conducted to gauge initial recovery. Based on the biological monitoring, methods were developed to allow for efficient long-term data collection. The success of these wetland restoration based on cultural indicators was also assessed using survey devices developed in previous landscape perception research (Nassauer 1979, 1988, 1989, 1995).

Budget:	$135,000	Balance:	$0
Complete:	June 1999		

Result 2. The monitoring results of this project wer interpreted and presented to the scientific and planning professional communities. In addition, to monitor long-term ecological recovery and to establish how our proposed cultural-biological framework performs as sites mature, data bases were created. Finally, results and the nature of the data base were conveyed in field demonstrations for local and state agency staff.

Budget:	$25,000	Balance:	$0
Complete:	June 1999		

V. DISSEMINATION: Results will be disseminated by a data base established as a Web site and also in a field demonstration event for local and state agency staff.

VI. CONTEXT:

A. Significance: The uncertain relationship between cultural values and ecosystem function has long been an impediment to wetland assessment. Past attempts (e.g., those forwarded by the U.S. Army Corp of Engineers and the Environmental Protection Agency) to combine these two important aspects have yielded confusing interpretations of how best to design wetland mitigations. Often, the resulting wetlands lack the ecological character of the natural wetlands they were designed to replace. This project will attempt to develop a more meaningful framework to combine cultural and biological indicators for wetland decision making.

Since both cultural and biological monitoring will happen during the critical site installation phase of these wetland restorations, we have an ideal opportunity to establish how initial implementation decisions affect long-term wetland recovery. Monitoring restored wetlands immediately after installation provides essential baseline data for long-term monitoring. In particular, this project represents the first test of biological indicators as a way to measure ecological recovery. We will learn how effective these indicators are for determining the extent to which restored wetlands are adequate replacements for natural wetlands in the landscape. The data base developed in this project can be used for decades to build a unique analysis of constructed or restored wetland biological function and cultural sustainability. A long-term perspective of wetland recovery is necessary for understanding how and when functions linked to complex vegetation and soil development re-establishes.

Although the recovery of these sites will take decades, many limitations to restoration success are evident immediately after project installation. Not all plants establish successfully and hydrology is often predicted incorrectly. In addition, decisions related to basin construction and installation scheduling can often result in changes to the original design. Plants necessary for habitat integrity may need to be added after the first year and the hydrologic regime may need to be refined. Pairing of biological and cultural indicators is essential for interpreting restored wetland condition because human behavior (e.g., mowing, weed removal, aesthetic improvement) greatly influences whether wetlands survive in urban or agricultural landscapes. Biologically successful wetlands are often compromised or destroyed when people perceive them as unattractive and employ misguided designs to 'improve' them. This project will identify what works both culturally and biologically. Using both biological and cultural indicators to adjust restorations is a precedent setting collaborative effort. Using biological indicators to affect cultural adjustments allows ecological knowledge to make healthy landscapes. Using cultural indicators pragmatically incorporates what people want and how people behave in the ecosystems of urban and rural landscapes.

B. Time: All proposed activities will occur over the two year period of funding. Long-term monitoring would ideally extend over decades. Both investigators believe that the two year data base will be a strong factor in receiving long-term funding from more traditional scientific research sources. Both are committed to participating in such long-term research.

C. Budget Context: This project will monitor three wetlands constructed with LCMR assistance in 1995-1997. Those projects were:

Arboretum Model Wetland Demonstration Project:	$680,000
Wetland Restoration and Enhancement to Create Community Amenity and Form	$200,000

Ecoogical indicators were developed in:

Assessing Wetland Quality with Ecological Indicators	$275,000

Non LCMR Budget History:

Minnehaha Creek Watershed District (Arboretum)	$250,000
Metropolitan Council (N. St. Paul)	$100,000
MN DNR (N.St. Paul)	$ 40,000
MN PCA (N. St. Paul)	$ 35,000
MN Department of Transportation (southern Minnesota sites)	$ 65,000

BUDGET: See attached table.

VII. COOPERATION

Cooperators include:
J. Nassauer, University of Michigan
B. Kovach, Minnesota Department of Transportation
P. Olin, Minnesota Landscape Arboretum

VIII. LOCATION

Two of the restorations are located in the Big Woods, two are in the St. Croix Moraine and Outwash Plains, two are in the Oak Savannah, and two are in the Minnesota River Prairie ecoregion subsections.

IX. REPORTING REQUIREMENTS. Periodic work program progress reports will be submitted not later than January 1998 and January 1999. A final work program report and associated products will be submitted by June 30, 1999.