WETLAND MATTERS

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TWI TO PLAN WETLAND RESTORATION AT FORMER JOLIET ARSENAL SITE

Where army explosives were once manufactured and stored will someday be the site of a prairie park of national significance, called the Midewin National Tallgrass Prairie near Joliet, Illinois. The Wetlands Initiative (TWI) is part of the team working to develop the wetland restoration plan for the 19,000-acre Midewin site.

Working with the U.S. Forest Service, Illinois Department of Natural Resources, and others, TWI is developing a wetland restoration plan that will include enhancement of existing wetlands and restoration of what once were wetlands. Special attention will be given to a recovery plan for the wet dolomitic prairie on the site. Midewin has some of the most extensive examples of this extremely rare ecosystem in North America, making its recovery a high priority.

In February 1996, President Clinton signed the Illinois Land Conservation Act of 1995, creating the first federally-designated tallgrass prairie on the site of the former U.S. Army Joliet Arsenal. Over the decades that the army used the site, the landscape was modified substantially to accommodate the construction and operation of the explosives plant and storage of the plant's output. In addition, the site had been extensively farmed and heavily grazed, even during the operation of the munitions plant. Consequently, few, if any, of the native plant communities remain intact.

A considerable amount of information has been compiled about the site already. The Natural Resources Conservation Service, U.S. Fish and Wildlife Service, Illinois Department of Natural Resources, Openlands Project, and The Conservation Fund have worked together to incorporate into a geographical information system (GIS) soil surveys, farm drainage tile surveys, ecological inventories of the three perennial streams, and biotic inventories of the extant flora and fauna. TWI will build upon this database to provide the U.S. Forest Service with a plan to restore the wetlands of Midewin.

In order to identify where hydrologic and botanical restoration would be most appropriate, TWI will prepare a report that describes plant/soil associations, and characterizes the plant communities, their distributions, and their hydrologic needs. Describing the specific plant/soil associations for the various plant communities also will provide the information necessary to reintroduce federally- and state-listed species, as well as other species of concern.

It is estimated that prior to European settlement, upwards of 75 percent of the Midewin landscape was in wetland communities, such as sedge meadows, wet and wet-mesic tallgrass prairie, sloughs, marshes, and wet and wet-mesic dolomite prairie.

The National Biological Service has identified the tallgrass prairie as the North American continent's most endangered ecosystem.

In Illinois, less than .07 percent of the presettlement tallgrass prairie ecosystem exists today. Further, 97 percent of the state's presettlement wetlands have been lost.

Situated at the confluence of the Kankakee and Des Plaines rivers—forming the Illinois River—the Midewin National Tallgrass Prairie provides habitat for significant populations of bobolink, upland sandpiper, grasshopper sparrow, sora, king and Virginia rails, loggerhead shrike, Bell's vireo, Henslow's sparrow, and Blanding's turtle. The restoration of 10,500 acres—currently in row crop production—and the subsequent restoration of 6,500 acres of grassland to native prairie and wetland will create a continentally-significant resource.

Within the tallgrass prairie ecosystem, wet dolomitic prairie stands out as the "rarest of the rare." For this reason, special attention will be given to identifying locations for its restoration. Working with Midewin staff, The Wetlands Initiative will identify four 10- to 20-acre parcels for study, and a series of transects will be established for each. A complete plant species list will be compiled based on field surveys throughout the summer and fall. Depth-of-soil-to-bedrock and the soil's physical features (morphology) will be observed and classified. Soils will be dried and analyzed for chemical properties. Depth-to-free-standing water will be surveyed throughout the growing season. These data, along with topographic and anthropogenic disturbance information, will be analyzed and appropriate sites for dolomitic prairie restoration will be identified, mapped, and ranked.

The restoration of the many wetland communities associated with the tallgrass prairie ecosystem is predicated on the restoration of the ecosystem's hydrology. The restoration plan will include several alternatives based on the ability to restore hydrology and mitigate previous land uses. TWI also will develop an ecologically-based management program to support the restoration plan and a monitoring protocol to determine the success of management activities.

FOR THE FIRST TIME, PEOPLE WILL HAVE AN OPPORTUNITY TO VIEW THE LANDSCAPE OF THE MIDWEST ON A SCALE ONLY EXPERIENCED BY THE EARLY SETTLERS AND TO RE-ESTABLISH A SENSE OF CONNECTEDNESS TO THEIR NATURAL HERITAGE.

TWI will work with Midewin staff, as well as other agency partners, in an iterative process of review to ensure that project objectives are met. As the planning process develops, the public will be invited to evaluate the proposed management prescriptions, standards, and guidelines. Finally, as the land management practices are employed and the monitoring protocol implemented, the emerging results will be judged by the quality of the habitat restored.

Midewin National Tallgrass Prairie will provide a unique recreational and educational experience. For the first time, people will have an opportunity to view the landscape of the Midwest on a scale only experienced by the early settlers and, in the process, re-establish a sense of connectedness to their natural heritage. Midewin will illustrate how nature and people can work together for the benefit of both.

Prairie Creek, a tributary of the Kankakee River, cuts through the former Joliet Arsenal, site of the future Midewin National Tallgrass Prairie which will include restoration of 17,000 acres of grassland and row crops to native prairie and wetland.

TWI Researches Floodplain Formation, Soils, Carp, and Trees

Since its founding in 1994, TWI has included research as one of its highest priorities. Our studies focus on how wetlands were formed, what factors are critical to their successful restoration, and how threats to their long-term survival can be minimized.

This issue of *Wetland Matters* focuses on four areas of research currently underway by TWI and its partners. Specifically, the research looks at:

- How floodplains and wetlands were formed and how beaver functioned as geomorphological agents before European settlement;
- How combining soil maps and historic natural area survey data can increase the success of selecting vegetation for restoration and creation projects;
- How to keep carp from disrupting stream and lake bottoms;
- How root-pruned oak seedlings are suitable for planting in floodplains because of their flood tolerance and fast-growing characteristics.

Floodplain Formation

If scientists and engineers expect to develop effective watershed management strategies for the future, they need to look to the past. Fundamental to the failure of past policy has been the lack of basic understanding of how our river systems were formed and, as a result, how they functioned prior to European settlement. Some preliminary evidence has already been uncovered to show that beavers were a primary geomorphological agent forming the floodplains and river

systems prior to European settlement.

Working with Wetlands Research, Inc., The Wetlands Initiative is conducting research to develop a reliable theory of stream formation, based on the hypothesis that beaver ponds were one of the primary control structures throughout the North American drainage system.

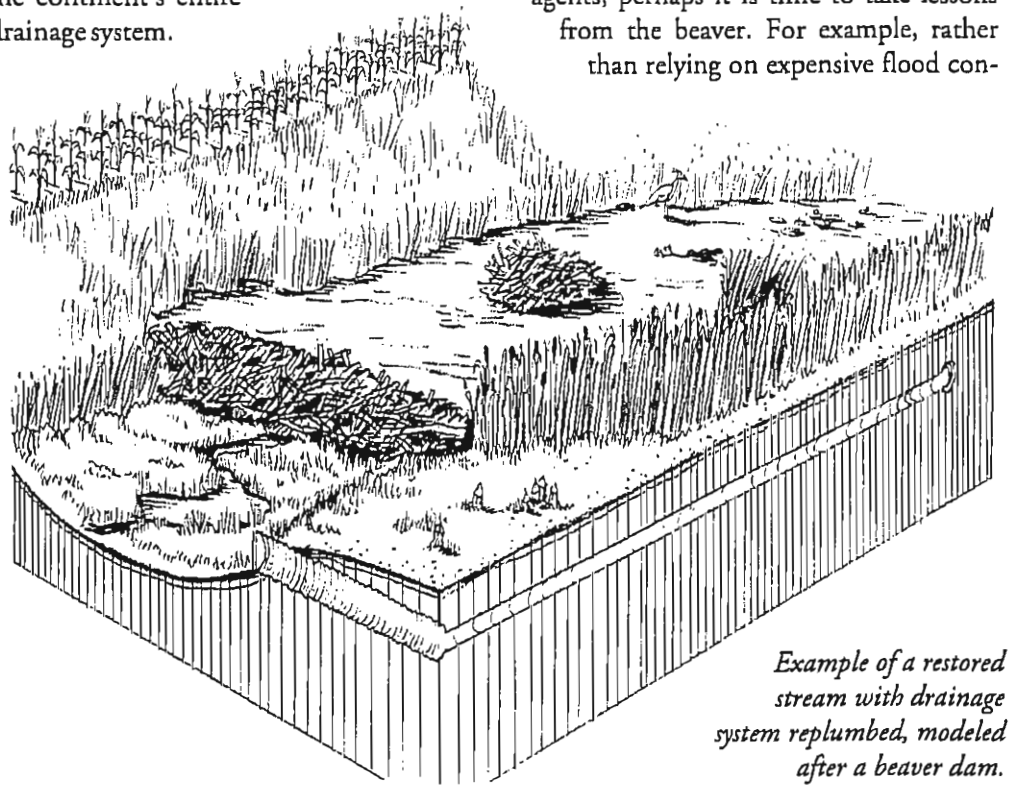
Two geomorphologists first suggested this theory in 1938, based on studies in the Adirondack Mountains. They noted that the generally accepted theory of stream formation was not consistent with reality: neither glacial lakes nor meandering streams could explain the longitudinal, stair-stepped profiles of floodplains nor their flat cross-sections. They concluded that beaver were responsible for these landscape characteristics.

Long before Europeans settled this continent, beaver ranged from the Arctic Circle to the Rio Grande, damming smaller stream valleys every 400 to 500 feet. Given the 10,000- to 12,000-year span of their work, there was adequate time for beaver to shape the continent's entire drainage system. Beaver would have exerted complete hydrologic control over the upper watershed of the Mississippi River.

From the mid-1600s to the mid-1800s, however, nearly 99 percent of the beaver population was eliminated. By 1843, the beaver was essentially non-existent in Illinois.

The ramifications of this shift from beaver to human population are still evident today. Rivers no longer meander, slowing at the frequent wide ponds and dams formed by the beaver. Rather, humans have deepened channels, increasing sediment and nutrient loads, and decreasing habitat for fish and wildlife populations. Flood flows have increased; base flows have decreased; and the entire stream system of North America has become less stable.

For the past 150 years, human attempts to control nature using purely textbook civil engineering techniques—dams, levees, channels—have missed their mark. If humans are going to continue to be geomorphological agents, perhaps it is time to take lessons from the beaver. For example, rather than relying on expensive flood con-



Example of a restored stream with drainage system replumbed, modeled after a beaver dam.

trol structures (e.g., dams, levees and reservoirs), small scale ponds—emulating the work of the beaver—could store as much floodwater as is now currently contained in The Army Corps of Engineers' reservoirs throughout the upper Mississippi basin.

To expand on this theory of stream formation, TWI has supported archeological and pedological research at several locations where ancient beaver dams may have existed along the Des Plaines River in northeastern Illinois. Core samples from these areas already suggest a high probability that these sites—rich in organic deposits—were formed by beaver dams.

Soil Research

By combining historic information about the vegetation of an area with current soil data, scientists are able to uncover what plant communities can successfully be reintroduced in the creation or restoration of prairie, wetland, or other native environments. TWI's research looks at how soil maps can be combined with natural area survey data to assist scientists in constructing historic plant communities.

Soil maps are based on the U.S. soil classification system, which uses diagnostic horizons that incorporate characteristics of vegetative imprint. For example, soils that formed under grass, called Mollisols, are classified differently from those that formed under trees, called Alfisols. Transitional soils between vegetation types are also classified. Each closely related grouping of soil individuals, called a series, must have certain physical and chemical parameters in order to be classified and named. Some of those most important for plants include: texture of the topsoil (A horizon) and subsoil (B horizon), climate (average annual temperature and rainfall), drainage class, and pH range (calcareous or acidic).

Similarly, the location, extent, and type of native plant communities have been mapped based on both current field data and on data from the Illinois Natural Area Inventory. Additional information regarding species and distribution was available from the 19th century General Land Office Survey plats and field notes.

Given the 10,000- to 12,000-year span of their work, there was adequate time for beaver to shape the continent's entire drainage system.

Using a geographic information system (GIS), the vegetation map was superimposed on the U.S. Natural Resources Conservation Service (NRCS) county soil survey map at the same scale. Field truth was done on a selected sample or portion of the identified reference sites. From this analysis, it was determined that specific soil classifications support certain limited classes or communities of vegetation within certain ecological zone or land types. It was then possible to generalize to a larger area or region using the soil taxonomic classification as a guide.

For example, we have determined that poorly drained Mollisols (Aquolls) support a range of sedge meadow or wet prairie vegetation. Therefore, we can recommend specific species be planted on similar soils. The GIS database would be useful for developing criteria to guide restoration and creation of native environments. This database should increase the chances of successful restoration and creation projects. The results of this study will be critical in designing restoration plans at the Midewin National Tallgrass Prairie.

Carp Research

The common carp, once a boon for commercial and sports fishermen, has become the bane of the modern water resource manager. The carp *(Cyprimus carpio)* was introduced to the United States from Europe in the late 19th century and now has firmly established itself as a serious detriment to the health of our nation's warm water lakes and rivers.

The fish feed by dredging bottom sediments and eating exposed invertebrates or detrites and by rooting through aquatic plants and eating hidden eggs or the plants themselves. These disruptive feeding habits stir up the sediment, producing muddy waters. As a result, growth of aquatic plants is inhibited and feeding opportunities for sight-feeding game fish (potential carp predators) are reduced. Phytoplankton populations can explode, causing algae blooms, which further reduce water clarity. This adds additional stress to an already highly-disturbed system. Where conditions are favorable, the species has become dominant because of high fecundity, omnivorous feeding habits, and high growth rates.

As a result, considerable attention has been given to economically and environmentally effective ways to control the common carp. The Wetlands Initiative, Wetlands Research, Inc. (WRI) and the Max McGraw Wildlife Foundation have been working together to find solutions to this problem.

WRI has used a degradable mesh which, when installed on stream and lake bottoms, appears to effectively offset the effects of carp. For example, a 1990 study showed that 2.5 cm mesh anchored to the streambed not only increased the number of game fish present in the stream, but increased the density of the macroinvertebrate community (Figure 1). These organisms are a vital link in the food web, provding food for forage fish which could be natural predators for carp. The mesh protected the small animals—including mayflies, caddis flies, and damsel flies—from predators and the force of moving water.

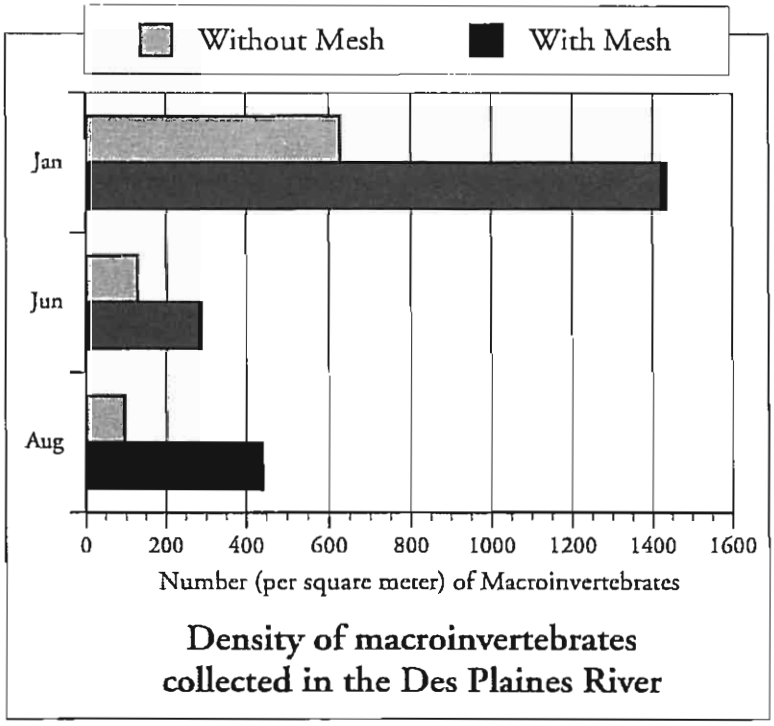
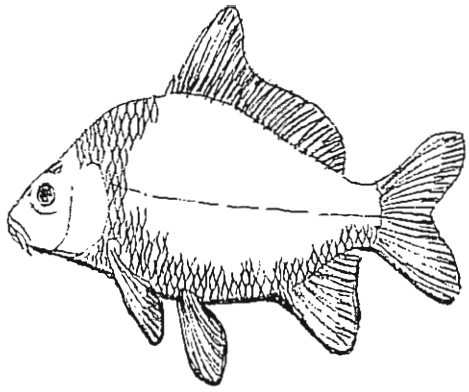


FIGURE 1. In an earlier study, the stream reaches of the Des Plaines River, Illinois, that were treated with mesh anchored to the stream bottom showed increased growth of macroinvertebrates. The presence of these organisms improved the habitat for fish.

Source: Anderson, R.V. 1996. Effects of streambed modification on stream quality and carp in Des Plaines River, Wetlands Research, Inc.



Common carp

Swamp white oak

Last year, TWI worked with the Max McGraw Wildlife Foundation to study whether the mesh adversely affects the survival and movement of unioned mussels. This year, the research will attempt to quantify the effects of common carp on nutrients, phytoplankton, zooplankton, macrophytic plants, macroinvertebrates, and turbidity. Also, research will study the effectiveness of the mesh covering to protect macrophytes in aquatic systems affected by common carp. The mesh could prove to be a cost-effective way to improve habitat for game fish, waterfowl, and other aquatic-dependent species.

Tree Research

The bottomland hardwood forests in the Mississippi River basin suffered major losses during the 1993 floods. Botanists who work to reintroduce trees to these and other floodplains that have suffered catastrophic flood events must choose hardy, fast-growing species. Therefore, The Wetlands Initiative is studying what species demonstrate fast growth rates and flood tolerance, making them suitable for reintroduction into selected riparian locations.

Working with WRI, the goal of this study is to determine if root-pruned oak seedlings—particularly burr and swamp white oaks—are suitable for use in flood conditions. TWI will plant approximately 415 trees of each species grown from potted root-pruned stock. Other studies have shown that root pruning of tree roots during propagation greatly accelerates growth rates. For example, acorn production can occur in 5 to 7 years after planting, as compared to 20 to 25 years for bare root plantings or natural reproduction. Also, the first year survival rates reportedly are as high as 90 percent.

Research will include measurements of the effects of inundation on mortality and growth rates of newly planted oaks. Researchers will investigate the timing, depth, and duration of inundation and simulate actual spring and fall flood conditions during experiments.

This information will provide resource managers with the information necessary to select species and the location and timing of planting. If research proves that these root-pruned oak seedlings are successful, managers will be able to restock floodplains devastated by the 1993 floods with trees that produce acorns almost overnight, providing forage for migratory waterfowl and other wildlife. Restoring selected floodplains to their historic bottomland hardwood species would have a profound environmental impact. In addition, the economic benefits of fast-growing trees for use as pulp, fiber, lumber, and veneer could be substantial.

The Wetlands Initiative

The Wetlands Initiative is a nonprofit corporation dedicated to restoring wetland resources of the Midwest to reduce flood damages, improve water quality, and increase wildlife habitat and biodiversity. Our mission is to accelerate the restoration of wetlands in ways that provide economic benefits to society and the landowner. TWI's goal is to restore one million acres by the year 2010. While this number may seem large, it represents only 2% of the wetlands lost in the Midwest. We will promote wetland restoration through research, education and public policy analysis, and by establishing demonstration projects to test the economic feasibility of large-scale wetland restoration.

53 West Jackson Boulevard, Suite 1015
Chicago, Illinois 60604-3703
Phone (312) 922-0777
Fax (312) 922-1823

The Wetlands Initiative
53 West Jackson Boulevard, Suite 1015
Chicago, IL 60604-3703