CHAPTER 13. LEARNING FROM PAST EXPERIENCES:

Case Studies from Wisconsin

The case studies outlined in this chapter illustrate some of the issues raised in this handbook. Case Study #1 highlights two wetlands in Ozaukee County that are typical of the many small wetlands constructed to mimic prairie potholes across the state. Case Study #2 highlights a larger, more costly and ambitious wetland project in Columbia County. Your wetland restoration project may fall somewhere between the extremes of the small cattail basin described in Case Study #1 and the large diverse site described in Case Study #2. For additional project examples refer to the Whittlesey Creek study outlined in Chapter 1 and the Phantom Flowage project in Chapter 12.

Ecologically, small restorations are just as important as large ones. Many small, isolated wetlands provide critical habitat for reptiles and amphibians. Isolated wetlands are used nationwide by 450 species of migratory birds, 25 of which are listed as federally endangered species. Because breeding ducks are territorial and need isolation to produce young, ten 1-acre wetland restorations with associated upland habitat or in a large wetland complex may provide more habitat for nesting ducks than an isolated 10-acre wetland. Small wetlands are often filled and lost at a greater rate than large conspicuous wetlands with more protection or obstacles to development. When done well, small wetland restoration projects are positive additions to our landscape.

Case Study #1: Ozaukee County . . . . .

The pre-settlement vegetation of Ozaukee County, which borders Lake Michigan just north of Milwaukee County, consisted largely of forested uplands and lowlands. Early surveyors described this area as swamp forests of tamarack and white cedar. Today, the landscape is open, rolling ground, with farmland being replaced by residential areas as more homes are built north of Milwaukee.

More than 300 small wetlands were created or restored in Ozaukee County between 1988 and 1999. Most of these wetlands, built on private land, were created as part of the Conservation Reserve Program (CRP). The Natural Resource Conservation Service (NRCS), United States Fish and Wildlife Service, and the Wisconsin DNR cooperated to design, build, and fund these projects consisting of a series of pothole wetlands clustered in recently farmed fields. A subset of these wetlands have been monitored and researched by Dr. James A. Reinartz and his students at the University of Wisconsin-Milwaukee. Some of these wetland restorations are more than 10 years old and are able to provide us with a look at what has worked and what has not.

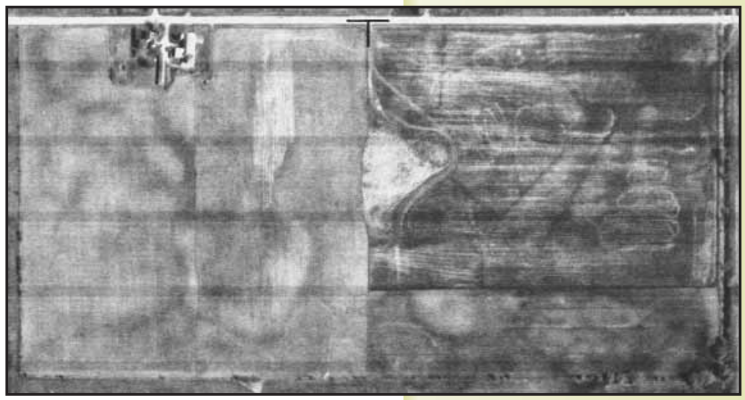
Restoration Goal

The lowlands where these wetland restorations occur were once drainage ways through pre-settlement forests or ephemeral wetlands. After settlement the forests were cut and the land was drained for crops. Wetland areas became depressions or swales in farm fields. Many of the wetland restoration projects took advantage of these low spots on the landscape to block drainage by taking soil from the high sides of the basin and creating a berm on the low side to impound water. Drain tiles, if present, were broken. Historic conditions could not be recreated exactly, due to the extensive deforestation and agricultural use of the land, but the depressions that were once wetlands are natural places to concentrate restoration efforts on today's altered landscape.

Top, aerial photo of "1989" restoration site prior to establishment.

Middle, aerial photo of "1989" restoration site one year following restoration work. Note clusters of berm and scrape wetlands within farm field.

Bottom, aerial photo of "1989" restoration site five years after restoration.



Photos: Southeastern Wisconsin Regional Planning Commission

Construction

Two wetlands are highlighted, a 1.5-acre wetland that was created in 1989 and a half acre wetland that was created in 1990. Each wetland was part of a cluster of four additional wetlands created on the properties and formed by using scrapes and berms. Prior to wetland construction, the land was used for agriculture. The sites have silty, clay loam soils classified as having low permeability. During the construction, topsoil was scraped off and stockpiled. The underlying clay subsoil was scraped and pushed up to create a berm with a spillway on each end to establish a maximum water level in the impoundment. The stockpiled topsoil was then replaced over the constructed basin and berm. Both sites were seeded with a mixture of oats, timothy, brome grass, and alfalfa. Hydrology was restored at the site constructed in 1989 by breaking 30 feet of tile in addition to the scrape and berm.

Native Wetland Seeding- Is it Beneficial?

Native wetland seed was not used in the wetland constructed in 1989. As part of a University of Wisconsin-Milwaukee project led by Dr. Reinartz, the site constructed in 1990 became one of five wetlands seeded with a mixture of 22 native wetland species. The seeds were collected locally on private land and stored outdoors in a metal can for winter stratification (to break dormancy). They were then hand scattered around the edge of the wetland in the spring of 1991, with half the seed cast in the shallow water at the wetland edge and half just above the water line. The development of vegetation and wildlife usage was monitored on these sites and 28 other

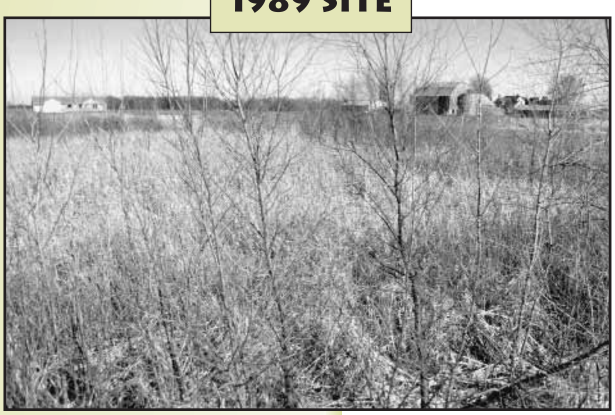
Top left, "1989" restoration one year after restoration.

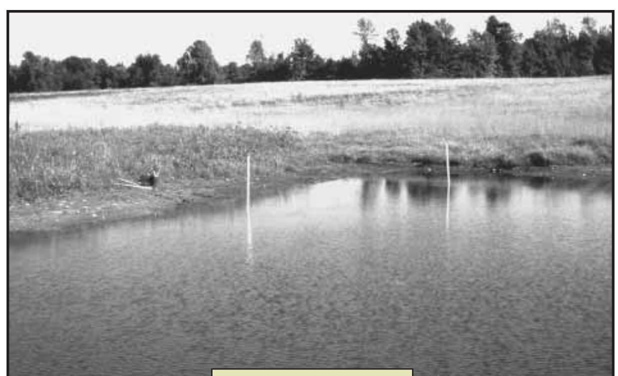
Bottom left, "1989" site ten years after restoration. Open water has been replaced by cattails in the basin and willows on the berm.

Top right, "1990" site during first growing season.

Bottom right, "1990" site nine years later. Open water and a diversity of native plants support wildlife use, including waterfowl and muskrats.

1989 SITE





1990 SITE

Top photos: Jim Reinartz

Bottom photos: Alice Thompson

wetlands. Two to three years after construction, the seeded wetlands as a group had a higher number of native plant species and a lower area covered by cattails.

Viewing both wetlands 10 years after construction, the difference between these similarly constructed wetlands is remarkable. About half of the 1990 restoration area is open water with a diverse native and non-native plant community surrounding the open water. The shallow water edges are colonized by spike rushes (*Eleocharis* spp.) and coontail, a submerged aquatic. Very few cattails are present. In contrast, the 1989 site has a dense thicket of cattails with no open water, and by early summer no standing water. On the drier perimeter, the cattails give way to an equally dense willow fringe. After 10 years, all five of the seeded wetlands had higher diversity than the unseeded wetlands. These studies suggest that early seeding with native plants can "jump-start" the colonization of the site by natives and give the natives the establishment advantage. Cattail seed is light and wind blown and can quickly seed in from nearby wetlands. If cattail is the only plant in the wetland, it can rapidly spread. Once it is dominant it will exclude any other plants from gaining a foothold.

A closer comparison of the sites reveals some important distinctions between these two wetlands. The wetland constructed in 1989 appears to rely solely on surface water to supply the hydrology. This surface water drains agricultural land, with nearby cattle and sheep. As a result, the nutrient-rich animal waste drains directly to the wetland. In contrast, the wetland constructed in 1990 shows signs of groundwater input for its hydrology. Groundwater provides a stable, year-round water source that is lower in nutrients that favor invasive plants. Additionally, in the wetland constructed in 1990, the year-round supply of water made conditions favorable for a resident population of muskrats. The muskrats continually clip and chew wetland plants, including cattails. All of these differences illustrate the complexity in evaluating the results of wetland restoration.

"It is crucial that we continue to monitor wetland creations and restorations to learn more about those factors that lead to successes and failures. Success can only be measured relative to the goals of the project. It is important that landowners not only allow, but engage in or encourage monitoring of projects on their land."

—Dr. James A. Reinartz, Director of the University of Wisconsin-Milwaukee Field Station

Case Study #2: Walker Site, Columbia County . . .

Following an extensive search for a suitable Columbia County site, a consortium of owners, including the Wisconsin Waterfowl Association, purchased 155 acres of cropland as a wetland restoration site, about 90 acres of which were restorable wetlands. The Walker family dairy farm operated on the property for 75 years. The site's lowland soils included muck, and higher slopes were mapped as hydric mineral soils grading to upland soils. When purchased for restora-

Determining the depth at which wetland (hydric) soils still occur is important in planning a wetland restoration.

Jeff Nania

tion, the entire basin affected by any change in hydrology was acquired so that there would be no limitations on how the land was to be restored.

The goal of the Walker Site restoration was to return drained cropland to its historic wetland condition. To accomplish this, restorers identified each site alteration that occurred over the years and determined as much as possible its impact on the wetland. The plan was to reverse each artificial impact in order to restore the original hydrology and topography to the site. The restoration's success hinged not only on the plan and construction, but also the initial evaluation of site potential (see Chapter 3). The presence of groundwater, remnant native plants, and a rich native seed bank, were important to the restoration.

Site Features

The restoration site is a 90-acre basin, crisscrossed by a series of drainage ditches constructed from the 1930s to the 1960s, with 60 acres of uplands surrounding it. The main drainage ditch ranged from 10 to 15 feet deep and 20 to 30 feet wide with a year-round flow. A series of lateral ditches fed the main ditch, but no drain tile had been used.

A water control structure is used to control water levels during restoration, creating a regime of high water and drawdown to stress reed canary grass.

Alice Thompson

The Walker dairy farm also grew corn, and they planted low areas with reed canary grass to be cut for animal bedding. The entire site was plowed in drier years throughout its crop history, and only portions were plowed in wet years. This indicated that the soils could not be effectively drained despite extensive ditching. An on-site seed bank study sampling soil layers at 6-inch intervals produced viable, native wetland seed. However, there was no viable seed found in the prairie upland fringe.

The reed canary grass stands (planted for animal bedding) had become monocultures with over 95 percent dominance (see Chapter 6 for a discussion of this invasive species). Nonetheless, many of these areas showed strong remnant seed banks. Since the goals of the restoration were to return the site to historic water levels and establish native plant communities, much of the plan hinged on eradication of the reed canary grass.

By comparing the site to nearby undisturbed wetlands, planners determined that shallow marsh and sedge meadow/shrub carr were the historic wetland types on the organic soil. The mineral soils had supported wet and mesic prairie (see Chapter 1 for definitions of wetland types) and upland areas had remnant woods consisting of shagbark hickory and red and black oak.

Restoration

In the summer of 1996, a temporary water control structure was installed at the drainage outlet to manage water levels during construction. A series of water level manipulations were planned, alternating with prescribed burns, to eradicate the reed canary grass. During the first summer, water levels were set

U. of Florida, Center for Aquatic Plants (Gainesville)

2 feet higher than the estimated historic levels in order to flood the reed canary grass. The water levels were then drawn down in winter. A prescribed burn in the spring preceded another water level elevation for the next summer. Four cycles of flooding/drawdown/burn resulted in eliminating about 80 percent of the reed canary grass in the basin. The reed canary that persisted occurred on the upper reaches of the site where it could not be flooded.

Beginning in 1996, the most critical portions of the ditches were filled over a four-year period. By the end of the first season, about a quarter of the ditches were filled. Water levels rose with the combination of ditch filling and the use of a water control structure. To fill the main ditch, a low pressure bulldozer skimmed 4 to 8 inches of remaining reed canary grass sod that was on a spoil pile and rolled it into the ditch. The remainder of the ditch was filled with spoils still intact from the original ditching. Ditched areas and slopes were graded to approximate the original elevations. Areas that had received erosional deposition from uplands were bulldozed to the original soil layer. In three successive years most of the ditches were filled, and the rising water levels affected more areas each year. The 60-acre upland area was planted with native prairie seed collected on nearby private land. The prairie was seeded over a three-year period, as seed became available.

Jeff Nania

Reed canary grass is scraped from a restoration site and used to fill an existing ditch.

Results

Water levels began to stabilize three years after construction. By the fourth year, even areas considerably upslope from the basin had wetland vegetation. Water levels will be allowed to stabilize without manipulation, unless reed canary grass areas increase in size. Eventually the water control structure will be abandoned to create a self-sustaining natural system.

The restored wetland now contains a diverse native community. Marsh areas are now covered with open water. Flooded trees and shrubs provide structure for waterfowl and other wetland animals. Beds of lake sedge (*Carex lacustris*) and tussock sedge (*Carex stricta*) have flourished in areas with saturated soils. A total of 140 plant species have been recorded at the site. However, continued management of reed canary grass, including prescribed burns, is necessary to protect the native vegetation

The upland prairie has responded slower. Typically prairie plants take several years for root development before becoming large enough to be noticed above ground. In the most recent season, however, prairie plants were beginning to cover the uplands. A remnant prairie patch of less than an acre responded to repeated burns and a colony of state-threatened lesser yellow lady's slipper rebounded under management.

Bob Hay

The response of wildlife to the diversity of native vegetation was immediate. Before the restoration, at most half-a-dozen ducks, mainly mallards or blue-winged teal, would be flushed from the ditches. By the end of the second season of restoration, birds counted during fall migration averaged 1,000 birds per night, peaking at 1,400! By 1999, more than 2,000 waterfowl per day utilized the wetland complex. Wood ducks, mallards, blue-winged teal, tundra swans, Canada geese, sandhill cranes, green herons, soras, yellow-headed blackbirds, black terns, great blue herons, and double-crested cormorants were observed. More than 25 state threatened great egrets were sighted using the wetland throughout the spring. Besides painted turtle and snapping turtle, the state threatened Blanding's turtle occurs on the site. The goal of restoring the hydrology and native vegetation on site has attracted a great variety of wildlife.

Wetland vegetation returns to the restored Walker site from the dormant seed bank.

Wetland hydrology returns to the historic level at the Walker site following the filling of ditches that have a high water storage capacity.

It is important to continue monitoring your wetland restoration for many years to determine what species become established and to detect any invasive plant problems.

Photos: Jeff Nania