Ecologically Isolated Wetlands

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Introduction

Wetlands are areas where water covers the soil surface or is present either at or near the surface of the soil all year or part of the year. The presence of water and subsequent lack of oxygen creates a particular type of soil (hydric soil) in which plants adapted to flooding can grow. Examples of flood tolerant plants, or hydrophytes, include cattails, sedges, smartweed, rushes, marsh marigolds, bur reed, cypress, and willows. The presence of hydrophytes, hydric soils, and water is used to identify wetland areas.

Wetlands are dynamic, highly productive systems. In fact, wetlands, as measured by the amount of plant material produced (primary productivity), are one of world's most productive ecosystems. High production of wetland plants is the result of rapid recycling of nutrients that occurs with changing water levels and breakdown of dead plant material catalyzed by wet conditions. Dead plant material, rapidly broken down in water by microorganisms, which in turn are fed upon by aquatic invertebrates, is the fuel that supports the abundance and diversity of wetland associated wildlife.

This leaflet is intended for landowners or land managers who have wetlands on their property or whose properties historically contained wetlands. It is also intended for conservation planners seeking to understand and restore wetland functions by mitigating for the effects of habitat isolation. This leaflet describes wetland processes and functions, ecological and economic benefits of healthy wetlands, risks associated with wetland loss and degradation, and, finally, steps that might be undertaken to reduce the effects of isolation.

Wetland functions and economic benefits

Wetlands are formed and maintained through various processes, depending on the hydrology, climate, and other factors related to the site. For example, in the

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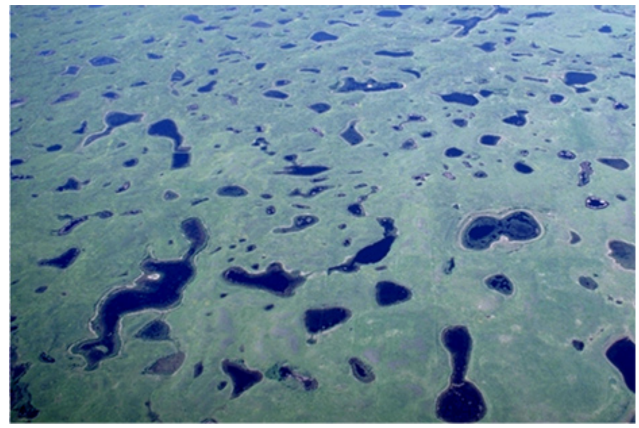

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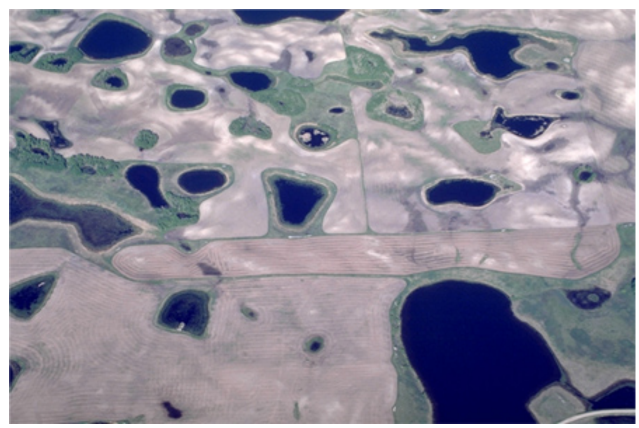

Ducks Unlimited

Conversion of wetlands and adjacent habitats to agricultural uses has contributed to their functional isolation. Aerial photos of prairie pothole region before (a) and after (b) conversion of upland grasslands to cultivation.

northern plains of North America, numerous shallow depressions were created by glaciers that covered the region 12,000 to 25,000 years ago. These so-called potholes are filled in the spring with runoff from snowmelt or rain, or from elevated ground water tables that saturate porous lowland soils and provide a relatively constant source of water through the summer. Coastal wetlands are subject to daily and seasonal tidal influences, variable terrestrial inputs, and occa-

Bottomland forest in central Mississippi

sional catastrophic events such as hurricanes. In the active delta of the Mississippi River, nutrient-rich sediments carried by late winter/spring floodwaters are released as river water leaves the main courses, forming extensive mudflats that are rapidly vegetated by wetland plants. Further up the river, the productivity of bottomland forests depends on nutrients delivered by winter/spring floodwaters and detrital-based processes that occur when bottomlands are flooded. The timing of flooding is highly variable, but it is generally delayed in the widely separated basins in the intermountain west that are fed by snowmelt from surrounding mountain ranges. These are just a few examples of the varied hydrological patterns in wetlands.

Historically, wetlands were not well understood, and they were undervalued and underappreciated. They were often regarded as wastelands and impediments to development and were readily converted into other land uses, leading to widespread wetland loss and isolation. Today, wetlands are recognized as important landscape features that provide numerous economic, ecological, and social benefits. Wetlands offer many services including flood control, ground water recharge and discharge, erosion control, water quality control, water for livestock, and recreational opportunities. In fact, it is estimated that the global value of wetland resources is $14.9 trillion, or 45 percent of the value of all natural ecosystems.

Wetlands are often compared to natural sponges, which slowly release stored surface water, rain, snowmelt, ground water, and floodwater. Wetland vegetation contributes to this process by slowing the water's momentum and allowing it to percolate into and be stored in the underlying soils. This lowers flood heights, reduces erosion, and recharges ground water, which contributes to surface water flow during dry periods of the year. Wetlands help protect adjacent and downstream landowners from flood and/or erosion damage to crops or infrastructure. For example, under normal circumstances, a watershed composed of at least 30 percent wetlands can reduce flood water levels by 60 to 80 percent compared to watersheds containing no wetlands.

Wetland vegetation absorbs and filters a variety of sediments, nutrients such as nitrogen and phosphorus, and other chemical and organic pollutants, thus maintaining water quality in rivers, streams, and lakes and reducing municipal water treatment costs. Wetland plants take up nitrogen, phosphorus, and other agricultural contaminants, while the hydric soils characteristic of wetlands chemically bind other pollutants. Studies have shown that a 1-acre wetland can effectively purify the nitrate runoff from about 100 acres of cropland. Organic waste in wetlands is broken down by bacteria and other microorganisms in the water column and the mud. Wetlands are used to treat municipal wastes (urban storm water runoff, landfill leachate), runoff from feedlots, mining wastes, pulp mill wastes, and other industrial wastes.

Wetland loss and isolation

Loss and degradation of wetlands in North America since European settlement has been substantial. Indeed, it is estimated that more than half of the wetlands in the United States have been drained and converted to other purposes. Ten states (Arkansas, California, Connecticut, Illinois, Indiana, Iowa, Kentucky, Maryland, Missouri, and Ohio) have lost 70 percent or more of their original wetland acreage. The losses continue to this day—58,000 acres of wetlands are lost each year in the United States. Some categories have been especially impacted by human development. For example, the shallowest and most easily drained wetlands (wetlands receiving only temporary flooding) have been essentially eliminated from regions with intensive agricultural activity. As a result of wetland loss and degradation, remaining wetlands have become increasingly disconnected (isolated) from surrounding wetlands, resulting in a loss of critical habitat for a wide variety of wildlife species.

The term isolated wetlands has many different meanings; wetlands can be isolated geographically, hydrologically, or ecologically. In this leaflet, isolated wetlands refers to ecologically isolated wetlands. Ecologically isolated wetlands are those that are not connected to each other or to other bodies of water by vegetated corridors or buffers, through which wildlife can easily disperse. Ecologically isolated wetlands include those that are separated from other bodies of water by a distance too great for a given wildlife species to move, as well as those isolated by natural or

Woodbury County Conservation Board

Restored Owego Wetland Complex in northwestern Iowa

human-made barriers, such as steep cliffs or roads, over or around which it is difficult for wildlife to pass.

Ecological isolation can be viewed along a continuum, depending on the wildlife species in question. For example, some prairie pothole wetlands might be considered isolated for amphibians with limited capabilities for dispersal, but for waterfowl that are able to traverse longer distances, these same wetlands can be highly connected. While a few wetlands are naturally isolated, human activities, especially those related to urban and agricultural development, are major contributors to wetland isolation.

Wetlands that are ecologically connected to one another (those that are not ecologically isolated) are referred to as wetland complexes. Wetland complexes consist of groups of wetlands that are functionally inter-connected by upland vegetated corridors or buffers, creating a mosaic of habitat for wildlife. Wildlife populations are most viable when a variety of wetland types exist in complexes and wildlife are able to move freely among diverse habitats to satisfy their complex life history needs. Where wildlife species may inhabit isolated wetlands, their survival, reproduction, and dispersal abilities may be impaired by isolation. Healthy populations of many wildlife species depend not just on a single wetland, but on a landscape that consists of a variety of wetlands connected with vegetated corridors: a wetland complex. Thus, a high diversity and abundance of smaller wetlands is critical in maintaining wildlife populations and is more often valuable to wildlife than a few larger wetlands of the same type.

Wetland-adapted wildlife

A diverse assemblage of flora and fauna have adapted to, and are thus dependent on, the historic abundance and seasonality of wetlands for their life history needs. Wetlands are top producers of waterfowl, songbirds, shorebirds, wading birds, reptiles, amphibians, and many invertebrate species. Wetland complexes containing a variety of wetland types and connected to upland habitat are needed to meet the range of habitat requirements of wildlife populations that have evolved with the presence of wetlands.

Even seasonal and temporary wetlands provide critical habitat for wildlife adapted to breeding exclusively in these areas. For example, many amphibians are adapted to ephemeral wetland habitats for breeding and rearing. In northern areas, they actively court and lay their eggs in the spring when wetlands contain lots of water due to snowmelt and spring rains. Seasonal and temporary wetlands are ideal nursing areas for developing amphibians because of the relatively warm water temperatures, abundant microorganisms for food, and lack of predators. Fully developed, amphibians emerge in summer and are able to move to surrounding aquatic, riparian, or upland habitat to forage or overwinter. Temporary wetlands provide ideal courtship and egg-laying location for amphibians because they tend to dry out in the summer, making them unable to support fish, which are effective predators of amphibian eggs, larvae, and adults.

Like amphibians, many invertebrates require the fish-free aquatic environments of wetland in which to lay eggs and/or go through larval stages. Invertebrates also take advantage of the seasonality of wetlands as their egg and larval stages often correspond to wet times of the year. Invertebrates are vital to the survival of wetland ecosystems, as they form the base of the food chain.

U.S. Fish and Wildlife Service

Waterfowl migration northward

Migratory waterfowl are also adapted to seasonal wetland dynamics. During their migratory journey northward, migratory waterfowl have adapted to the seasonal occurrence and productivity of wetlands and wetland complexes. Smaller wetlands are of particular importance, as they tend to thaw sooner in the spring than larger wetlands thereby providing protein-rich invertebrates and high-energy seeds and tubers, required by waterfowl during this time.

A significant number of species of conservation concern are dependent on wetland habitats. Wetlands provide habitat for one-third of federally listed endangered and threatened plant and animal species. A study by NatureServe found that at least 66 species listed as threatened, endangered, or candidate under the Endangered Species Act are supported by isolated wetland habitats. Nearly two-thirds of these listed species are completely dependent on isolated wetland habitat for their survival. Any further loss or degradation of wetland habitats could have a serious impact on the survival of these and other wildlife species.

Wetland complexes aid in the dispersal and recolonization of suitable habitats for amphibians and other wildlife species. The loss of individual wetlands within complexes reduces the connectivity and threatens remaining species populations. It has been shown that amphibian species richness decreases with greater wetland isolation. For example, if a population of amphibians in one wetland dies out due to factors such as prolonged drought or disease, amphibians from neighboring wetlands will be able to recolonize the site. However, if a wetland becomes isolated, recolonizing by amphibian populations is not possible due to the distance or barriers between wetlands. This may place local populations at the risk of extirpation and overall biodiversity will decline over time.

NRCS

Bottomland hardwood restoration in Arkansas

As wetlands continue to be lost, degraded, or isolated, the health and survival of many wildlife populations is at risk. Wetland-adapted wildlife require connectivity among wetlands to meet their varied habitat requirements. For example, waterfowl may breed in small wetlands but move to upland areas to nest. For wildlife populations to be healthy, they must be able to access their required habitats. When wetlands become isolated from one another or from upland areas, wildlife are limited in their abilities to access their required habitats and the health of these populations can decline.

Wetland restoration and enhancement

Because their ecological and economic values are now well understood, wetland restoration and enhancement projects are often undertaken to restore these values. Restoration refers to the return of a degraded or lost wetland to a pre-existing condition, or as close to that condition as possible. Enhancement refers to increasing one or more of the functions performed by an existing wetland beyond what currently or previously existed in the wetland.

Specific recommendations for wetland restoration and enhancement are beyond the scope of this leaflet. However, the Environmental Protection Agency and the Natural Resources Conservation Service have developed a number of technical resources on this topic. These include the Interagency Workgroup on Wetland Restoration's "An introduction and user's guide to wetland restoration, creation, and enhancement," available at *http://www.epa.gov/owow/wetlands/pdf/restdocfinal.pdf* and Conservation Practice standards 644 (Wetland Wildlife Habitat Management), 657 (Wetland Restoration), and 659 (Wetland Enhancement), available at *http://www.wli.nrcs.usda.gov/restoration/*. Landowners should begin wetland restoration or enhancement projects by reviewing these documents and contacting natural resource professionals to discuss the development, implementation, and evaluation of a wetland restoration or enhancement project.

Planning, implementation, and evaluation—Restoration and enhancement projects are often complicated, as the hydrology, climate, and current and historic plant and animal communities must be considered. Extensive planning must be done before a wetland restoration or enhancement project can be implemented. First, the landowner must understand the problems (wetland functions that have been lost) and opportunities (how lost functions can be restored) that exist. For wetland restoration or enhancement projects, the local landscape and historical factors that led to the creation and function of the wetland in the first place must be understood. These factors include land use, topography, climate, precipitation patterns, soil types, ground and surface water flows, and vegetation communities. The factors contributing to the wetland loss or degradation must also be researched, as well as the possible opportunities to restore or enhance the wetland.

Once the problems and opportunities are understood, objectives for restoration must be outlined. Objectives might include planting riparian buffers, fencing livestock from wetland areas, or reducing point and nonpoint sources of pollution. The available resources able to undertake the restoration or enhancement project must be inventoried and analyzed to formulate a plan of action and any alternative plans of action that might be considered. Available resources might include wetland restoration expertise or financial resources. Armed with all this information, landowners will be well equipped to make decisions and decide on the proper plan of action for their wetland restoration or enhancement project.

Wetland restoration or enhancement plans can involve both passive and active activities, and often both are used at the same site. Passive restoration involves removing the factors that caused the loss or degradation in the first place, and allowing the natural recolonization of wetland plant and animal communities and the reestablishment of wetland hydrology and soils. Passive approaches to wetland restoration are most appropriate when the degraded site retains basic wetland characteristics. Active restoration involves direct control of the site processes, such as re-contouring, changing waterflow, and/or intensive planting and seeding. Active approaches to wetland restoration are most appropriate when a wetland is severely degraded or lost. For example, if a wetland has been drained and converted to cropland a number of years ago, and it does not retain hydric soils or hydrophytes, an active approach to restoration is necessary. Landowners and managers are strongly urged to discuss their wetland restoration or enhancement plans with experts from Federal, State, or local government agencies or qualified personnel from conservation organizations. These experts may also be available to help the landowner implement the plan. Evaluation of the plan throughout the planning process, as well as during and after its implementation, is key to the success of the project, as well as future wetland restoration and enhancement projects.

A brief history of wetland protection in the United States

Section 404 of the Clean Water Act gives the U.S. Army Corps of Engineers the authority to issue permits to dredge or fill navigable waters of the United States. Until recently, the Corps had used a working definition of navigable waters that afforded Federal protection for almost all of the Nation's wetlands. However, in 2001, the United States Supreme Court issued a decision that restricted the Corps' jurisdiction to navigable waters, their tributaries, and wetlands adjacent to these navigable waters and tributaries. Therefore, wetlands not connected to navigable waters by surface water flow are now excluded from the Clean Water Act, which provided one of the few Federal mechanisms for the protection of these unique ecological communities. While the Federal Endangered Species Act and the Swampbuster program may protect some of these wetlands, their protection now falls mainly on State, tribal, and local governments and individual landowners.

Misguided restoration or enhancements—The restoration of lost wetlands can add ecological and economic value to the landscape. However, restoration that results in the establishment of isolated wetlands has limited value and may even be detrimental to wildlife populations or entire ecosystems. For example, in areas where the majority of wetlands have been lost, restoring a single wetland will not restore the values associated with historical wetland complexes. In these areas, restoration plans should be undertaken to restore not only a single wetland, but a number of wetlands that are ecologically connected in wetland complexes. In restoring wetland complexes, it is important to ensure that a variety of wetland types are created and that vegetated corridors between these wetlands are maintained. A mosaic of both wetland and upland areas on the landscape is essential for many wildlife species.

Wetland enhancement projects designed to increase a particular wetland function often degrades other important wetland functions. For example, adding more water to a wetland may create better fish habitat, but it may degrade habitat for amphibians and/or decrease the ability of the wetland to hold flood waters. The costs and benefits of each wetland enhancement project should be considered and project goals should include minimizing any decrease in existing wetland functions.

Assistance programs

Financial and technical assistance for wetland habitat projects are available from an array of government agencies and public and private organizations. Table 1 lists the contact information of organizations that can provide information about wetland management, as well as other natural resource projects, and describes their associated conservation incentive programs.

Table 1 Technical and financial assistance to restore or enhance wetlands

Program	Land eligibility	Type of assistance	Wetland restoration or enhancement opportunities	Contact
Conservation Reserve Program	Highly erodible land, wetland, and certain other lands with cropping history, stream-side areas in pasture land	50% cost-share for establishing permanent cover and conservation practices and annual rental payments for land enrolled in 10- to 15-year contracts. Additional financial incentives for some practices	Plant long-term, resource-conserving covers in wetland and upland areas to improve water quality, control erosion, and enhance wildlife habitat	NRCS or FSA State or local office
Partners for Fish and Wildlife Program	Most degraded fish and/or wildlife habitat	Up to 100% financial and technical assistance to restore wildlife habitat under a minimum 10-year cooperative agreement	Restore wetland hydrology; plant native trees, shrubs, grasses, and other vegetation; install fencing and off-stream livestock watering facilities to allow for restoration of stream and riparian areas; remove exotic plants and animals	U.S. Fish and Wildlife Service local office
Waterways for Wildlife	Private land	Technical and program development assistance to coalesce habitat efforts of corporations and private landowners to meet common watershed level goals	Enhance wetland and adjacent upland habitats by planting buffers, creating habitat structures, and other activities	Wildlife Habitat Council
Wetlands Reserve Program	Previously degraded wetland and adjacent upland buffer	75% cost-share for wetland restoration under 10-year contracts and 30-year easements and 100% cost-share on restoration under permanent easements. Payments for purchase of 30-year or permanent conservation easements	Restore and protect wetlands and limited adjacent upland area; improve wetland wildlife habitat	NRCS State or local office
Wildlife at Work	Corporate lands	Technical assistance on developing habitat projects into programs that allow companies to involve employees and the community	Enhance wetland and adjacent upland habitats by planting buffers, creating habitat structures, and other activities	Wildlife Habitat Council
Wildlife Habitat Incentives Program	High-priority fish and wildlife habitats	Up to 75% cost-share for conservation practices under 5- to 10-year agreements	Establish and improve fish and wildlife habitat including wetland and adjacent upland habitats, particularly those for wildlife species experiencing declining or significantly reduced populations	NRCS State or local office

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