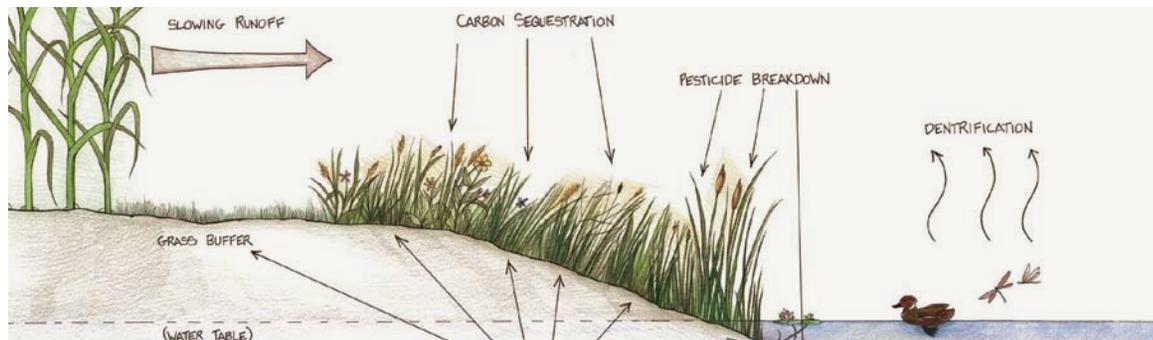


# Wetlands

A Component of an Integrated Farming Operation





## Introduction

**We've come a long way from thinking of wetlands as the enemy. The growing understanding of the dramatic roles that wetlands play in safeguarding water quality and protecting working land is complemented by a growing appreciation for the subtleties of different wetland environments. Wetlands are as unique as the land they're situated upon, as individual as your farm or ranch.**

They may also be a productive and even profitable component of a working farm or ranch operation. Just consider some of the most vital roles wetlands play on working ground:

- » Filtering out suspended sediments and nutrients before they reach streams and lakes;
- » Cleansing water as it approaches the water table;
- » Buffering wet and dry cycles;
- » Storing floodwater;
- » Providing wildlife habitat;
- » Enhancing vegetative growth that may be grazed or harvested.

Rather than serving as a financial drain on a working farm or ranch, wetlands are increasingly valuable. Fee hunting and other recreational income opportunities abound in and around privately managed wetlands. Because of their importance in the landscape, wetlands can be a magnet for funds from federal, state and private conservation organizations, putting profit into protecting, enhancing and managing these valuable resources. And there's significant value in removing from production land that simply isn't practical to farm anyway.

In this document, we will explore some of the basics of wetland protection and restoration. Obviously, there is plenty of science—biology, physics and chemistry—that will fall well beyond the scope of this paper, so be sure to consult experts who understand wetlands in your area before you embark on a wetland project. But start here and consider how preserving or restoring wetlands on your farm or ranch could be a valuable decision.



## OUR SHRINKING WETLANDS

In the Lower 48 states, more than half of the wetlands that existed when the Pilgrims landed have been drained or converted to other uses. Nearly half of the states have lost more than 50 percent of their wetlands, and some, including California, Illinois, Indiana, Iowa, Kentucky, Missouri and Ohio, have lost more than 80 percent.

And despite a growing awareness of the importance of wetlands, the contiguous U.S. lost nearly 60,000 acres of wetlands per year between 1986 and 1997. The good news is that the rate of loss was about 10 percent of what it had been in the previous few decades. The bad news is that lost wetlands represent lost benefits to the land and the ecosystem. More recent information—studies in 2004 and 2006—indicate that we are now restoring the same number of wetland acres per year that we are losing.

Protecting, restoring or enhancing a wetland on your farm reverses a tragic trend, and could offer significant advantages—on the farm level as well as the ecosystem level.

## THE DEFINITION OF WETLANDS

The U.S. EPA defines wetlands as follows, after specifically excluding prior converted cropland:

**40 CFR 230.3(t)** The term *wetlands* means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas.

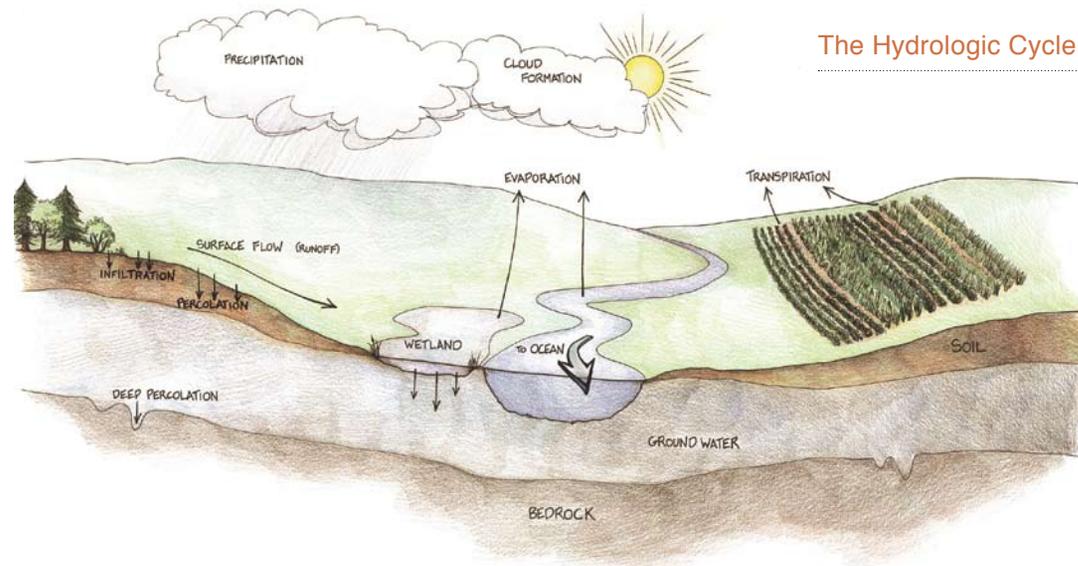
Water constantly works its way through a hydrologic cycle of evaporation, precipitation, infiltration and percolation. Wetlands perform vital roles in all aspects of the cycle, including capturing rain so it can recharge groundwater supplies.

## What is a Wetland?

The basic definition of a wetland, framed by the U.S. Environmental Protection Agency (EPA), is a parcel of land that, under normal circumstances, supports vegetation that tolerates water-saturated soils. Basically, it's land that is wet at least some of the year. (For details, U.S. EPA outlines the definition in 40 CFR 230.3(t): see sidebar.)

That's a pretty broad definition, and it has to be. It covers far more than ponds or marshes. A wetland can include a seasonal wet meadow in the high desert along the eastern edge of the Rocky Mountains, a ribbon of riparian habitat beside a stream in the arid West or a cypress swamp along the Louisiana Gulf Coast. Wetland vegetation can be the familiar cattails and rushes of the "classic" marsh, or the mosses, grasses, forbs and trees of an array of wetland environments.

Each individual wetland is a system, with its own hydrology, its own plant and animal community and its particular freeze/thaw cycles, nutrient release patterns and capacity to store and release water. And each wetland fits into larger watersheds and regional systems.





Mangrove Wetland, Florida



Riparian Belt, Idaho



Seasonal Wet Meadow, Oregon

## SOME COMMON TYPES OF WETLANDS

Wetlands are as diverse as the landscapes they occupy. Here are some examples of invaluable freshwater wetland habitats around the country:

- » **Prairie potholes, Minnesota.** According to the Izaak Walton League, more than 300 species of birds rely on these vital watering holes in the Upper Midwest; 50 to 80 percent of North America's migrating waterfowl use them.
- » **Wet meadows, southern Colorado.** Critical wildlife (and livestock) feeding grounds as other arid highland soils dry up.
- » **Playas, New Mexico.** Shallow, rain-and-snow-fed wetlands in the southern High Plains feed more than 1 million ducks, as well as hundreds of thousands more birds, along the Central Flyway.
- » **Emergent marshes (or hemimarshes), Illinois.** These wetlands, marked by a combination of open water and stands of grass, sedge or rush, are important breeding grounds for plants and animals, and valuable feeding grounds for the creatures that prey upon them.
- » **Mangrove swamps, Florida.** Strong roots and complex ecosystems support wildlife and protect coastal property.
- » **The Rainwater Basin, Nebraska.** Wetlands covering 17 counties in south-central Nebraska nurture migratory birds, including sandhill cranes, as well as raptors and other species.
- » **Kettle bogs, Massachusetts.** These rain-fed remnants of glacial scouring are oases for wildlife, as well as rare plants.
- » **Pocosins, North Carolina.** With their abundant crops of wild berries, these thickly vegetated depressions are loaded with wildlife, from salamanders to songbirds to bears.
- » **Riparian belts, Oregon.** Streambanks provide water for vegetation that, in turn, shades the water and keeps it cool enough for young fish, including trout and salmon. The vegetation can also support wildlife and livestock.
- » **Green tree reservoirs, Mississippi.** Carefully managed flooded dormant hardwood stands shelter nesting and foraging waterfowl.
- » **Vernal pools, Ohio and California.** Seasonally wet vernal pools lack fish, which makes them perfect breeding grounds for amphibians and crustaceans that thrive without predation.

Wherever you farm, there's likely to be a type of wetland native to your area. And chances are, your work protecting or enhancing it could have a tremendous impact on your local environment—and an impact that may be felt from pole to pole, as birds migrate from your land to their seasonal breeding grounds as far away as South America and the Arctic.

### THREE TYPES OF WETLANDS

Beyond the broad definition of wetlands—saturated land that can support vegetation that tolerates wet soils—there are more specific definitions. Though other regions have other types of wetlands, the three specific types of wetlands defined by the State of Louisiana help shed light on some important characteristics:

- » **Hydrologic:** covered with water or saturated to within 12 inches of the soil surface.
- » **Hydrophytic:** inundated for part of the year. At least half of the plants present grow in saturated or wet soils.
- » **Hydric:** peat muck or heavy clay soils, which are anaerobic at the surface at least part of the time.

Studies cited by Ducks Unlimited demonstrated that a mallard duck must find all the resources it needs within a 12-mile radius, or it moves on in hopes of finding a better environment. Those needs include seasonally flooded bottomland forests (also called green tree reservoirs), shrub or scrub swamps, moist soil wetlands, emergent marsh (vegetated marsh that includes open water), fishless ponds or seasonally flooded cropland.

Of course, the value of wetlands extends well beyond the needs of migrating waterfowl. Understanding the nature of the wetland on your farm or ranch is vital to conserving or enhancing it. It's also critical to seeing its economic value. For instance—assuming there are no endangered species issues—a wet meadow or riparian area in an arid region could provide weeks of extra grazing for livestock. A vernal pool may be a great place for a stand of hardwood trees for your grandchildren to harvest, rather than a constant headache to try to farm. An emergent marsh may yield far more in hunting fees than it ever would in grain or hay.

Chris Evans, Bugwood Network



## What Do Wetlands Do?

The most popular answer to the question, “What’s the most valuable function of wetlands?” is “habitat.” That’s true, and it’s extremely important, especially because of past wetland losses.

Birds are perhaps the showiest type of wetland wildlife, the flagships of wetland habitats. But they are just part of the extraordinary web of plants and animals that depend upon wetlands for survival. Planning a wetland that nurtures the creatures lower on the food chain—from insects to salamanders to spring peepers—provides a vital environmental boost and in turn it nourishes the birds and mammals at the top of the food chain.

In wetlands that are adjacent to other surface waters, sheltered areas could be invaluable nurseries for fish, shellfish and other commercially important species.

Another vital role wetlands play is filtration and chemical transformation—many scientists refer to wetlands as “the kidneys of the earth.” With their combination of aerobic and anaerobic conditions and their biological and chemical richness, wetlands maintain the widest range of oxidation and reduction reactions in the landscape. In turn, that helps capture, convert or detoxify chemicals in the environment.

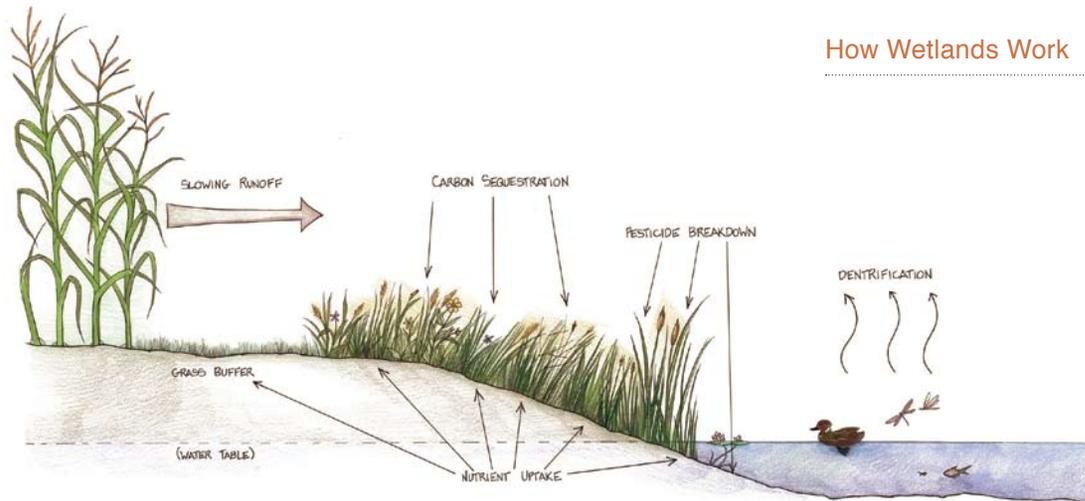
There are several kinds of cleansing functions that wetlands accomplish:

- » **Slowing runoff** so sediments and nutrients fall out of suspension rather than being swept into streams and lakes;
- » **Utilizing nutrients** and even some metals in their plant communities, removing them from the waste stream;
- » **Denitrification** of nutrient-enriched water, allowing nitrogen to escape into the atmosphere rather than impact water quality;
- » **Sequestering carbon dioxide** (though there is an air quality tradeoff—anaerobic bacteria in turn create methane and nitrous oxide, which are potent greenhouse gases);
- » **Breaking down pesticides** in biologically active zones that occur where water and aerobic soil meet.





## How Wetlands Work



Well-designed wetlands perform a host of important roles in protecting water quality. Upland buffer vegetation slows runoff from cropland, reducing its erosive potential and causing the water to drop much of its sediment load. Wetland plants trap more sediment and use nutrients in the runoff to create biomass, sequestering carbon in the process. Where wetland soils meet the water, aerobic bacteria break down many pesticides. Chemical reactions in the wetland environment also engage in denitrification, converting nitrates into gaseous molecular nitrogen that dissipates into the atmosphere. By the time water settles into pools and puddles, it can be significantly cleaner than when it began its journey from the field.

Wetlands are extraordinarily effective at their filtering roles. In fact, a constructed wetland in sandy soil at the United States Department of Agriculture Agricultural Research Service (USDA-ARS) station in Florence, S.C., removed approximately half of the total suspended solids (sediments) and about 60 percent of the nitrogen from municipal wastewater that was applied to it.

Because their soils work like a sponge and their topography acts as a bowl, wetlands can also buffer the effects of flooding. Stormwater collects in wetlands rather than rushing off in a damaging flood. It can then be released slowly, often allowing the extra moisture to nourish the surrounding fields and streams for weeks or months rather than flowing off in destructive, short-lived surges that have little time to infiltrate the soil. Some of the water retained in wetlands can also recharge groundwater supplies and aquifers.

## Wetlands on the Farm

Whether you can work a wetland or simply protect it depends on the wetland itself, the species that inhabit it and any programs you may have enrolled it in to secure funding.

If your wetland is home to an endangered fairy shrimp or rare butterfly, you are providing an invaluable environmental service by protecting it, but chances are you won't have a lot of flexibility in farming the ground. (You may still be able to hunt it, though.)

If your wetland stays wet or saturated all year—for instance, it's an emergent marsh or a bog—it's not likely to be farmable. But seasonal or ephemeral wetlands, which enjoy a dry cycle, may be good for sustainably managed haying or grazing, as long as the land isn't covered by an easement that prohibits those activities.

Riparian areas along streams and rivers may also be prime grazing ground, especially at the beginning or end of the dry season, if grazed sustainably. However, it is important to consider whether grazing livestock are likely to trample down the banks, increase erosion or contaminate the water with manure and urine—if the banks are steep or the water quality is already compromised, grazing could create more problems than it solves.

## The Profit Potential of Wetlands

There are plenty of ways to get wetlands to pay their way on working land, and even to generate a significant profit.

On the most basic level, not farming a wetland could boost profitability simply by **ceasing to drag it down**. Many farmers and ranchers have struggled with wet fields—wasting time and fuel working the ground, wasting fertilizer and herbicides on crops that get flooded out, wasting seed on stands that end up spotty and wasting effort and money harvesting a short crop from ground that really shouldn't have been farmed in the first place. Rather than throwing away money in a losing fight against Mother Nature, consider finding value in the parcel's more natural state.

An array of federal, state and private **conservation programs** offer funding to protect or restore wetlands for their environmental value. Returns from acreage covered by a government program

## CAN WETLANDS CLEAN UP TILE DRAINAGE?

One of the great ironies of creating 14 acres of wetlands on the 250-acre Franklin Farm operated by The Nature Conservancy (TNC) near Lexington, Ill., is that the Conservancy had to lay in new tile to get the project started.

With funding from the Environmental Quality Incentives Program (EQIP) and the Conservation Reserve Program (CRP) and help from the McLean County NRCS staff, the county's Soil and Water Conservation District, Dr. David Kovaic from University of Illinois, and the Franklin family, which owns the farm, The Conservancy created carefully sized wetlands to study the proper ratio of wetlands to cropland for removing nitrates from water carried by tile lines that drain into the bermed-off parcels. The team created wetlands that sized at 3, 6 and 9 percent of the area of adjacent farmed fields.

TNC science technician Tim Lindenbaum says early data showed a 30-to-90-percent removal of nitrates from drainage water, depending on the wetland acreage. The key element appears to be how long water is retained in the wetland before flowing to the nearby river. TNC aquatic ecologist Maria Lemke also notes that the wetlands appear to be helping reduce phosphorus, too.

In addition to reducing the nutrient load from tile drainwater, the new wetlands also have attracted a variety of birds and wildlife, including sandhill cranes, migrating waterfowl, raccoons and deer, notes Lindenbaum.

## OHIO WETLAND SAVES SOIL, HEADACHES AND MONEY

Many fields have a trouble spot, and one patch on a 100-acre field that Marvin Bumb farms with his father and brother near Bellevue, Ohio, was a little corner that posed big problems. Adjacent to a wooded area, the 2.2-acre parcel was shaded, wet and prone to washing out deep ruts during heavy storms. “We couldn’t get equipment across the gullies,” says Bumb. Silt from the gullies ended up on a neighbor’s property or in drainage ditches, blocking tile outlets and blowing out the field’s drainage system with alarming regularity.

Instead of fighting the inevitable flood again, the Bumbs worked with NRCS technicians to create a wetland on the problem parcel. Today, the wetland holds water all year long, even during most storms. A berm holds back most flows, and a spillway allows extreme storms to drain into a tile main that shunts the water cleanly and safely into a ditch. A grassed border around the wetland stabilizes the soil and provides habitat for wildlife—Bumb’s only maintenance is a dose of 2,4-D in late spring to control thistles and other noxious weeds.

“It’s turned out even better than I expected,” says Bumb of his wetland. “We never really grew anything next to the woods because of the shade and the wetness. The benefits of not farming that land, and of being able to farm the rest of the field without the erosion, more than offset the acreage we lost. If I had to do it all again, I’d do exactly the same thing.”

contract or conservation easement may well exceed the profit potential of cropping the ground. Although some level of management may be required to maintain a healthy wetland, it could be less frustrating than trying to wrestle a crop from unproductive ground.

Of course, availability of funds can change, so check with your local conservation district, your USDA Natural Resources Conservation District (NRCS) office and organizations like Ducks Unlimited or local land trusts for details on the programs in your area and for additional technical assistance.

Selling or leasing **hunting rights** (or bird-watching privileges) is a growing income opportunity for many farmers and ranchers. Some landowners simply let hunters onto the land. Others offer deluxe accommodations and top-flight hunting camps, depending on restrictions placed by funding programs—some allow blinds and permanent structures, others, like the Wetlands Reserve Program, don’t. Fees range accordingly, too. Some landowners offer daily leases, others season-long or multi-year contracts. Some choose to focus on duck season, while others offer hunting rights to different species in different seasons. The bottom line is that letting visitors hunt your wetland could readily bolster your income from the field, and recreational use statutes enacted by most states protect landowners from much of the liability associated with having guests on the farm.

A more sophisticated revenue generator is creating a **wetlands mitigation bank**, in which developers buy shares of your wetland to mitigate for damage that they are causing to wetlands somewhere else. The profit potential is substantial, especially in areas where subdivisions, shopping centers or road projects impact local wetlands. On the other side of the coin, wetland mitigation banks involve a thicket of regulations, standards and compliance check-ups, so they require fairly deep pockets to get started and strong motivation to keep going.

Then there’s the long-term outlook. In the most general terms, consider whether a wetland would actually appeal to a prospective buyer of your property. If you’re thinking about a traditional farm or ranch buyer, the first instinct is to assume that the wetland is a problem. But many customers for farm and ranch acreage today are duck clubs and other hunting groups—and a wetland can be just what they’re looking for. Similarly, organizations seeking to purchase conservation easements may see a wetland on the farm as an asset that they are eager to pay to protect.

For a look at 10 diverse wetlands projects, download *Wetlands: A More Profitable Alternative?* from the Conservation Technology Information Center web site ([www.conservationinformation.org/?action=learningcenter\\_publications\\_wetlands](http://www.conservationinformation.org/?action=learningcenter_publications_wetlands)).



Dennis Clay

## WILDLIFE VALUE MAY BEAT CROPS ON WET GROUND

“Hard-to-farm ground may shine when the key product is recreation instead of corn, beans or cotton,” says Daryl Jones of the Natural Resource Enterprises Program at Mississippi State University. “Recreational enterprises can make marginal acreage—and the whole farm—much more profitable than putting it under the plow,” Jones says.

In 2001, there were 13 million hunters, 34 million anglers and 66 million people who went wildlife watching in Mississippi, says Jones. Those people are willing to spend good money to enjoy their hobbies, which is why recreational enterprises such as fee hunting or wildlife guide services can become big revenue streams on farms. Enhancing habitat through wetland restoration or management can add significant value.

Jones and his colleagues offer a wealth of information on the Natural Resources Enterprise Program web site ([www.naturalresources.msstate.edu/](http://www.naturalresources.msstate.edu/)), including studies on profitability, details on landowner liability and other related topics.



# Restoring A Wetland

Getting Started

## Restoring A Wetland: Getting Started

Protecting, restoring or establishing a wetland isn't easy. Perhaps the biggest challenge many land-owners face in the process is fighting nature—literally and figuratively trying to push water uphill. That's why the most critical step in the entire process is carefully considering the site where the wetland is or will be located, and evaluating it with a cold eye toward feasibility.

The fundamental question is: Will the site function as a wetland?

If the parcel is already a wetland, then the answer is “yes.” If you're trying to restore a field that has been drained, tilled or selected because it might be a good place to situate a wetland, you'll need to pay attention to several key factors:

- » **Soils.** Does the site have wetland soils—will the ground hold water? Even bottom ground can have sandy patches that don't hold water well. If you have lighter soils, are there hardpans, layers that tend to swell when wet, or other barriers to drainage that may help them stay saturated?
- » **Topography.** Wetlands thrive in shallow depressions that trap moisture. The depth of the ideal depression will depend upon the type of wetland you want to create, how well the soils hold water and whether the local climate encourages or discourages evaporation. Note that most wetlands are surprisingly flat—1-percent slope is ideal for many wetland sites.
- » **Microtopography** (small depressions and rises in relief that are six inches or less from grade). Look beyond the landscape at the nooks and crannies of your site. Are there sizeable swales that could capture runoff during a storm—or small depressions that could hold water during drier times to support wildlife? Could little ridges and knobs serve as nesting islands for wildlife when water returns to the site? Would the land support the creation of microtopography during construction?
- » **Water supply.** What will supply water to the wetland? Flooding rivers, meandering creeks, springs, return flows seeping in from groundwater, surface runoff and rainfall play various roles in the formation and maintenance of wetlands around the world. Because you will be anxious to establish wetland vegetation, consider a backup source of water, too—for instance, you may

need to pump water to a rain-fed playa in a drought year so your wetland vegetation survives the season.

- » **The neighborhood.** What is happening upstream that may impact incoming water? (For instance, nutrient-rich runoff from a livestock operation could complicate your vegetation management.) What's happening downstream—will a new shopping center or a high roadbed hem in your wetland and cause water levels to climb too high after a heavy rain?
- » **The legal landscape.** Liens, water rights decisions upstream and downstream of you and easements or other agreements—on your land or on neighboring properties—can help or hinder your project. Make sure you know exactly what you are legally able to do before you start.

Before you start on your wetland, find a reference site nearby, an existing wetland that can serve as an illustration of what to expect as your project develops. Make sure the reference site is positioned in a similar place in the landscape—for instance, if you're working on bottom ground, don't use an upland pocosin as your reference, or if your wet meadow is

## VITAL INFORMATION

Research on site selection can make or break a wetland project. There are several sources for vital information on the soils and water that define your wetland site:

- » **NRCS soil maps** define specific soil types on nearly every parcel of land in the U.S. In fact, as of summer 2007, soil maps for 95 percent of U.S. counties were available online at <http://websoilsurvey.nrcs.usda.gov/app/>.
- » Your **local NRCS office** will have maps and data on local hydrology, soils and topography—and technicians who will help you apply the information.
- » The **Federal Emergency Management Agency (FEMA)** has **floodplain maps** that can help you site a wetland. For just a few dollars apiece, maps are available for download or may be ordered in printed form at <http://msc.fema.gov/webapp/wcs/stores/servlet/FemaWelcomeView?storeId=10001&catalogId=10001&langId=-1>
- » Your local **water management district** will have details on drainage, flow and elevation for its service area—all invaluable for planning a wetland.
- » The U.S. Fish and Wildlife Service's **National Wetlands Inventory** can provide maps of wetlands for download at <http://wetlandsfws.er.usgs.gov/NWI/index.html>.
- » The **Conservation Technology Information Center** offers a variety of resources on its [www.conservationinformation.org](http://www.conservationinformation.org) web site, including a book of wetlands case studies called *Wetlands: A More Profitable Alternative?*
- » Your local **extension agent** may have insight on wetlands and wetland issues.
- » Check your **local library or historical society** for old photos of your area—some may have captured wetlands or native vegetation right on your property.

## HOW DEEP?

The depth of a wetland is a key factor in what it does and how well it functions. Plant and animal species have specific habitat requirements or preferences. For instance, of the 156 bird species that use moist-soil wetlands, 131 prefer water depths of 10 inches or less, according to the University of Missouri.

The water level in shallow wetlands can also be drawn up and down to ease access to food sources such as submerged vegetation and seeds, or arthropods like crayfish and insects. The less energy a bird has to expend to get to its food, the more reserves it will have for migration or reproduction.

Remember: the most effective wetlands are not fishing holes—but they are infinitely more valuable to the ecosystem.

situated at 1,100 feet of elevation, don't compare it with a meadow at 4,800 feet. Also, check with a local expert or two to make sure that the reference site is healthy and functioning, so you can be sure you're setting the right goals.

While you are checking in with local experts on your reference site, start assembling a team of advisors who can help you through your project. Wetlands are extremely intricate. It's hard to find one person with the expertise in engineering, hydrology, biology, botany, water law, real estate appraisal, local zoning and funding. But pulling together a team of advisors will help you manage the project.

Remember that assembling an advisory team doesn't have to cost a fortune. Federally funded NRCS has a mission to provide technical assistance to landowners pursuing conservation projects—all the way to helping you create engineering drawings of your dikes and control structures. Local conservation districts exist to encourage projects like yours and help you get the information and funding you need. Federal and state wildlife agencies have great expertise in the ecology of wetlands. Conservation and wildlife groups can be outstanding resources for information, funding or in-kind support.

If you envision a wetland on your farm, you can bet that there are experts in your area who are eager to contribute their time and knowledge to help you make it happen.

## Vegetation—The Key to Success

Of course, water is the heart of a wetland. But just as vital to success in a wetland project is the vegetation that becomes established on the site. “We seem to spend less time with vegetation than anything else, and vegetation is the foundation of the whole food chain,” notes Dr. Norman Melvin III, Team Leader for the NRCS National Wetland Team.

Plants anchor the soil, take up nutrients that could otherwise pollute the water, facilitate the filtration of contaminants, protect shorelines and riverbanks from wave action and shelter many species. Clearly they deserve a great deal of care and attention.

Absolutely the most important aspect of vegetation management in a wetland project is making

sure that native plants get the upper hand. Invasive, non-native species—from purple loosestrife to *Phragmites* to reed canarygrass—can destroy habitat, crowd out native plants and spread to other sensitive areas. The U.S. Fish and Wildlife Service estimates that the U.S. is losing 4,600 acres of habitat to invasive plants every day.

Most fields have a substantial seed bank—dormant seeds, nutlets and corms waiting for the right conditions to germinate—if they haven't been effectively drained and cropped continuously for many years. Wildlife, wind and water will bring in even more. So when you saturate wetland soils, chances are very high that you'll start seeing wetland vegetation in a few years.

However, actively introducing seed or transplants can tip the scales in favor of native species—especially if the land has not hosted wetland species in many years, which could reduce the viability of the seed bank. In fact, a study by researchers at The Ohio State University and USDA-ARS showed that actively revegetating a wetland yielded stands of more than 50 percent wetland species over a four-year period; in the same timeframe, passively waiting for vegetation to enter and spread resulted in a plant community comprised of less than half wetland plants. (Not surprisingly, success depends on choosing species that are compatible with the depth, duration and seasonality of the site's water.)

One of the many problems posed by invasive species is that they often dramatically diminish species diversity. A diverse plant community can yield a more diverse wildlife community, which makes a wetland more successful. Of course, not every species is desirable—for information on managing unwelcome species, see page 25.

In addition to controlling invasive non-native species, there are several other steps to help encourage a diverse plant community in your wetland:

- » **Plant desired vegetation**—from seed, root pieces or transplants—to stack the deck in favor of key species. Check with the U.S. Army Corps of Engineers to find local wetlands that have received permits to be drained or manipulated. The topsoil from those sites could be a great source of seed and other germinating plant parts. You can use a fertilizer broadcast spreader to distribute the seed-rich topsoil to your site during the dormant season.

## BUFFERS: LOOK BEYOND THE WETLAND

The saturated area of a wetland project is obviously the heart of the effort, but a successful wetland also includes upland buffers. Those are the areas that protect the wetland from rushing stormwater, that filter out some contaminants before they reach the wetland, and that harbor the nests and roosts of wildlife that feed in the wetland.

Well-designed buffers are built to function. Edge habitat encourages predators—for better or worse, depending upon your goals. Certain vegetation invites specific species to breed or seek shelter for the night. Cool-season grasses can serve as a firebreak during dry seasons.

Not only can you look beyond your wetland—be sure to look beyond your property line. A neighbor's woodlot may make your wetland function better by providing shelter for wetland wildlife, or her Conservation Reserve Program (CRP) planting may serve as a filter for runoff water headed your way. Once you have mapped out your wetland and buffers, check with your conservation district or NRCS staff—your neighbor might be able to enroll in the same conservation program as you to get paid for enhancing your wetland.

## RIPARIAN RESTORATION BOOSTS FORAGE

When members of the Pete's Creek Partnership purchased a 1,200-acre ranch near Susanville, Calif. in 1993, they saw a patchwork of riparian areas, wet meadows, wetlands and sagebrush uplands that had been profoundly disturbed by overuse of the creek that served as the cornerstone of the system. A lack of riparian vegetation led to erosion. Erosion led to downcutting of the creek bottom. A lower creek bottom, as well as diversions of water from the creek to irrigate pastures, dropped the water table below the level of the wet meadows. Normally wet grazing areas dried up and became covered with low-nutrition sagebrush.

With the help of NRCS and the U.S. Fish and Wildlife Service's Partners for Fish and Wildlife Program, the partnership fenced off 1.25 miles of the creek and began an aggressive restoration of streamside vegetation and the removal of sage from former grazing meadows. In addition to the creek restoration, the owners instituted a rotational grazing program to mimic the effects of ancient herds on the landscape, allowing cattle to efficiently utilize more of the available forage, then letting the land rest before grazing resumes.

Within four years, the results were abundantly clear. The riparian buffer grew lush and grazing areas improved—in fact, stocking rates jumped from 200 cow-calf pairs to 300 pairs, an outstanding illustration that doing good can also help livestock producers do well.



Healthy riparian vegetation can bolster streambanks, reducing erosion and shading the water. Managed well, riparian vegetation can benefit both livestock and wildlife: lush for weeks or months after upland vegetation goes dormant, it can extend grazing and browsing opportunities.

important to recognize the potential impact of wetland plants on nearby crops. Japanese millet is a favorite food source for wetland wildlife, but on cropland—where it's called barnyardgrass—it is a despised weed. Smartweed in a wetland is great duck food, but in a soybean field, it's an expensive hassle. If the spread of weeds is a concern, check with a local expert on alternative wetland plant choices, or how to buffer your crops from encroachment by wetland plantings.

- » **Stick to native food for native wildlife.** Some non-native species are a bountiful food source, but alien plants really don't belong in your wetland.
- » **Match plants to the soils** in your site and the water management regimen you expect to maintain. Some species like standing water, some can't tolerate it at all, and some prefer areas that get occasional drying.
- » **Buy or source locally adapted plants.** That reduces the chances of losing your vegetation during hot summers or cold winters.
- » **Don't over-plant.** It's not a lawn, it's a wetland. Lower planting density can encourage greater diversity as a variety of species fill in the spaces between established plants. (However, monitor vegetation carefully to make sure that invasive species aren't creeping in to fill in those spaces.)

Even widely acclaimed wetland species need to be approached with some care. It's

## Construction—Capturing Vital Water

To restore or enhance many wetland sites, it may be necessary to build structures to capture water or reverse existing efforts to keep the land drained. Among the most common construction projects are:

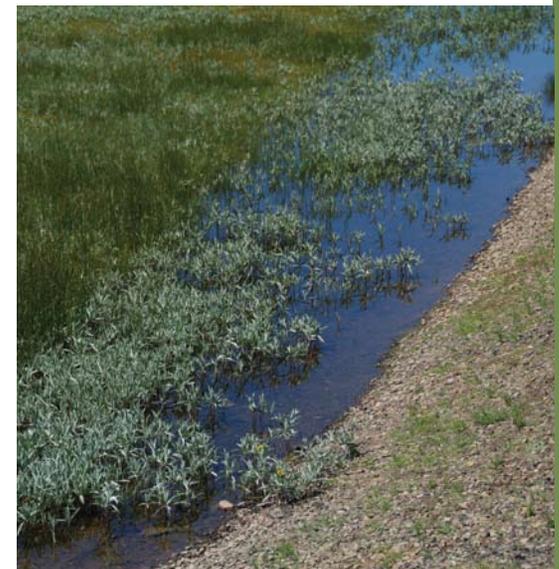
- » **Interrupting drainage ditches** with earthen “ditch plugs.” Remember, though, that you can only plug a ditch that drains just the site you are restoring to its wetland condition—it is against the law to interfere with drainage that serves your neighbors.
- » **Plugging or breaking tile lines.** If a neighbor’s tile crosses your property, the tile under your wetland can be replaced with a non-perforated pipe. Your neighbor’s drainage is unaffected and your wetland retains its water.
- » **Low berms, or rice levees, along the contour.** These low, temporary earthen structures can limit runoff and give vegetation and debris a chance to build up and stabilize the wetland.
- » **Dikes or high berms.** Most effective along the contour, dikes can capture water and form a boundary to a wetland. Dikes may also be built parallel to drainage ditches, preventing the loss of the wetland’s water while allowing the ditch to drain other fields or properties. A series of low dikes is often preferable to a single, taller one that would create an undesirably deep wetland.
- » **Water control structures.** From simple spillways—reinforced with vegetation, fabric or other material to prevent erosion—to constructed weirs and risers, structures that allow you to control water levels can be vital to success.

Wetland structures must be carefully engineered to ensure that they will function as needed, require minimal maintenance and, if you are enrolled in an incentive program, meet program standards. Get help from an NRCS technician or a private wetland engineer.

*It is also absolutely imperative that you get approval from state and federal authorities—including environmental protection agencies, NRCS and the U.S. Army Corps of Engineers—before turning the first bucket of earth on a wetland. Unauthorized alteration of a wetland, even if it is well-intentioned, could lead to denial of farm program services as well as huge fines.*



Managing tile (above) is a central part of many wetland construction projects. Plugging or breaking old tile lines can help keep water on the land. If the lines provide drainage for neighbors, replace perforated line with non-perforated tile under your land. Constructing berms and dikes (below) requires engineering and planning. Get help from NRCS or a consultant to make sure your project is designed well, built to last, discourages pests and complies with program standards.



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**“The terms of your conservation easement or wetlands mitigation banking charter may require very thorough monitoring...a monitoring program is an important way to ensure that you are on-track, your structures are working properly, the earthwork isn’t failing, vegetation is reestablishing adequately and to catch invaders before they get too far ahead of you.”**

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## Management Is Key

Wetlands aren’t a flood-it-and-leave-it project—they require ongoing observation and management.

The first step is monitoring.

The terms of your conservation easement or wetlands mitigation banking charter may require very thorough monitoring and detailed records, so be sure to collect the data you need. And even if it’s not required, a monitoring program is an important way to ensure that you are on-track, your structures are working properly, the earthwork isn’t failing, vegetation is reestablishing adequately and to catch invaders before they get too far ahead of you.

Start with a plant inventory of your wetland and your nearby reference site—the existing wetland with the same elevation and depth as yours. What plants are growing in each of the types of habitat in the wetland (in the water, on the water’s edge, in wetter and drier upland areas, shaded vs. open areas, etc.)? Your reference site should give you a pretty good sense of what you’ll be aiming for on your project.

A good monitoring program will also alert you to successional changes in your plant community over time. As the years go on, grasses in some areas are likely to give way to forbs, shrubs, bushes and trees. It’s the classic progression from wetland to meadow to forest—but if you are aiming to maintain the wetland in early successional stages for wildlife purposes, you may have to periodically reset the clock on succession to remove undesired vegetation and encourage the growth of heavily seeded grasses and forbs.

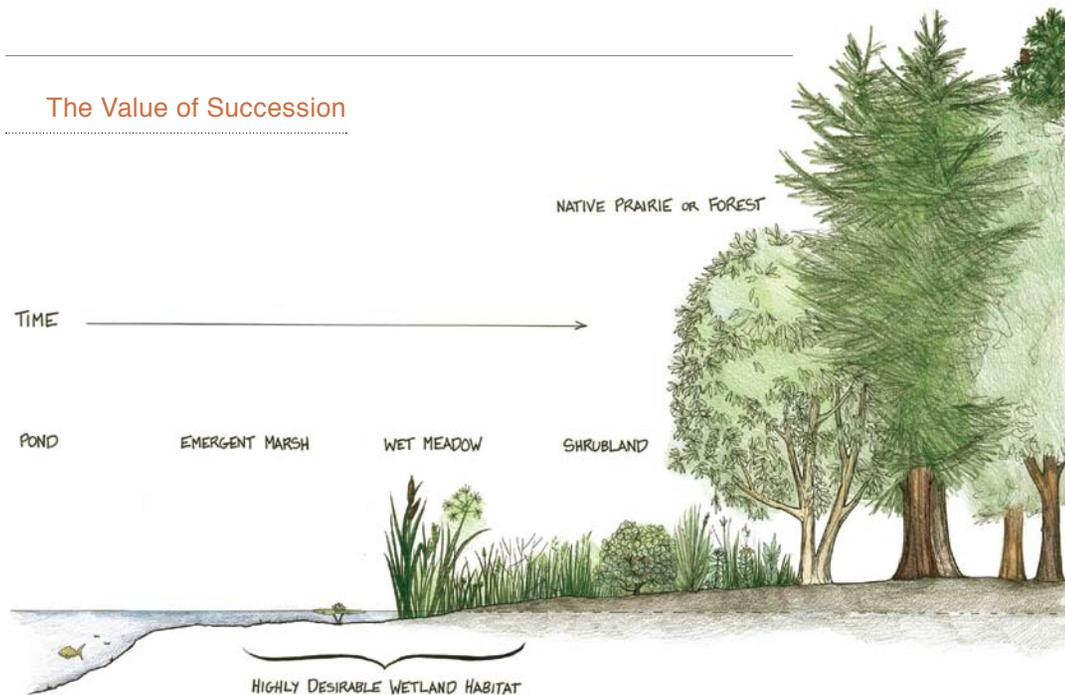
Work with local experts on the best way to manage succession for wildlife and the plant community in your environment. Periodic burns may mimic local cycles of growth and destruction. Haying, mowing or disking can control oversized vegetation (like willows and other woody plants that can begin to crowd out grasses and forbs) and create opportunities for new flushes of growth.

Of course, be careful when disturbing your wetland. Schedule maintenance after birds have fledged and wildlife can leave their burrows and dens. Time your mowing or disking to favor the life cycles of native species, so seeds are mature when they’re spread, and germination or regrowth can occur rapidly when you present the opportunity.

While you're monitoring vegetation, watch for wildlife, too. It's important to know if beaver, nutria, feral pigs or other animals are damaging structures that help your wetland function. Check the behavior of water at various stages of the seasonal cycle to make sure the wetland is functioning as planned.

Most important, practice "adaptive management," recognizing where reality diverges from planning and figuring out how to keep your wetland functioning as well as possible in your environment.

### The Value of Succession



Succession is the natural cycle of plant community development. In a wetland project, it can begin with newly worked ground and build from a flush of annual grasses to eventually develop into woodland or native prairie. Wetlands are often managed to maintain earlier succession communities, which provide valuable habitat that may have been plowed under or grown over in other parts of the area.

### VOLUNTEERS—LOCAL LABOR AT THE READY

Planting, monitoring and weeding wetlands can be arduous work, and a large site could require a significant amount of labor. Fortunately, legions of environmentally minded people are likely to be eager to help you succeed.

Contact local environmental groups, wildlife organizations, conservation districts, Boy Scout troops or other youth organizations to see if they can provide a volunteer team to assist you in your wetland project.

It's a win-win situation—you get help, volunteers get the satisfaction of knowing they helped restore or establish valuable habitat and the wetland project gets a significant boost.



Water control structures allow you to manage water depth and timing. Good planning and management can help encourage a diverse community of desirable vegetation, create good habitat waterfowl and other wildlife, and even adjust sedimentation levels to create a properly functioning wetland.

## Control Sedimentation

Sedimentation is another huge threat to wetlands. The very fact that wetlands act as a huge filter on the landscape means that they collect sediment, the tiny, waterborne particles that form and feed a wetland's rich soils.

Sediment can change the entire shape and function of a wetland, filling in a marsh and making it a meadow. Eventually, it could become a forest. Even if you manage to keep vegetative succession at bay, decreasing water levels by increasing sediment layers may invite invasive species—especially *Phragmites* or cattails—to colonize where there was once a diverse population of wetland plants. Studies in Iowa documented that depositing just  $\frac{1}{4}$  inch of sediment in a wetland can significantly reduce plant species richness and diversity, turning a diverse aquatic plant community into a near-monoculture of cattails.

In addition to reducing plant diversity, deepening layers of sediment can decrease animal diversity, too. As sediment figuratively chokes out algae and zooplankton and literally chokes the gill-breathing invertebrates in a wetland, populations can shift from an array of herbivores (like mayflies and midges) to sediment-burrowing worms. In turn, that can affect the entire food chain, all the way up to displacing birds and amphibians that seek out flying insects and can't live on worms in the mud.

Finally, sediments can plug up the most chemically active filter sites in a wetland—the thin, aerobic zone at the interface of soil and water, and in the oxygenated soils around plant roots. Those areas are the “organs” that detoxify contaminants. If they're buried under new layers of sediment that lack the rich load of microbes that conduct the chemical reactions, they can cease to function. Worse, the contaminants themselves are buried intact, ready to reemerge when the sediment is disturbed.

The dangers of sedimentation underscore the importance of upland buffers in a wetland plan. Buffers of perennial vegetation around a wetland slow runoff and capture sediments before they reach the wetland—their ideal width and composition will depend on your site and local conditions. Conservation tillage or no-till on upland fields can dramatically reduce erosion. Where sediment flow is still a problem, it may be worthwhile to install a silt-trapping fence or check dams above wetlands.

## Manage Water Carefully

In many wetlands, not managing water more closely mimics the cycle of natural local wetlands. But if you want to manage your wetland for wildlife, water management is an important component of success.

The rate at which you add or remove water from a wetland can have profound impacts on how that wetland functions. Standing water can encourage many bird species and can inhibit the germination of undesirable plants.

Drawing down the water at specific times of the year—mimicking the natural cycles of recharge and drying—can encourage the germination and growth of the plant community you desire. A summer drawdown may also allow other management tactics, like mowing, disking or burning.

To guide their management decisions, wetland experts live by the acronym DDT—Depth, Duration and Timing, a memory aid championed by Ducks Unlimited biologist Phil Covington.

Depth impacts both plants and animals. What's optimum for specific wildlife species? Depending on the season—the timing—the key factor may be providing good feeding grounds for diving ducks, plenty of mud for shallows-loving shorebirds, or breeding habitat for salamanders. Certain plants, such as *Phragmites* or cattails, can be controlled by maintaining deep water on a site. Others, like duckweed, thrive in those conditions.

The art of managing depth lies in understanding duration. How long will you maintain water at a particular level? At what rate will you drain the wetland? If you drain it too quickly, soils can dry out and poor germination of wetland species can result. Allowing soils to remain wet for two to three weeks by drawing water down slowly—an inch or two a day—can help stimulate germination of wetland plants and nurture young seedlings.

Timing is also vital. To encourage spring annuals, schedule your drawdown for March or April; for summer-germinating plants, delay your drawdown. Varying the timing of drawdown from year to year may help maintain diversity in your plant community—NRCS's Melvin points out that following the same water management schedule year after year could be the worst thing you could do. Check with local botanists or wetland ecologists to map out a strategy; your local NRCS office may also have literature on managing wetlands for wildlife.



Pigweed is not a welcome guest on cropland, but it is an outstanding source of nutrition for birds and other wetland wildlife.

Successful management of water is the result of carefully developed control mechanisms. Variables from the slope of the wetland—which should be as gradual as possible for finely tuned management—to the levees, flashboards or pumps that will be used to manage the water will need to be designed for the site and engineered to last. This is where expert advice and good design will pay off for the life of the project.

Of course, before you begin a water drawdown, make sure you have an adequate source of water to re-flood the wetland.

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“The important thing to remember is that wetlands funding is highly prized, and highly competitive. Plan well and consider the variables that can help make your wetland project as valuable as possible to the local or regional environment, and talk with people who have been through the bidding or grant-writing process for the programs in which you want to participate.”

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## Funding Your Wetland Project

Restoring a wetland requires money. Fortunately, because wetland restoration is such a high priority for many stakeholders from the local to the international spheres, there is an array of programs to help fund well-designed wetland projects.

The best starting point for exploring funding is your local conservation district (sometimes called a soil and water conservation district or a resource district). District staffers there should be well-versed in programs on all levels. They can also tell you about technical assistance capabilities available through the district or through NRCS and help you begin the planning process.

The important thing to remember is that wetlands funding is highly prized, and highly competitive. Plan well and consider the variables that can help make your wetland project as valuable as possible to the local or regional environment, and talk with people who have been through the bidding or grant-writing process for the programs in which you want to participate.

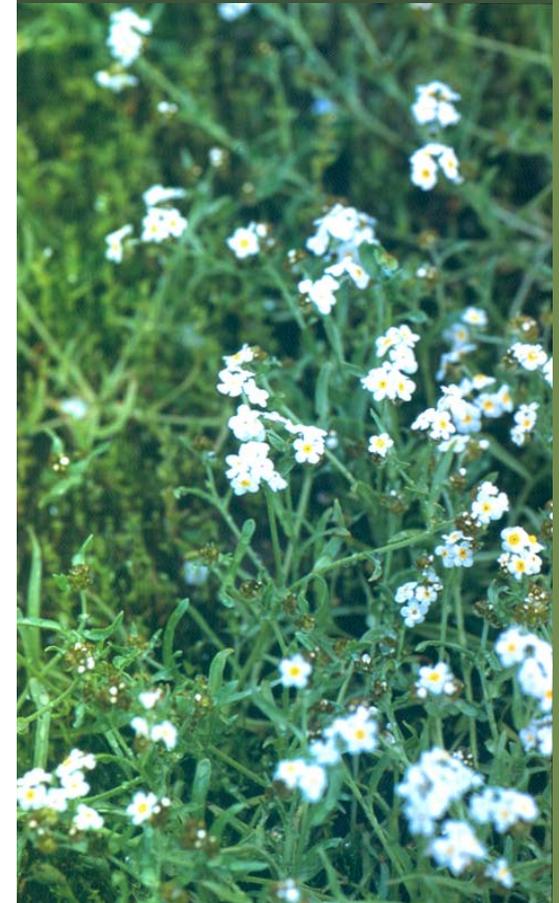
Funding programs and levels can change. However, several federal and state programs have traditionally served as cornerstones of wetlands funding, including:

- » **Wetlands Reserve Program (WRP)**—Funded by the Farm Bill and administered by NRCS, WRP was authorized to restore up to 2.3 million acres of wetlands under the 2002 Farm Bill. In wetland terms, WRP offers substantial payout for a substantial commitment—approximately 80 percent of the acreage enrolled in WRP is engaged in a perpetual easement that covers most, if not all, construction costs, and 14 percent is covered by 30-year contracts. ([www.nrcs.usda.gov/programs/wrp/](http://www.nrcs.usda.gov/programs/wrp/))

- » **Environmental Quality Incentives Program (EQIP)**—Another NRCS-administered program, EQIP offers incentive payments, cost-share assistance and technical help for a variety of conservation projects. High-priority projects help conserve water, protect at-risk species and reduce sedimentation—a great fit with many wetland restoration projects. ([www.nrcs.usda.gov/PROGRAMS/EQIP/](http://www.nrcs.usda.gov/PROGRAMS/EQIP/))
- » **North American Wetlands Conservation Act Grants**—Grants through the U.S. Fish and Wildlife Service support wetland conservation and restoration in the U.S., Canada and Mexico. ([www.fws.gov/birdhabitat/Grants/NAWCA/index.shtm](http://www.fws.gov/birdhabitat/Grants/NAWCA/index.shtm))
- » **Conservation Reserve Enhancement Program (CREP)**—A state-federal partnership that encourages the adoption of specific conservation practices, CREP annual rental payments and cost-share may be applied to some wetlands projects. In fact, as of 2005, about one-sixth of the acreage in CREP was in wetlands or riparian buffers. ([www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=cep](http://www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=cep))
- » **Five-Star Program**—Developed by U.S. EPA to encourage community partnerships, this program grants \$5,000 to \$20,000 to wetlands programs that meet its criteria, including cost sharing and involving at least five stakeholder groups in the project. ([www.epa.gov/wetlands/restore/5star/](http://www.epa.gov/wetlands/restore/5star/))
- » **EPA Regional Grant Program**—Each of U.S. EPA's 10 regions has grant money that can be dedicated to wetlands demonstration projects. Contact your local region to see if you or a group you help assemble could be eligible.
- » **Clean Water State Revolving Fund**—Funded by U.S. EPA and state money, these low-interest loans typically went to municipalities and other handlers of wastewater. In recent years, though, nonpoint source pollution prevention programs, including wetlands projects, have been funded through the program. Rules vary by state—it's worth a look.

## FOR MORE INFORMATION

Check with your local conservation district on funding sources, or go online to the U.S. EPA funding database at [www.epa.gov/owow/funding/databases.html](http://www.epa.gov/owow/funding/databases.html).



## PLANT DATA CENTER OFFERS DETAILS

Which problem plant species are found in your area? Check the USDA NRCS PLANTS Data Center web site (<http://plants.usda.gov>) to find out. Technical Note 190-72 by the NRCS National Wetland Team also offers identification and control information for some of the most notorious invasive wetland plants ([ftp://ftp-fc.sc.egov.usda.gov/WLI/NoxiousPlants5\\_24\\_2007.pdf](ftp://ftp-fc.sc.egov.usda.gov/WLI/NoxiousPlants5_24_2007.pdf)).

Understanding your state's conservation priorities can help you develop a wetland restoration plan that is more likely to help achieve those key goals and qualify for funding. The web site of the Association of Fish and Wildlife Agencies features a state-by-state exploration of wildlife action plans ([www.wildlifeactionplans.org/index.html](http://www.wildlifeactionplans.org/index.html)).

A wide variety of non-governmental organizations can also fund wetlands conservation and restoration. Strong support may be garnered from local philanthropies or watershed councils, or from national wildlife advocacy groups like Ducks Unlimited ([www.ducks.org](http://www.ducks.org)) or the National Fish and Wildlife Foundation ([www.nfwf.org/AM/Template.cfm?Section=Grants](http://www.nfwf.org/AM/Template.cfm?Section=Grants)).

Wildlife organizations like the National Audubon Society ([www.audubon.org](http://www.audubon.org)) may also be able to offer invaluable technical information on key species of interest—many groups employ wildlife biologists who are very well-versed in wetlands ecology.

Corporate America also supports wetlands as a way of sponsoring environmental improvements. The National Corporate Wetlands Restoration Partnership ([www.coastalamerica.gov/text/cwrp.html](http://www.coastalamerica.gov/text/cwrp.html)) began in 1999 when the Gillette Company joined with U.S. EPA and the Massachusetts Executive Office of Environmental Affairs to sponsor “green” projects in the Bay State, administered by Coastal America. The initiative grew quickly—now, the program is running across the country with more than 200 corporate partners and more than 100 non-federal agencies ranging from state governments to private foundations.

Local or state land trusts may also be an excellent source of support through conservation easement funding. Working closely with a land trust that shares your interests and values, you could craft a conservation easement that allows you to retain ownership of your wetland even after selling the development rights to the parcel—much like a contract in perpetuity under WRP. Conservation easements can create outstanding win-win opportunities, but they must be considered very carefully. The Land Trust Alliance ([www.landtrustalliance.org](http://www.landtrustalliance.org)) and American Farmland Trust ([www.farmland.org](http://www.farmland.org)) are invaluable resources for information on easements and the organizations that fund them.

## Wetland Challenges

Wetlands offer a great deal of reward, but they also involve some risk—and some significant challenges. Beyond the basic challenges of planning, funding and implementing a wetland project, issues such as invasive weed species and undesirable wildlife can add complexity and cost to your effort. Be aware of the risks your project faces—that could help you prevent the problem or at least gain the upper hand when it's time to manage it.

Several invasive plant species are drawn to newly created wetland environments. First, the topography of most wetlands makes them an ideal collection area for seed and other plant propagules that gravity is ready to drop in a bowl. Like any plant species, invasive weeds require appropriate soil type, temperature, sunlight and available water to thrive. The problem is that some invasive species are so well-adapted to such a wide variety of environments that they out-compete native plants. For instance, common reed (also known by its genus name, *Phragmites*) tolerates far more alkaline, acid or saline conditions than most wetland plants, though it is perfectly at home in a freshwater, pH-neutral environment. That makes it a fearsome competitor in almost any wetland environment. Similarly, purple loosestrife is at home in most wetland soil textures, and though it prefers sun, it does fine in shady conditions.

Three key species tend to float to the top of the list of invasives most feared and despised by wetlands managers.

The first is *Phragmites*. Tall and vigorous, this reed spreads by both seed and rhizome. *Phragmites* stands can be as thick as 240 stems per square yard, choking out nearly every other plant in the area. Common reed offers poor habitat to most wildlife except pest species such as the red-winged blackbird, which can quickly become a pest in nearby crops.

Cutting *Phragmites* stands in late July, before the plant begins storing carbohydrates in its roots and rhizomes, can be an effective way to control *Phragmites* as long as the cut stems are removed so they don't send out roots. Backing up a cutting program by flooding the site can help, too—the deeper the better. *Phragmites* seedlings fare poorly where waves can break their fragile stems. Chemical control can also be effective.



Establishing a diverse community of desirable plant species while fighting invasives can be one of the great challenges of wetland management.



Jill M. Swearingen, USDA National Parks Service, Bugwood.org

Non-native weeds such as *Phragmites*, or common reed, can choke out native species and degrade wetland habitat. Keeping invasives out starts in the planning stages.

**Reed canarygrass** is another rapacious weed in wetland systems, crowding out native plants from coast to coast. Integrated management programs can feature some combination of grazing, mowing, disking, burning, herbicides and the aggressive planting of desirable wetland species that can shade out the invasive crop.

**Purple loosestrife** (sometimes called “the purple plague”) overwhelms other vegetation by out-reproducing it. Each plant can produce hundreds of thousands of seeds, and its hardiness and adaptability results in excellent germination. Herbicides can suppress it, as can dense plantings of competitive plants such as Japanese millet. But purple loosestrife stands as an example of the importance of keeping invasive weeds out of your wetland in the first place—once it establishes a toehold, it is extremely difficult to manage.

Invasive species can include fauna as well as flora. Among the most celebrated values of wetlands is the quality of the wildlife habitat they create. Of course, not all wildlife is compatible with farming or other human activities, so it can be important to manage the habitat to discourage unwanted occupants or manage the wildlife to reduce its impact on the wetland.

The voracious **New Zealand mud snail** has infested many wetlands in the Pacific Northwest, consuming so much algae and phytoplankton that they left little nutrition for native species. **Grass carp** introduced in the 1960s as biological plant control agents in canals have an appetite for the same aquatic plants that sustain ducks and shelter young fish. And the widely distributed mosquito fish, *Gambusia*, has exhibited an appetite for the insects that prey on mosquito larvae rather than the larvae themselves. Their aggressive attacks on beneficial insects and native fish have earned *Gambusia* the nickname “killer guppies.”

Of course, **mosquitoes** are a concern in wetland environments, especially in light of the extensive media coverage of mosquito-borne diseases such as West Nile virus. However, it’s important to note that there are approximately 200 species of mosquitoes in the U.S. Most serve as the vital base of the wetland food chain; just a few have been implicated in spreading West Nile.

The key vector of West Nile virus in the eastern U.S. is *Culex pipiens*, which prefers degraded wetlands with warm, shallow, stagnant pools covered by large algae blooms caused by runoff of excess nutrients. In fact, a long-lasting mud puddle or water in an old can or tire is a better breeding ground

for *C. pipiens* than a healthy wetland, where a hungry population of insects, fish, amphibians and birds combines with water movement to minimize the survival of larvae and consume plenty of adults.

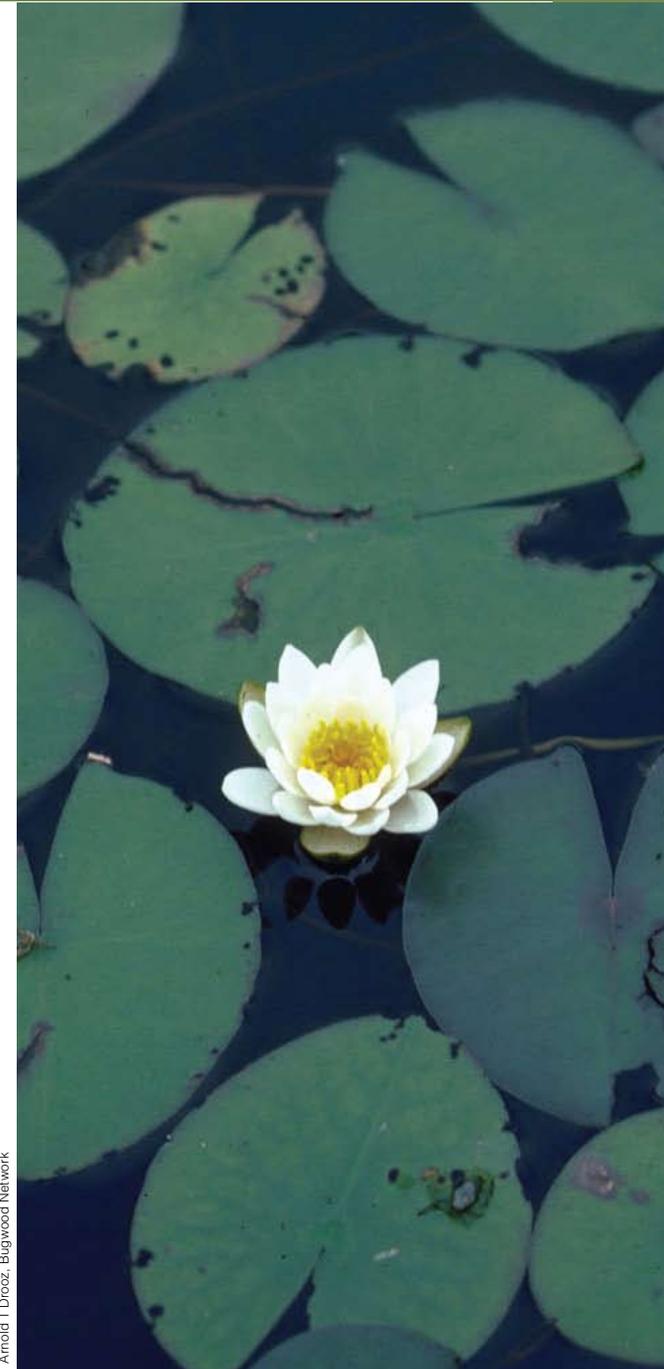
That means that the good management practices that help establish and maintain a healthy wetland also help make it less hospitable to *C. pipiens*. Unfortunately, the big West Nile vector in the western U.S. is *C. tarsalis*, which breeds in clear water. The presence of *C. tarsalis* may warrant mosquito control measures that include maintaining permanent or semi-permanent open water deep enough to breed native mosquito-eating fish and even considering larvicides such as *Bacillus thuringiensis* (Bt).

Some species that value wetland habitat can be either a welcome sight or a problem—or a bit of both. **Canada geese** utilize wetlands along their migratory paths, just as ducks do. However, they also utilize nearby croplands to satisfy their impressive appetites—an adult Canada goose eats up to 4 pounds of grass per day—which can make geese a significant problem on many farms and ranches.

Geese tend to be drawn to open water at least 2 to 3 acres in size, with adequate open space around the ponds for “runways.” If geese cause economic damage in your area, consider managing your wetland to create habitat that is less attractive to geese—shallower and smaller areas of open water, or bushes, trees or islands that interfere with takeoff and landing. Hazing tactics such as mylar streamers or audio deterrents may be of some help, too.

**Rodents** fall into a similar category of good news/bad news in a wetland. Many rodents serve as an important source of food for snakes, mammals and birds of prey that wetlands support. Some are threatened or endangered species, so your wetland could be vital to their survival. However, some rodents—such as ship rats or Norway rats—can act as predators of bird eggs and chicks. Others, including beavers, nutria and muskrats, can interfere with water management or damage expensive infrastructure, including dikes and water control structures.

Rodent management begins before the first shovelful of earth is turned. Work with local wildlife experts to determine the types of rodents that are most likely to live in your wetland. Explore ways to harbor the desired species and discourage unwanted ones. For instance, creating a borrow ditch at the foot of a dike attracts destructive burrowing rodents, so consider moving the borrow area at least 50 feet from the toe of the dike. Similarly, locating water control structures away from prime beaver habitat, or using an in-line riser situated in the middle of the dike, may help minimize the conflict between





In order to get to the beauty and function of wetlands, landowners must navigate legal straits and program rules. Fortunately, for the diligent, there is an array of programs designed to encourage and help fund wetland protection or restoration. It is vital, though, to make sure every step is in accordance with local, state and federal law. After looking at paperwork, though, comes the reward of uncommon beauty, like this common camas bloom.

you and your resident beavers. The key is understanding rodent biology and preferences.

Despite the challenges posed by some wildlife recruited by wetlands, the benefits your wetland can provide to a vast array of species, as well as to your operation, can easily outweigh the extra management requirements.

## Legal Issues Surrounding Wetlands

Not surprisingly, there are many legal issues surrounding wetlands, ranging from local relationships with neighboring properties to working with the U.S. Army Corps of Engineers and other federal agencies. The following discussion is designed to spark more thorough conversations with qualified experts in your area. As with any projects that deal with land and water use, it is important to proceed with a solid understanding of the process and issues that surround your wetland. *Do not begin to convert or modify any wetland, even to improve its function, until you have consulted with the appropriate agencies.*

The most **local legal issues** surround the impact of your wetland on neighboring properties. If the water from your project backs up onto your neighbor's cropland, you could find yourself in trouble. Similarly, if a pond or impoundment threatens a neighbor downhill, you could wind up in court. So when you look at the topography of your project site, remember to look over the property line and consider its impacts. (On the positive side, perhaps your neighbor is interested in joining you in the project.)

In states where **riparian water rights** are honored, it is important to understand whether you have the right to impound water from your downstream neighbors. They may have senior water rights to yours—in that case, you'll need to make sure they get the water to which they are entitled. Work closely with local irrigation districts and hydrologists for details on your water rights—and your neighbors'.

Program **contracts and easements** set parameters and obligations on your project, too. It is vital to fully understand the requirements of the programs in which you are enrolled. It is just as vital to define in the agreements how the funding entity will determine whether your obligations are being

met. It will be very important to clearly define goals such as vegetative cover from the outset, and explicitly outline monitoring procedures, including who is responsible for monitoring and how the monitoring is to be conducted.

It is also very important to establish in your contracts and easements how construction, maintenance and alterations will be permitted and accomplished. During the construction stage, be sure to document your plans and make detailed records of when and how every phase was constructed. Be sure to include any changes that were made to the original plans during construction, creating updated drawings called “as-built” documents. Keep those records current—complete your “as-built” documentation as soon as a phase is completed so you can refer back to it if questions arise about what was actually done on the project.

For practical purposes, any movement of soil or exchange of water in a wetland is subject to two very important and far-reaching pieces of federal legislation, Swampbuster and the Clean Water Act. Running afoul of either of these laws carries very high stakes, so be absolutely sure you have consulted the appropriate parties and received the official go-ahead before embarking on your project.

Under the **Swampbuster** provision of the 1985 Food Security Act (also known as the Farm Bill), federal farm program benefits will be withheld from producers who convert or modify wetlands. Simply put, that means if you start building a dike without proper permits, you could lose your USDA program benefits.

Section 404 of the **Clean Water Act** exempts most normal farming practices. However, actions that affect wetlands—anything that could be construed as filling, deepening or altering a wetland—requires a permit under Section 404. That requires working with several federal agencies, including:

- » **The U.S. Army Corps of Engineers**, which determines jurisdiction and administers permits;
- » **U.S. EPA**, which establishes the environmental criteria used in evaluating permit applications, reviews and comments on individual applications and enforces the law;
- » **U.S. Fish and Wildlife Service**, which comments on individual permits with an eye toward their potential impacts on fish and animals.

## DOES YOUR WETLAND FALL UNDER CLEAN WATER ACT JURISDICTION?

There have been dozens of jurisdictional cases at every level of the court system in the past decade attempting to clarify whether particular types of wetlands fall under the Clean Water Act. Generally speaking, the courts have found that wetlands that are adjacent to any tributary or have any hydrological connection to a navigable waterway are covered under Section 404 of the Clean Water Act. The Supreme Court has ruled that “tributary” can include creeks, streams or even constructed ditches and culverts. In addition, distance is not a factor. So even if your wetland is 20 miles from the nearest navigable river, it could fall under Clean Water Act rules if the roadside ditch next to it empties into a culvert, which empties into a drainage ditch, which ultimately finds its way to the river.

The benefits of wetlands can be felt all the way up the food chain, from plants to waterfowl to the raptors that hunt them...and the humans who farm or ranch on the land and drink the water beneath it.

State regulatory agencies may also require permits under their own water quality or environmental health statutes. Check with your conservation district or other local experts for insights on local, state and federal rules.

The **Endangered Species Act** could also apply to a wetland restoration or development. (Remember that there are both federal and state lists of threatened and endangered species, so be sure to consult with regulators at both levels of government.) If your land is home to threatened or endangered species, whether plant or animal, you will need to be absolutely sure you have the proper permits before you begin impacting the habitat. If your wetland attracts endangered species, you could find yourself limited on management or utilization to help protect the species.

Planning ahead can help create a win-win situation. Landowners can work with the U.S. Fish and Wildlife Service and state regulators to create legal agreements that allow the landowner vital flexibility under the federal Endangered Species Act, including:

- » A **Safe Harbor Agreement**, which allows a landowner to create habitat that could attract an endangered species in return for assurances that use of the land will not then become locked down by additional restrictions if the species does in fact move in. Safe Harbor agreements include a “no surprises” clause, which allows the landowner to receive a special permit to return the land to any legal use after the term of the Safe Harbor agreement as long as conditions on the property don’t fall below a baseline established in the original plan.



» A **Candidate Conservation Agreement** covers species that are in danger, but not officially listed as threatened or endangered. The government seeks landowners willing to improve the chances of species recovery so it won't need to be listed as threatened or endangered. The landowner receives assurance that if the species does get listed, he or she will not be held to additional restrictions on the use of the land.

For details on the tools available to help landowners deal with the possible impacts of the federal Endangered Species Act, visit [www.fws.gov/angered/landowner/index.html](http://www.fws.gov/angered/landowner/index.html).

Just as you need to check with hydrologists and ecologists on the physical and biological functions of your wetland project, be sure to work with a lawyer or other qualified advisor who can help you with the regulatory functions that surround it. With planning and proper permits, you can get to work creating an invaluable resource that could have significant benefits to you and the environment.

## Wetlands Offer Opportunities

Protecting, preserving or restoring a wetland takes commitment. It takes time, money and management.

Those investments can pay off in a host of ways. Your wetland project could turn difficult or marginal land into a profitable part of your farm or ranch—by providing forage or pasture, by taking risky ground out of production, by protecting your prime ground from the ravages of runoff and floodwaters or by offering income prospects from hunting or bird watching.

Your wetland could become a source of pride and pleasure, whether it's from watching your grandkids catch frogs or from having your very own place to hunt ducks. And it can have a profound impact that can be felt locally as you help turn the tide of habitat loss, and across the globe as migratory birds take off from your wetland and continue on their ancient path.



Healthy creeks, streams, wetlands and pastures are all linked in a web of sustainability. Good management can improve working land today and safeguard our resources for our children.



# Resources

A Listing of Agencies and Organizations

## For More Information

**Though every wetland project is unique in some way, there is a wealth of information available on wetlands to get you started.**

**A great place to start is your local conservation district or NRCS office. The internet is also full of outstanding resources.**

**Try these for a start.**

### U.S. ENVIRONMENTAL PROTECTION AGENCY

[www.epa.gov/owow/wetlands/](http://www.epa.gov/owow/wetlands/)

Perhaps the most comprehensive site on wetlands, from the definition of a wetland to advanced discussions on the hydrology and economics of wetland systems. The Agency's document on wetland restoration ([epa.gov/owow/wetlands/pdf/restdocfinal.pdf](http://epa.gov/owow/wetlands/pdf/restdocfinal.pdf)) is an invaluable starting point for exploring wetlands, as is <http://epa.gov/owow/wetlands/restore/principles.html>.

### USDA NATURAL RESOURCES CONSERVATION SERVICE

[www.nrcs.usda.gov](http://www.nrcs.usda.gov)

The on-the-ground technical resource for wetlands, NRCS offers information on relevant federal programs on its web site. Look for information on the Wetlands Reserve Program (WRP), Environmental Quality Incentives Program (EQUIP), Conservation Reserve Enhancement Program (CREP) and other incentives on the NRCS site. NRCS soil maps (<http://websoilsurvey.nrcs.usda.gov/app/>) are invaluable for finding an appropriate site for a wetland project, and the Service's resource on hydric soils (<http://soils.usda.gov/use/hydric/>) is a key accompaniment.

NRCS also has a National Wetland Team, whose web site ([www.wli.nrcs.usda.gov](http://www.wli.nrcs.usda.gov)) is a treasure trove of information on wetland engineering, hydrology, wildlife, soils, vegetation and invasive species. In particular, the team's *Wetland Restoration, Enhancement, and Management* (<ftp://ftp-fc.sc.egov.usda.gov/WLI/wre&m.pdf>) is a must-read resource before embarking on a wetland restoration project.

### U.S. FISH AND WILDLIFE SERVICE

[www.fws.gov](http://www.fws.gov)

To encourage landowners to conserve or enhance wetlands, the U.S. Fish and Wildlife Service offers technical expertise as well as a variety of habitat incentive programs ([www.fws.gov/habitat](http://www.fws.gov/habitat)). The Service's National Wetlands Inventory (<http://wetlandsfws.er.usgs.gov/NWI/index.html>) is also an invaluable resource for siting projects.

### FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA)

[www.fema.gov](http://www.fema.gov)

FEMA floodplain maps are a fundamental tool for figuring out a good site for a wetland project. The maps can be ordered online for a nominal fee.

## U.S. GEOLOGICAL SURVEY WETLANDS RESTORATION BIBLIOGRAPHY

[www.npwrc.usgs.gov/resource/literatr/wetresto/index.htm](http://www.npwrc.usgs.gov/resource/literatr/wetresto/index.htm)

A searchable database of documents on wetlands restoration—the Mother Lode of writings on the subject, including dozens of case studies.

## ENVIRONMENTAL LAW INSTITUTE (ELI)

[www.eli.org](http://www.eli.org)

This nonpartisan educational and research center is a font of great information on wetlands issues, including outstanding analyses of the legal and regulatory climate that surrounds wetland projects. ELI's National Wetlands Newsletter is a must-read before engaging in a wetland project—a subscription opens access to an online, searchable archive.

## ELECTRONIC TOOLKIT FOR FISH AND WILDLIFE HABITAT MANAGEMENT

[www.whmi.nrcs.usda.gov/technical/etool.html](http://www.whmi.nrcs.usda.gov/technical/etool.html)

A treasure trove of information on wildlife habitat, this NRCS resource should be on the Favorites list for any wetland-oriented farmer, rancher or advisor.

## NATURAL RESOURCE ENTERPRISES PROGRAM, MISSISSIPPI STATE UNIVERSITY

[www.naturalresources.msstate.edu](http://www.naturalresources.msstate.edu)

A wealth of data on generating revenue from natural resources, including wetlands. Visit for survey results, technical advice, marketing savvy and details on legal issues. A paper on hunting leases (<http://msucares.com/pubs/publications/p2310.pdf>) is especially helpful.

## DUCKS UNLIMITED

[www.ducks.org](http://www.ducks.org)

Perhaps the leading private proponent of wetland restoration in North America, Ducks Unlimited employs wetland experts with an eye for the hydrology and biology that make wetlands invaluable for waterfowl.

## IZAACK WALTON LEAGUE

[www.iwla.org](http://www.iwla.org)

Since the early 20th century, the Izaak Walton League has been a grassroots voice for conservation. The group's wetlands fact sheets ([www.iwla.org/index.php?id=400](http://www.iwla.org/index.php?id=400)) include valuable publications and resources.

## LAND TRUST ALLIANCE

[www.landtrustalliance.org](http://www.landtrustalliance.org)

The gathering point for land trusts from across the U.S., the Land Trust Alliance offers insight as well as an invaluable network of organizations that could help landowners create win-win conservation easements to help finance and protect wetland projects.

## AMERICAN FARMLAND TRUST

[www.farmland.org](http://www.farmland.org)

This active policy and research group is on the front lines of conservation policy and easement practice—another excellent resource for landowners exploring easements as a conservation tool.

## CORPORATE WETLANDS RESTORATION PROJECT

[www.coastalamerica.gov/text/cwrp.html](http://www.coastalamerica.gov/text/cwrp.html)

A look at a growing, nationwide effort to link corporate dollars with local wetland restoration efforts.

### A LANDOWNER'S GUIDE TO *PHRAGMITES* CONTROL

[www.michigan.gov/documents/deq/  
deq-ogI-Guide-Phragmites\\_204659\\_7.pdf](http://www.michigan.gov/documents/deq/deq-ogI-Guide-Phragmites_204659_7.pdf)

This document from the Michigan Department of Environmental Quality provides an excellent overview on controlling one of the nationwide challenges in wetlands.

### ENVIRONMENTAL CONCERN

[www.wetland.org/publications\\_home.htm](http://www.wetland.org/publications_home.htm)

This Maryland-based organization has parlayed decades of experience with Chesapeake Bay watershed projects into a series of books and other educational resources, many of which are handbooks on wetland construction and management.

### CONSERVATION TECHNOLOGY INFORMATION CENTER (CTIC)

[www.conservationinformation.org](http://www.conservationinformation.org)

Long a respected clearinghouse for information on conservation practices that are economically sustainable as well as environmentally sustainable, CTIC is proud to provide this publication as part of an array of wetland resources, from frequent articles in Partners online magazine to wetlands publications such as *Wetlands: A More Profitable Alternative?*



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