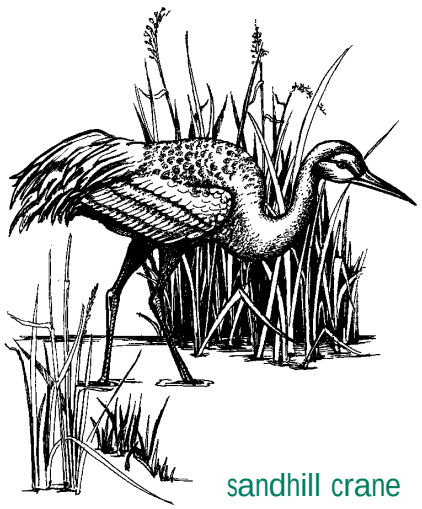
PRIVATE LAND PARTNERSHIPS
WORKING TOGETHER FOR WILDLIFE

INTRODUCTION TO WETLAND MANAGEMENT

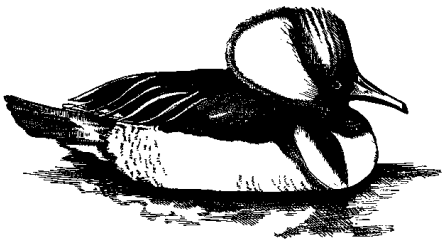
Glaciers, melting nearly 12,000 years ago, left behind raw materials--water, lowlands, and poorly-drained soils--to form up to 11 million acres of wetlands in Michigan. This total was nearly one-third of the state's land mass. In the fewer than 200 years since European settlers first arrived, between 35 to 50 percent of Michigan's wetland acres have been drained, filled, or otherwise altered. Much of the loss occurred through efforts to increase agricultural production on these rich soils, but other wetlands were filled to make room for development. The greatest amount of loss has occurred in southern Michigan where some counties have experienced a loss of more than 75 percent. This loss is not limited to Michigan. It is estimated that in 1780 there were 221 million acres of wetlands in the continental United States. Today, only about 47 percent remain. During the 1980s, wetland loss through draining or filling continued at an annual estimated rate of 290,000 acres. While the rate of loss has decreased in recent years, the goal of "no net loss" is not yet a reality.



sandhill crane

People often think of a wetland as an area that floods, or at least has soggy soils, throughout the growing season. They often picture a specific, isolated area such as a cattail marsh or a wooded swamp. However, there is much more to consider and there are many different types of wetlands. Wetlands are often transitional zones between dry upland sites such as old fields and forests and open-water areas such as lakes and rivers. Most wetlands have three things in common: (1) water at or near the surface some time of the year (2) hydric soils, and (3) wetland vegetation.

The distribution, movement, amount, and seasonal availability of water influences wetland systems. Wetlands have enough water on or near the ground surface to affect the soils and the type of plants that can grow there. Sites with soggy, saturated soils but no standing water can also be wetlands. A wetland does not have to be "wet" all of the time--only during part of the year. The presence of water results in a lack of oxygen in spaces between soil particles. Wetland or "hydric" soils develop under such saturated conditions, and wetland or "hydrophytic" vegetation, grows in the moist soil.

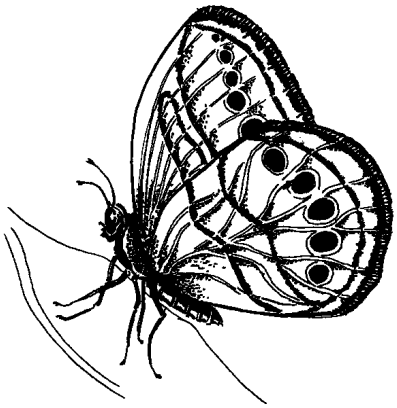


hooded merganser

Wetland Values

Some people view wetlands as wastelands, but this belief is far from true. All Michigan citizens, whether they own land or not, benefit from wetlands, which are some of our most valuable natural resources. Wetlands provide recreational opportunities for birdwatchers, hunters, hikers, photographers, canoeists, anglers, and other outdoor enthusiasts. Wetlands are among the most biologically diverse and productive landscape cover types. Acre for acre, the biomass or living material produced on marshlands is four times that of grasslands and three times that of cropland. Production in marshlands can equal or even exceed that in tropical forests.

Wetlands provide habitat for thousands of species of fish, insects, amphibians, reptiles, birds, and mammals. Nearly 35 percent of the nation's rare wildlife species are located in wetlands or are



Mitchell's satyr

dependent on them. The Mitchell's satyr butterfly, for example, is a rare Michigan butterfly typically only found in prairie fens. Mammals (muskrats, mink, and beavers), waterfowl (ducks and geese), shorebirds (plovers and sandpipers) wading birds (herons and rails), amphibians (salamanders, frogs, and toads), and insects (dragonflies and mayflies) are examples of the host of wild creatures raised in and around wetlands. In addition, muskellunge and northern pike spawn in wetlands. Many species of wildlife use wetlands along with other habitats.

Wetland plants are important as they stabilize soils and reduce erosion. Wetlands act as huge sponges to store water, which helps to reduce flood damage. The water then percolates back into the earth where it helps to recharge the ground water supply and/or maintain water levels in streams and rivers. A one-acre wetland holding water to a depth of one foot, will store 330,000 gallons of water.

Wetlands function as nature's kidneys to filter pollutants and sediments from surface water. They capture and slow runoff water in their thick tangle of plants. When water is slowed, pollutants and sediments drop out of suspension. Wetland organisms intercept nutrients and pollutants, trapping them in wetland plants or substrates. Although too many pollutants can damage them, wetland plants also help to circulate and reuse nitrogen, phosphorus, and other essential nutrients. Many local governments have used this phenomenon to their advantage, constructing wetlands to filter treated wastewater and reducing the overall cost of treatment operations.

Marsh hay, wild rice, blueberries, cranberries, timber, furbearers, and fish are examples of products with economic value that wetlands provide. For this reason, farmers, trappers, fishermen, and others that rely on wetlands for income must exercise care to avoid degrading them while harvesting their products.

Types of Wetlands

Wetlands vary greatly depending on how much water is present, how long water is present, how the water got there, the type of soil, and the kinds of vegetation present. All wetlands, regardless of size and water depth, provide important wildlife habitat. Additional chapters in this section explain the types of wetlands in more detail and provide suggestions for protecting and managing them.

Swamps have saturated soils, may have standing water during part of the year, and are dominated by water-tolerant trees such as silver maple, cottonwood, black ash, or tamarack. Buttonbush, alder, willow, and red-osier dogwood are shrub species that often grow in swamps. Types of swamps include

tamarack

bottomland forests on floodplains, conifer swamps, and dense shrub swamps.

Marsh is another type of wetland covered periodically by standing or slow-moving water. Soft-stemmed plants such as cattails, sedges, and rushes dominate a marsh's nutrient-rich soils.

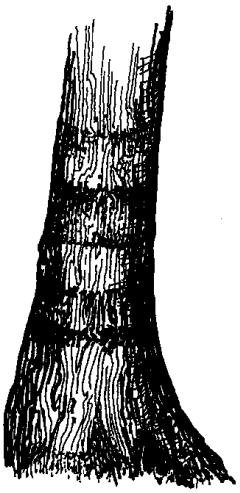
Wet meadows, sedge meadows, and wet prairies are similar to marshes in that they also contain grasslike vegetation. However, these wetlands typically have only seasonally saturated soils and little or no standing water.

Seasonal wetlands are shallow, temporary wetlands that can have standing water from late winter through early spring. Examples are seeps, which usually provide a year-round source of water, and vernal pools, which vary in size from a few square feet to over an acre. These wetlands can be important for breeding and migrant waterfowl, amphibians, and other wildlife.

Bogs and fens are wetlands with a thick accumulation of organic matter called peat. The acidic water of a bog is nutrient-poor because the bog is fed by rain water. Acid-loving plants include sphagnum moss, blueberries, and tamarack. "Insect-eating" plants such as pitcher plant and sundew are also found only in bogs and fens. Fens are somewhat rare in Michigan. Unlike bogs, they are fed by groundwater that has passed through calcium and manganese rich mineral soils. Fens are typically more nutrient-rich than bogs, they support sedges, rushes, and some shrubs.

Wetland Indicators

Some wetlands, such as swamps and marshes, are obvious to most people. Others, like seasonal wetlands or bogs, are not as easily recognized because they may dry out during part of the year or simply do not look very wet. Remember that all wetlands have three things in common and the presence of these may indicate that you have a wetland on your property:



Water marked trees may indicate the presence of a wetland.

Evidence of Hydrology:

• Standing or flowing water for seven or more consecutive days during the growing season.

•Waterlogged soil: Determined by digging a 12-inch-deep hole and then checking for water in the hole; or by looking for soil that glistens with water; or squeezing water from a handful of soil.

• Water marks on trees or small piles of debris lodged in trees or piled against other objects in the direction of water movement near river systems.

Wetland Soils:

• Check with your County Conservation District (CD) for a soil survey and a list of soil types that occur in wetlands.

• Check for a blue or gray color about a foot below the surface. Your local CD office may describe other color characteristics to look for.

• Look for organic matter such as peat or muck.

• Smell the soil for an odor like rotten eggs.

Wetland Vegetation:

More than 5,000 different plants grow in wetlands. Some common wetland plants to look for include:

• Water lilies, cattails, arrowhead, smartweed, pondweed and other plants in standing water.

• Grasses such as reed canary grass, barnyard grass, and prairie cordgrass, or rushes and sedges.

• Trees such as willow, white cedar, cottonwood, silver and red maple, green ash, tamarack, pin oak, and elm.

• Shrubs such as buttonbush, Michigan holly, and red-osier dogwood.

water lily

Are There Former Wetlands on my Property?

If you can answer "yes" to the following questions, it is quite possible that you may have a drained wetland that can be restored:

• Are there depressions or low areas (potholes) on your property that are drained with tile or ditches?

• Are vegetation changes readily visible in the field? For example, do you have patches of stressed or drowned crops or other vegetation?

• Do patches of wetland plants such as cattails, sedges, smartweeds, or red-osier dogwood occur in your fields?

Should I Protect, Enhance, or Create a Wetland?

Wetlands should be preserved whenever possible. Natural wetlands, which developed over thousands of years, are hard to duplicate because of their complexity. Preserving those that are not currently being drained or altered by humans is often the best way to maintain existing wetland functions, including wildlife habitat. Recognize, however, that wetlands are a dynamic system that will change with time. Change may be positive or negative.

Those wetlands that have been dredged, drained, filled, or otherwise altered offer an opportunity for restoration. Often, blocking a ditch or removing a portion of a field tile line may be all that is needed to restore water, which will help to germinate aquatic plant seeds lying dormant in the soil. Remember, a restored wetland need not hold water all year long; in fact, many do not. Temporary wetlands are usually less than two feet deep and often retain water for only a few weeks each spring.

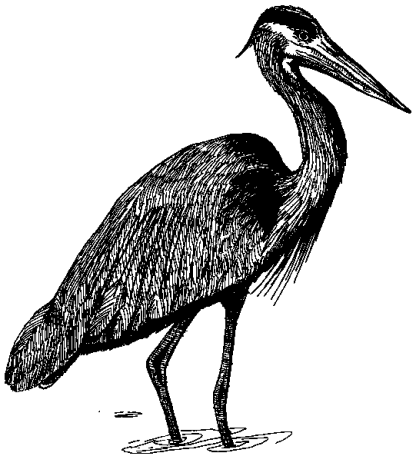
"Enhancement" of an existing wetland can be done to improve wetland functions. However, this can be difficult, and improving surrounding uplands may be more effective. Enhancement efforts may include varying water depths; mowing, burning, or planting; removing nuisance plants; adding nest structures and other habitat improvements.

Creating wetlands can also help wildlife, but this process may be both difficult and expensive depending on site characteristics. Often created wetlands do not function correctly and result with failed projects due to incorrect soils, vegetation, etc. It is hard to duplicate the complexity of wetland systems. Remember that wetlands can influence, and are influenced by, what goes on around them. The type and amount of vegetation around a wetland can greatly affect its value for wildlife, and how the wetland performs other functions. Having clear goals along with a site-specific plan are the keys to successful habitat management.

What Regulations Apply?

Because of their importance, wetland manipulations are regulated by local, state, or federal laws. Check with your township or other local government office to see if there is a wetland protection ordinance that applies to your property. State and some federal regulations can be addressed by contacting the Michigan Department of Environmental Quality (MDEQ), Land and Water Management Division. This agency coordinates the review of project proposals with various divisions within MDEQ, the Michigan Department of Natural Resources (MDNR), and federal agencies such as the U.S. Army Corps of Engineers, if required. Further, the Natural Resource Conservation Service also administers federal wetland regulations for landowners who participate in U.S. Department of Agriculture programs. Allow enough time for permit application and approval so as not to upset the time frame for your project.

In summary, wetlands are very complex systems that offer a variety of benefits to both people and wildlife. There are many types of wetlands that are each dependent on local hydrology, hydric soils, and wetland vegetation. Wetlands should be protected or restored whenever possible. As with any other management activity, prior planning helps to ensure that your goals are reached.



heron

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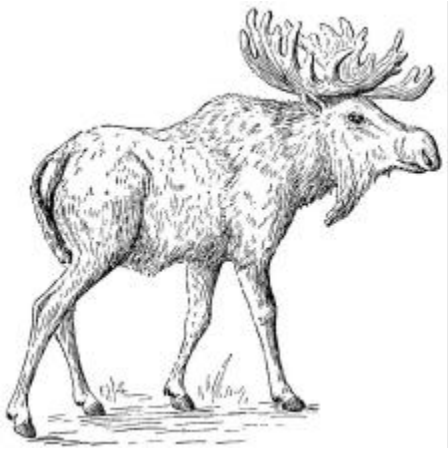
BOGS AND FENS

Bogs and their close cousins--fens--are biologically fascinating wetlands. Their deep peat layers offer a glimpse into the geologic past--seeds, plant parts, and even animals may remain intact in the acidic peat for thousands of years. If a bog or fen exists on your property, consider yourself lucky as they are very rare.

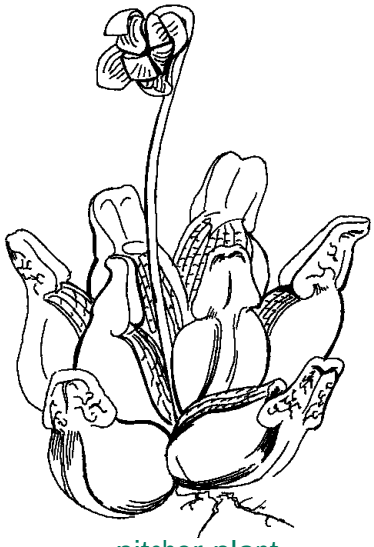
In Michigan, bogs and fens occurred historically as a result of glaciation, dating from about 8,000 to 12,000 years ago when the last ice sheets retreated north, although some bogs and fens are only 3,000 to 5,000 years old. The retreat of these glaciers created tundra climates, and over time, forests of spruce and fir, which still dominate in the north. However, bogs and fens began to form in areas that were too wet for most trees to grow, and that had poorly drained dark soils and cold water. Although both bogs and fens are similar types of wetlands as they are both considered peatlands, what sets them apart from each other is the source of their water supply. Fens typically are fed by a steady source of ground water whereas bogs are usually enclosed depressions filled by rain water.



These unusual wetlands are home to a variety of plants and animals including unique bog lemmings, pitcher plants, and sundews. The familiar song sparrow and red-winged blackbird live there along with yellow-bellied flycatchers, and Nashville warblers, which nest only in northern Michigan. American goldfinch, American woodcock, alder and willow flycatchers, and golden-winged and chestnut-sided warblers are other birds that use them. Ruffed grouse eat the catkins of bog birches, which often grow around the edges of bogs and fens, and migrating ducks use their open pools. Because bogs attract insects, shrews, mice, frogs, and toads, they also attract mink, raccoons, herons, and other predators. Moose also use these areas in the Upper Peninsula. In winter, the white cedar forests that often surround many bogs yield important browse and cover for deer.

Bogs

Bogs are unique wetlands because their nutrient-poor systems support a specific group of plant species. Such plants include carnivorous species such as pitcher plants, sundews, and bladderworts, which eat insects and are able to retain water from precipitation, and sphagnum moss, which grows abundantly over the layers of peat found here. Common shrubs include leatherleaf, bog laurel, bog rosemary and Labrador tea. Blueberries and cranberries are also common.



pitcher plant

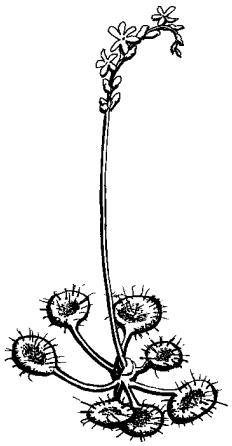
Although they occur throughout Michigan, bogs are more numerous in the Upper Peninsula where they are found along the margins of lakes and ponds and in depressions created by glacial activity. Many southern Michigan bogs, however, were converted to muck farms, and in many other cases landowners felled the trees, drained the bogs, and plowed the soil for agriculture.

Bogs often lie in frost hollows or other cold, wet environments where cold air and water are trapped. On clear nights, heavier

cold air settles to the ground and flows down slopes and valleys often ending in bog lakes or ponds. Although daytime surface temperatures may reach 90 to 100 degrees Farenheit, the root level of plants growing within a bog are typically 45 to 55 degrees Farenheit. Because of the great insulating quality of sphagnum moss, these areas rarely exceed 60 degrees Farenheit.

As bogs age, they tend to become more acidic. As peat accumulates in bogs, it becomes tightly compressed by the weight of material lying over it, and the oldest part turns into fine-textured black muck. This compressed peat becomes impermeable, cutting off the bog from the water table making it acidic, or mineral poor. Over time, the older peat is colonized by shrubs and then trees such as white pine, tamarack, and black spruce.

There are two ways that bogs are formed in Michigan: kettle-lake bogs, and paludification bogs. These processes may take thousands of years. In the Great Lakes region various estimates for forming a single foot of peat range from 100 to 800 years.



sundew

Kettle-lake bogs begin as reeds, sedges, and mosses around the edges of lakes formed by glaciation. This vegetation slowly expands across the entire lake surface, forming a floating mat of peat. This mat slowly consolidates and is then dominated by sphagnum moss and other bog plants. Over time, the peat forms an impermeable layer and isolates the bog from the water table. Shrubs and trees then begin to move in. Thus, this process of natural succession turns an open-water lake into a forested wetland. This process may also reverse itself during cooler and wetter periods and become more open.

Paludification bogs are formed by the blanketing of previously dry land by overgrowth of bog vegetation as it exceeds its basin boundaries. These bogs can be brought about by climatic change, hydrological change caused by beaver dams or logging, or the natural advancement of a peatland. Once this blanket advances and begins to accumulate, the formerly mineral-rich soil is cut off from the water table creating acidic conditions. This kills many existing trees and allows bog vegetation to dominate.

Fens

Fens are somewhat rare in Michigan. They are peat-covered grassy wetlands that are springy when walked upon. Fens are fed by mineral-rich artesian groundwater in the form of springs, rivulets, marl flats, or saturated peat. The constant supply of groundwater being forced up through accumulating peat causes some fens to appear higher than the surrounding terrain. Because the groundwater is rich in calcium and magnesium carbonates, the water is usually neutral or alkaline. Fens are often found on hillsides along lakes, streams, and rivers, which occur in glacial outwash on sandy glacial lakebeds. Others are located in broad outwash channels. Researchers distinguish among several different kinds of fens: prairie fens, northern fens, patterned fens, and poor fens.

bulrush

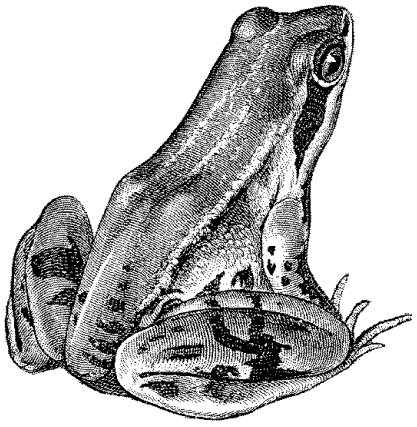
Prairie fens are found in the former oak-savanna prairie region of southern Lower Michigan. They are very rich in calcium and magnesium. Typical plants found in prairie fens are switchgrass, Indiangrass, big bluestem, sedges, rushes, Indian plantain, and prairie dropseed. The wettest part of a prairie fen, which is usually found near the water source, is called a "sedge flat" because members of the sedge family dominate the vegetation. The "fen meadow" is the largest part and is more diverse with many lowland prairie grasses and wildflowers. Slightly elevated areas, especially around the upland edge, also support tamarack, dogwood, bog birch, and poison sumac.

Northern fens are dominated by sedges and rushes and are found in areas of northern Michigan where limestone bedrock is cov-

ered with a thin mantle of glacial drift. Marl flats are very common in these places. Orchids, gentians, and other plants may be present. Bulrush, spike rush, cinquefoil, sawgrass, and white cedar usually surround northern fens.

Patterned fens have a gentle slope of less than one percent per mile, tend to have both acidic and alkaline areas, and feature strips of sedge-peat ridges only a few inches high alternating with depressions. The depressions are wettest with sedge and rush dominating. Besides sedges, the ridges may contain sphagnum, bog rosemary, bog birch, shrubby cinquefoil, leatherleaf, and stunted white spruce and larch. Patterned fens tend to occur on larger flat outwash or lake plain areas in the Upper Peninsula.

Poor fens are those peatlands with reduced water flow and lower mineral content. Consequently, the saturated peat is somewhat acidic. These fens occur throughout the northern Lower Peninsula and Upper Peninsula. Dominated by sedges and grasses, poor fens lack the plant diversity of northern and patterned fens.



Management Considerations

Bogs and fens are extremely sensitive to disturbance. Land-owners cannot create bogs or fens on their property. Bog management amounts to not disturbing the natural succession process and hydrology. Modifying the bog to convert it to a cranberry marsh will destroy the original plant community. Harvesting the top layers of sphagnum for commercial market will damage the fragile ecosystem. Researchers have little information about the recovery rate of harvested bogs but assume recovery is probably very slow or may never occur.

The following are options to consider when managing bogs and fens:

•Protect the mineral-rich groundwater source of fens from pollution or drainage or other alterations in hydrology.

•Avoid diverting or damming water flowing out of fens. Mowing for hay and allowing livestock to graze can also destroy these unique wetlands.

•Periodic burning in winter or early spring may help to retard the invasion of woody species, but because fire can be damaging as well as beneficial, be sure to consult with local fire authorities and a resource professional. Historically, many fens burned along with the surrounding prairie and forest, which were set by Native Americans or lightning. Fire burned the mulch and top growth of the fen--the specialty plants--with little danger to the peat below because of the steady water supply.

•Cottontail rabbits and snowshoe hares may help decrease the invasion of surrounding dogwood, willow, and other woody plants because these are their preferred food in winter.

•Avoid using fertilizers near any wetland. However, be especially careful near fens as polluted runoff can alter fen vegetation, gradually increase invasive species over natives. Remove invasive species such as garlic mustard, glossy buckthorn, or purple loosestrife, whenever they appear in order to avoid future problems.

•Do not alter water courses. Hydrology or water availability is a very important concept in maintaining bogs and fens. For example, changing water courses typically causes the soil to dry out, which can lead to the invasion of lowland and upland tree and shrub species. Also, additional water or drought over several years can have a major impact on the health and condition of these wetlands. Draining adjacent uplands might lead to a higher water table, which can also affect the site. Also, do not dig a pond within the site. Because of their importance and uniqueness, bogs, fens, and their adjacent uplands should be left alone if

garlic mustard

you want to maintain the existing bog and fen.

•Create a buffer strip of at least 100 yards around the wetland. This can be done by planting shrubs or grasses, or by not disturbing the area. Do not develop roads or trails in the bog, fen, or buffer strip.

•If livestock have access to the site, be sure to fence around it because heavy use by cows, horses, or sheep can damage the vegetation, disturb the soil surface layer, and pollute the water with manure.

In summary, bogs and fens are highly unusual, important places. They are important to wildlife seeking secure cover where they can feed, nest, rear their young, and escape predators. They also provide areas for many types of unique, threatened, and endangered plant and animal species. If you have a bog or fen on your property, enjoy its uniqueness and diverse plant and animal life.

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MARSHES

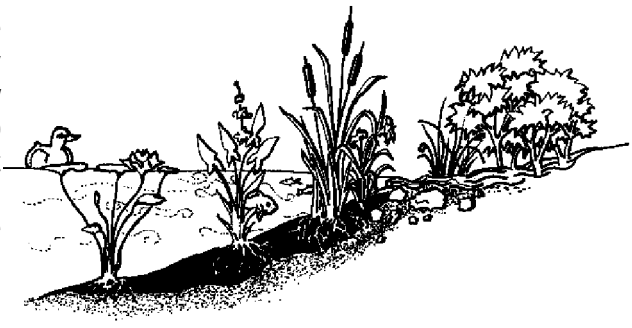
Marshes are shallow-water areas that sustain water-loving plants such as cattail, sedge, arrowhead, bulrush, water lily, and pondweed. Marshes found in Michigan include wet meadows with grasses and sedges, potholes with cattails, and shallow vegetation zones along Great Lakes shorelines. While marshes are generally covered by standing or slow-moving water, certain marshes dry out late in the growing season or during dry years. This fluctuating water level is part of the natural process, which increases plant and habitat diversity, and productivity of the marsh.

Less than an acre or as large as several thousand acres, marshes have appeared and disappeared since the beginning of time. When the glaciers slowly melted about 12,000 years ago, they left behind depressions that formed lakes and potholes. As these bodies of water became shallower and warmer, many turned into marshes--an evolutionary step in the long natural succession process from water to dry upland. Also, when rivers change course in their serpentine march to the Great Lakes, they also leave old isolated sections of a channel, called oxbows, many of which become marshes over time. Marshes may also occupy slow-moving shallow zones of active rivers or develop at river mouths along the Great Lakes as coastal marshes. Fluctuating water levels in the Great Lakes create, maintain, and continually alter these marshes.

The Importance of Marshes

Like most wetlands, marshes are dynamic systems that are important to wildlife and also provide other valuable functions. On average, marshes produce at least three times more biomass than lakes, upland grasslands, and farmland. Their high rate of productivity allows marshes to support complex food chains and a broad diversity of wildlife. For example, about 80 percent of Great Lakes fish use coastal marshes during at least one stage of their life cycle. Marshes also store and collect nutrients and sediments from surface water runoff, and they reduce flooding by temporarily storing water.

All wetlands provide food, water, shelter, and living space to many kinds of wildlife. Mammals such as muskrats, raccoons, mink, and deer feed, rest, and hide in marshes. Herons, shorebirds, waterfowl, red-winged blackbirds, sedge wrens, common yellowthroats, and other songbirds also seek shelter, nesting habitats, and food. Marshes with dense cattail stands provide choice winter habitat to ring-necked pheasants. Further, they supply food and cover to leopard and chorus frogs, snapping turtles, and northern water and ribbon snakes. Uncommon wildlife species that live in marshes include black terns, American and least bitterns, king rails, and massassauga rattlesnakes. Arrowhead and marsh mallow are examples of unique plants that may grow there.



Many human activities can harm marshes. Construction projects, some farming practices, and logging methods may increase silt loads into marshes. Draining marshes to create farmland and filling marshes to make building sites are activities that most commonly have destroyed these wetlands. Streams that provide water to marshes may also deliver pollutants and fertilizer runoff, which eventually alters marsh vegetation. Some marshes are accidentally ruined by well-intentioned landowners who dig ponds in the existing marsh and then deposit the spoils in the surrounding marsh. Because marshes are such a valuable natural resource, they should be preserved, restored, or enhanced whenever possible.

Marsh Conservation

The general rule for wetland management is to protect those that are healthy, restore those that have been damaged, and actively manipulate only those

that are too disturbed to function naturally. If a marsh on your property is not currently being affected by human activities, the best way to protect it for future generations may be to leave it alone, or conduct small management activities. In addition to avoiding harmful practices like draining or filling, consider the following:

• Avoid forest cutting and other mechanical operations, i.e., farming and logging, that may increase sediment within 100 feet of the marsh or any of its connecting streams. Cutting trees near the marsh can change water levels, accelerate erosion, and destroy travel corridors for wildlife using the marsh.

• Create or maintain a buffer zone of grassy vegetation to act as a filter strip around the marsh. Old farm fields taken out of production will naturally vegetate or can be planted to native grasses or wildflowers. This buffer will help protect the marsh and will provide habitat for insects, amphibians, reptiles, birds, and mammals. As a general guide, the buffer should be a minimum of 100 feet wide. For seeding rates and other information, refer to the chapters in the **Grass-land Management** section.

•Fence off the marsh and buffer zone if livestock have access to them. Heavy use by cows, horses and sheep can damage vegetation and pollute the water source with manure. However, light grazing over a short time period can be beneficial.

•Do not use the marsh environment as a dumping ground for refuse and debris, including logging waste. Doing so can lead to contamination of the water, soil, plants, and wildlife.

• Remove invasive plant species such as garlic mustard, glossy buckthorn, phragmites, and purple loosestrife. Reed canary grass is a problem plant that is best removed and replaced by native species such as cattail, bullrush, and cordgrass.

Marsh Restoration

Restoring a marsh on your property is one of the most satisfying of all habitat management projects because the results are usually immediate and dramatic. Normally too shallow to support fish, the restored marsh will become an oasis for other wildlife, and the amount and diversity of animals that quickly move in may surprise you.

The most important consideration is restoring the wetland depression or basin with a stable supply of water. Most likely the marsh has been drained by a ditch or field tiles. If the marsh has been drained by a ditch, plugging the ditch with soil will restore the natural water source. If drainage has occurred-from buried field tiles, removing at least 50 feet of tile will also bring water back to the marsh. Some landowners also add water-control structures to allow periodic drawdowns and re-flooding. The Michigan Department of Natural Resources, U.S. Fish & Wildlife Service, and Natural Resource Conservation Service (NRCS), and County Conservation Districts are among several organizations and agencies that offer assistance to landowners interested in wetland restorations. For additional information, see the **Wetland Restoration Techniques** chapter.

invasive species: reed canary grass, phragmites, and purple loosestrife

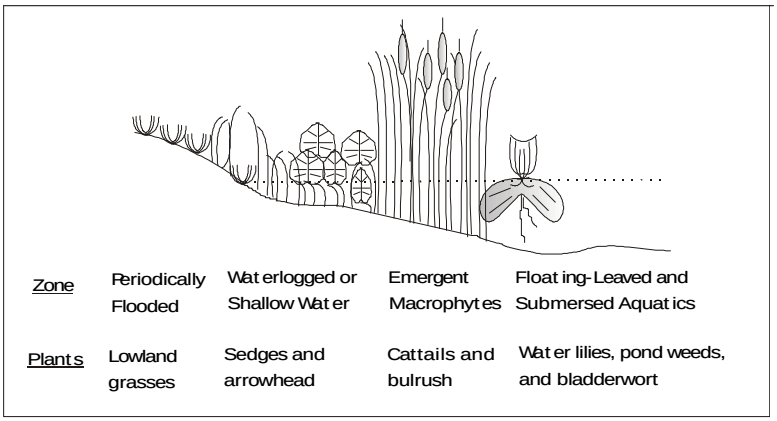
Marsh Creation

Although many landowners are interested, creating a marsh can be expensive and hard to do, especially if the site is not on hydric soils. In addition, quality wet meadows, sedge marshes, wooded swamps, and uplands may be destroyed by landowners trying to create deep water marshes or ponds. Careful planning is required, along with securing government permits. Remember, most private and government groups provide only technical assistance to wetland creation, whereas financial assistance is provided to projects that restore natural wetland systems.

The topography of your property and the surrounding land -- along with the soil type, watershed size, and drainage patterns--are important points to consider before actual construction begins. The U.S. Department of Agriculture maintains a NRCS office in nearly every Michigan County. Agency staff can help you evaluate the water-holding capability of the soil, the elevation of the present water table, and whether or not there will be adequate runoff or spring flow to maintain desired water levels in a con-

structed basin. Also, they can help you design the project.

In your design, think small and shallow. Areas as small as one-half acre or less will support a marsh. However, two to five acres would be productive for wildlife, especially waterfowl. Various water depths result in a mosaic of vegetation zones and increased diversity of both plant and animal species. A general rule worth noting is to provide water depths in the following proportions: 50 percent at less than 1-1/2 feet, 30 percent at 1-1/2 to 3 feet, and 20 percent at 3 to 6 feet.



Cross-section through a fresh water marsh, showing the water depth, and the plants found in each zone.

No simple guidelines exist that cover all the construction methods possible. Site characteristics, available funding, water source, and total size of the marsh to be created all must be considered. The project design may include excavations below the water table and the use of berms to catch surface water.

Great care should be taken in planning any excavation projects--including soil probing--to ensure that you can reach your goals without destroying desirable natural conditions. Digging too deep, for example, could cause many problems. A thin layer of clay or other impermeable soil may be the only reason water exists above the surface at the project site. Breaking this subsurface seal by digging too deeply would remove existing water, much like pulling a bathtub plug. Also, you need to be careful that you are not creating a pond that is too deep for maximum wildlife benefit. Another consideration is the side-slope grade of the excavation. This grade should range from a 4:1 to 6:1 horizontal distance:vertical drop to ensure that a variety of marsh-loving plants will grow in various patterns.

When excavating, be sure to scrape and stockpile the topsoil, then replace the upper six to eight inches on the berm and excavated basin to take advantage of seed sources already in the soil. In general, planting aquatic plants is not necessary because seeds are naturally transported in the environment and are usually already in the soil. But if vegetation is slow to respond on a new site (after 2-3 years) or you wish to add diversity to a present site, you might consider planting duck potato, pickerelweed, bulrush, and cattail—all of which are available from specialty growers. Water depths between one and two feet are ideal for these species. In addition, sago pondweed, coontail, and wild celery are common submergent plants able to grow at a variety of water depths.

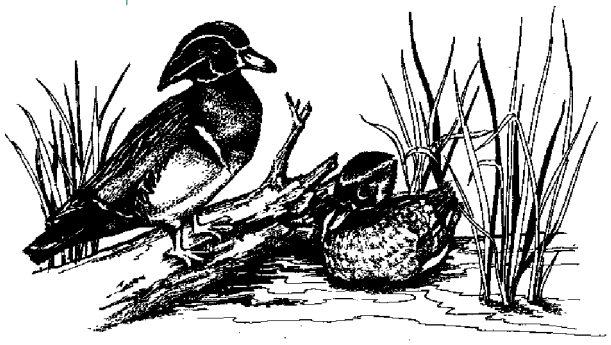
Other Management Considerations

The following are general options to consider when managing a marsh:

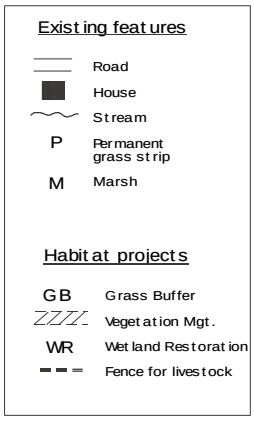
•Building nesting structures for wood ducks, mallards, and other waterfowl is not necessary, but can be helpful in attracting them. Ducks, turtles, and other animals will use loafing platforms. To learn more, refer to the chapters on **Wetland Birds**, **Waterfowl**, and **Frogs, Turtles, and Snakes** in the species section.

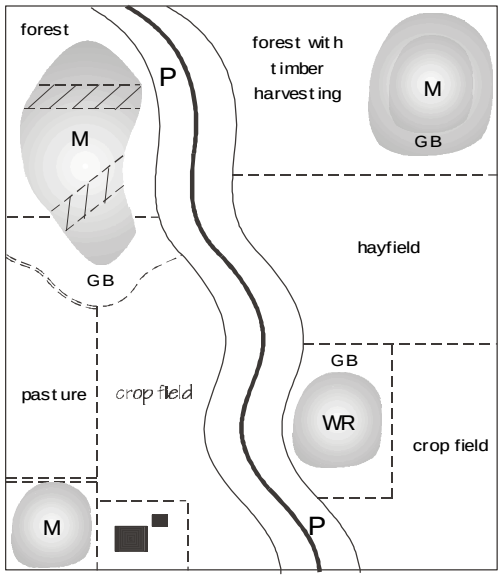
•You may want to adjust the vegetation:open water ratio of your marsh. Marshes with a ratio of 40 percent vegetation to 60 percent open water provide habitat for the greatest variety of wildlife. Wetlands with higher levels of vegetation will attract rails and red-winged blackbirds. More open water wetlands with a small percentage of vegetation will attract species such as herons and Canada geese.

•If your marsh contains more than 60 percent emergent vegetation, you may want to create openings approximmately 30 feet by 30 feet, or strips 30 feet wide from shore to shore. Openings in cattail marshes can be made in winter by cutting plants at ice level with a backblade pulled by a tractor. This practice works best after a dry fall because spring runoff will



40 Acres





This map is an example that demonstrates the many management options discussed throughout this chapter. The option(s) you choose should depend not only on your goals, but the location, condition, and present use of your land.

flood plant stubble with at least six inches of water during the next growing season, and should reduce regrowth for a few years. Herbicides that can be used in wetlands, such as Rodeo, can also be used to control vegetation. Remember to always follow label directions on all herbicides.

•Fire is another marsh management tool that can be used during winter or early spring. In addition to creating openings, the technique helps to rejuvenate fertility and to reduce the amount of emergent plant debris. Be sure to obtain necessary permits and follow all safety precautions. For more information, see the chapter on **Prescribed Burning** as a management tool.

•Constructing peninsulas and islands can enhance marsh use by waterfowl, shorebirds, and wading birds. However, if not done properly, such land forms can have a negative impact on wildlife and be a costly addition to your project. Consider increasing shoreline irregularity with small peninsulas. In wetlands larger than two to three acres, you might construct an island. Marshes from four to 25 acres in size should feature a maximum density of one island per four acres. Marshes larger than 25 acres can support a higher density. The islands should be at least 200 feet apart and 100 feet from the mainland to protect nesting waterfowl from predators.

•Another method to control the amount of marsh vegetation is to control the number of muskrats, which eat cattails and other tall emergents and build their homes from the plants. Regulating muskrat numbers through trapping will indirectly balance the amount of vegetation and open water in the marsh.

In summary, marshes are an important part of Michigan's natural landscape. Identifying any that exist or historically existed on your property is the first step toward developing a management plan. By protecting, restoring, enhancing, or successfully creating marshes using the above management practices, these dynamic wetlands will provide critically important wildlife habitat.

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SWAMPS

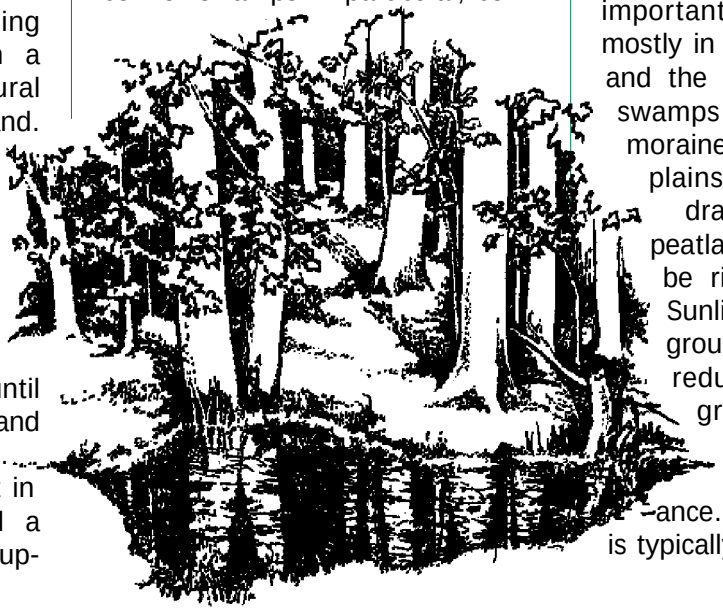
Swamps include a broad range of wetlands that have standing or slowly moving water and are dominated by trees or shrubs. Swamps differ from marshes in that swamps do not contain large amounts of cattails, sedges, bulrushes, and other non-woody aquatic plants. However, these plants may appear around swamp edges or in openings. Michigan swamps include conifer swamps, hardwood swamps, mixed conifer-hardwood swamps, and shrub swamps. Swamps and lowland forests are very similar and are often one in the same. However, swamps are often wetter for a longer period throughout the year and have deeper standing water than lowland forests. These lowland forests may be seasonal wetlands.

Like most wetlands, swamps are ever changing systems. Depending on the surrounding landscape, swamps are often a transitional step in the natural process from water to dry upland. All swamps start out as a lake, pond, stream, or other body of shallow slow moving water. Water-loving trees and shrubs take root in the warm, relatively stable wetland. As plants decay, their material accumulates and adds to the topsoil until the water depth decreases and supports more dense vegetation. Continued succession will result in very little surface water, and a buildup of organic soils, which support more woody vegetation. Occasional flooding or several years of wet weather can slow this process, and several dry years can speed it up.

Swamps provide habitat for mink, muskrats, beaver, otter, deer, black bear, squirrels, hares, barred owls, various species of woodpeckers, wood ducks, nuthatches, several kinds of warblers, black-capped chickadees, snakes, turtles, frogs, toads, butterflies, dragonflies, and many other insects. Uncommon animals such as red-shouldered hawks, cerulean and prothonatory warblers, Indiana bats, smallmouth salamanders, and Blanchard's cricket frog, all rely on swamps for survival.

About one-third to one-half of Michigan's wetland acreage has been lost since 1800. Swamps, conifer swamps in particular, comprise much of the overall loss--about two-thirds of the original 5.5 million acres of conifer swamps have either been drained or converted by logging activity to lowland hardwood, farmland, marshes or shrub swamps.

mink

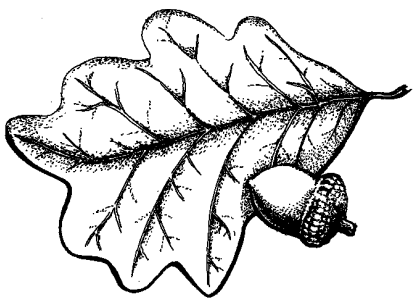


Types of Swamps

Northern white cedar and black spruce dominate most **conifer swamps** in northern Michigan, although balsam fir, eastern hemlock, and white pine may also be important components. Found mostly in northern Lower Michigan and the Upper Peninsula, conifer swamps are situated along moraines, lake beds, outwash plains, and other glacial drainage. Associated with peatlands, conifer swamps may be rich or poor in minerals. Sunlight penetration to the ground is usually poor. This reduces the amount of ground cover and gives some conifer swamps a dark, mysterious appearance. The soil of these swamps is typically acid, but it may also be

neutral or even alkaline if it is influenced by groundwater input. Alkaline sites tend to be cedar-dominated and offer greater plant diversity. In slightly less water-saturated conditions in northern Michigan or along northern floodplains, mixed conifer-hardwood swamps are more common.

Hardwood swamps are those dominated by ash, elm, and red maple but may also include silver maple, cottonwood, and black willow. Pin oak and swamp white oak are included in southern Lower Michigan and quaking aspen, bigtooth aspen, and balsam poplar can be found throughout northern Michigan swamps. In 1800, hardwood swamps comprised about five percent (1.7 million acres) of the state's land base, and most were found in southern Lower Michigan. Today, many of the conifer swamps have been converted to hardwood swamps. This is due to the extensive logging of conifer swamps and changes in hydrology. Much of this has occurred in the northern Lower Peninsula and the Upper Peninsula. Many southern Michigan counties hardwood swamp areas have decreased by as much as 50 percent. Many hardwood swamps are located along lower river reaches that flood in spring and fall. Southern Michigan lowlands tend to be very diverse and support many plants commonly found in states farther south.



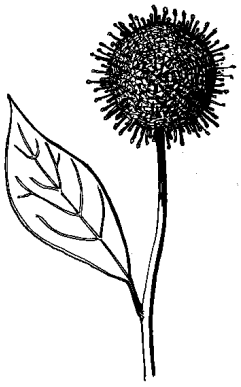
swamp white oak

Combinations of shrubs such as tag alder, buttonbush, willow, and dogwood often dominate **shrub swamps**. Alder-willow swamps are most commonly found along streams and lake margins in northern Lower Michigan and the Upper Peninsula. Buttonbush-willow swamps appear mostly in the southern Lower Peninsula. In 1800, about one percent, or some 43,000 acres, of Michigan was covered with some kind of shrub swamp, mostly in the Upper Peninsula. Today, about 730,000 acres are thought to exist statewide. The increase is due to extensive logging of conifer swamps and to the network of road construction.

Management Considerations

Swamp management for wildlife can be as simple as doing nothing or it can be very complex and involve the manipulation of wildlife habitat. Swamps that have a steady, stable supply of water year round function naturally. Usually they can best be managed by protecting the water source and enhancing the adjacent uplands.

Water is the key to swamp maintenance, even though water levels fluctuate throughout the year. Additional water over several years or many years of drought can impact the condition of the site. Draining adjacent uplands into the swamp, for example, can lead to a higher water table, which may prompt conversion of the swamp to a marsh of cattails. By altering watetables, soils could dry out, leading to succession and a conversion to upland vegetation.



buttonbush

One management option, therefore, may be to leave the swamp alone and allow it to mature naturally, especially if the tract is large (200 acres or more). Old-growth forest left intact, for example, will favor area-sensitive birds like the red-shouldered hawk, the cerulean warbler, and the prothonotary warbler. Do not fragment the swamp by making roads, and trails. Create a buffer strip of grass, shrubs or trees at least 100 feet wide around the swamp. Remove invasive species like garlic mustard, glossy buckthorn, and purple loosestrife that may be growing in the swamp or around it.

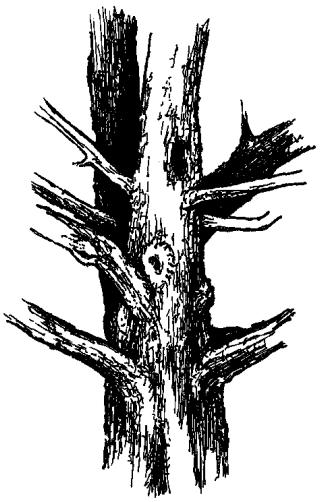
Swamps that have been fragmented can be regenerated by planting tree and shrub species suited to the sites, but the process takes a long time and may not be successful. The slow growth of many swamp-loving trees and the exacting conditions required to restore them are good reasons for maintaining what already exists. In many cases, little or no timber harvest is needed to increase the value to wildlife.

If timber harvest is part of your overall plan, however, take no more than 25 percent of the trees at one time and space harvests 10 to 20 years apart. Removing one to four trees in a group is the best way to

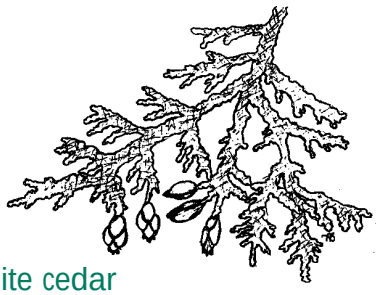
mimic natural disturbances such as lightning strikes and severe storms that topple trees. This method of uneven-aged management (also called selective cutting) promotes a swamp of mixed-aged, young and old trees and is the best timber harvesting strategy as it creates the least amount of disturbance to the swamp. Uuneven-aged management can retain benefits to a variety of wildlife species that require mix-aged forests. However, it is not the best harvesting method for many edge-loving wildlife species.

When conducting timber harvesting, retain a good mix of tree species, including swamp white oak, basswood, and hackberry, while managing for structural diversity--a mixture of ages, diameters, crown sizes, and shapes of trees. Leave old logs, large standing snags, and den trees because they provide food and habitat for invertebrates, amphibians, woodpeckers, and other cavity-nesting birds. See the **Timber Harvesting** chapter in the Forest Management section for more harvest strategies.

Because swamps are often devoid of young trees and an understory of shrubs, they don't provide high quality habitat for some wildlife species such as deer, rabbit, wild turkey, grouse, and woodcock. Opening the canopy by careful timber harvest to allow sunlight to reach the ground may stimulate the growth of vegetation that these species prefer. However, where stands exist on poorly drained muck soils or on sites with a high water table, the results of the timber harvest are far less predictable. The species composition of the resulting stand may not be at all like the parent stand. Consider, for example, that full-crowned swamps release up to 1/4 inch of soil moisture into the air each day through the process of evaporation and transpiration. The higher water table and seasonal flooding, which could result from extensive logging, may completely change the vegetation composition. Also, success in regenerating conifer swamps can be poor, especially if white cedar is the target species. White cedar is often promoted as critical to deer management because it provides both quality food and cover. However, once cedar is cut, white spruce and balsam fir usually regenerate the site because deer browse the nourishing shoots of white cedar. For more information see the chapter on **Lowland Conifers**.



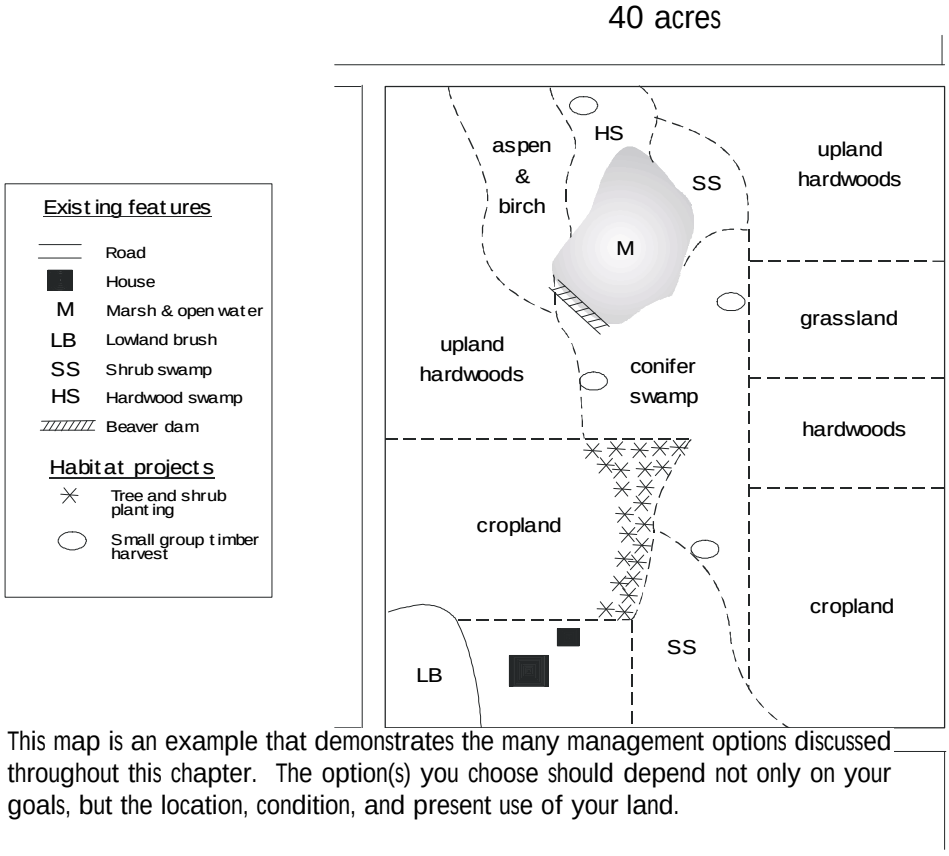
Minimize harvest activities in spring when water levels are high and flood events are likely. Do any selective cutting in late summer, and only when soils are dry and firm. Some swamps freeze, allowing for a winter harvest. Be careful not to disturb the soil any more than is necessary and avoid making permanent logging roads, which will alter the flow of water. Do not log where deer browsing is severe. Locate skid trails and any roads on the upland edge of the cut, and leave clumps of scattered trees as seed sources for regeneration.



white cedar

Shrub swamps with a ratio of 40 to 60 percent open water can provide habitat for a variety of wildlife such as beaver, muskrat, waterfowl, and numerous reptiles and amphibians. If your shrub swamp contains more than 60 percent woody vegetation, consider creating openings 30 feet by 30 feet or 30-foot-wide strips from edge to edge. Make the openings in winter by cutting willow, buttonbush and other woody plants at ice level with a chainsaw, loppers, or backblade pulled by a tractor. This practice works best after a dry fall because spring flooding over the cut stems during the next growing season will eliminate or reduce regrowth for several years.

Wildlife professionals do not usually recommend building water-control devices in swamps because of the difficulty in duplicating and enhancing the natural wetland processes. However, if dikes or other means of water retension already exist, waterfowl and shorebirds may benefit by drawing down the water level to only a few inches in spring to allow preferred plants such as smartweed, wild millet, arrowhead, bulrushes, and sedges to grow on exposed mud flats. The spring draw-down also provides waterbirds with improved access to insects, crayfish, and other invertebrates. Once the plants have produced seed in late summer or



This map is an example that demonstrates the many management options discussed throughout this chapter. The option(s) you choose should depend not only on your goals, but the location, condition, and present use of your land.

early fall, reflood the area with six inches of water to attract herons, rails, red-winged blackbirds, and waterfowl. Throughout the fall you can increase the depth to 12 inches to enable migrants to reach acorns and other food. Because ice action during the winter and early spring can cause significant damage to trees, it is important to draw down the area in late fall to water depths less than twelve inches. This practice of flooding and drawdown is best conducted in dormant swamps that have a dependable water supply and heavy soil to help retain the water. They should be at least one acre in size and contain a large number of mast-producing trees such as oak, red maple, willow, and ash.

Before creating dikes, earthen dams, or other water-control structures, consult with a professional to see if the management goal is desirable and realistic in terms of the site's potential. Water control structures are helpful in maintaining vegetation growth and regrowth. Unfortunately, they can be costly to install and maintain, and may alter the natural processes of the area. Remember that wildlife-flooding practices used in the southern United States are usually inappropriate for the north. Furthermore, government permits will be needed for most activities in a swamp.

Beaver dams often create combination marshes and swamps. Although many individuals are tempted to eliminate the beaver and its dam and replace it with an earthen dam, this is extremely costly and difficult due to soil conditions. If you have a beaver dam on your land, realize its importance to the landscape and enjoy the natural engineering abilities of the beaver.

In summary, swamps occur throughout Michigan and are important havens for many wildlife species. Determining the water source and evaluating the condition of the swamp and adjacent uplands will help you decide on management options. Simply protecting the swamp and its water source as it now exists will often be the most effective management decision. When considering harvest of swamp timber, carefully consider the various possible outcomes as these are highly complex environments.

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STREAMS AND RIVERS

Michigan wetlands are classified according to where they are found. Wetlands that occur on the edges of lakes and reservoirs are called lacustrine. Wetlands that form on the edges of shallow bodies of water such as marshes or bogs are called palustrine. Those that include rivers, streams, and surrounding areas are called riverine. Riverine wetlands are often the least stable because periodic flooding causes erosion and sedimentation.

Riverine wetlands are also among the most important. Streams and rivers serve as travel corridors for wildlife, both resident and migratory. Streams are identified as flowing bodies of water with a defined bank and bottom. These waterways, along with adjacent communities called riparian zones, provide a variety of substrates and an abundance of food--insects for birds and fish; and amphibians and reptiles for herons, raccoons, and other predators. Water, combined with trees, shrubs, and grasses, furnishes a rich variety of habitat for muskrats, mink, and beaver. Frogs and salamanders live in the shallow water of streams and along their muddy banks. Wood ducks laze in quiet backwaters and nest in tree cavities. Kingfishers fish from tree limbs above the river. Vireos, thrushes, and warblers use streamside cover as part of their nesting habitat and as shelter during migration. Brown bats and swallows gorge themselves on insects produced by these waterways and their adjacent communities. Shallow river expanses also provide important spawning-nursery habitat for fish, especially northern pike.

Because waterways are dynamic pieces of the wildlife-habitat puzzle, you are fortunate if a stream or river crosses your property. Michigan has an abundance of moving water--more than 36,000 running miles of navigable rivers and streams--plus countless more miles of brooks and other tiny tributaries. Some are so small they are barely noticeable, and yet each is vitally important.

Management Options

There are several things you can do to improve wildlife habitat in a riverine wetland. Before considering improvement projects, the waterway and riparian zone must be assessed to determine its current condition. In general, if a stream or river has little riparian vegetation, little in-stream cover (rocks, logs, vegetation), is relatively straight and shallow, or is subject to considerable amounts of erosion, it may be in need of some improvements. As with any wetland, it is important to seek assistance before making any management decisions. Contact the Department of Environmental Quality Land and Water Management Division, or your local Conservation District office for assistance with your management plan.

The following are options to consider when managing streams and rivers:

Keep Livestock Out

Allowing cattle and other livestock to access the stream can create enormous problems. The animals are capable of destroying wildlife habitat, polluting the water, and trampling streambanks causing erosion. If cattle must cross the stream to reach pastures on the other side, install a fence that will limit their access to one site. Adding

approaches of concrete, gravel or broken rock will lessen the cattle's impact. If livestock currently drink from your stream, consider the variety of low-cost watering systems now available. At the very least, choose a small section of the waterway that does not have a steep embankment, and weigh the cost and benefits of building a fence.

Improve Riparian Habitat

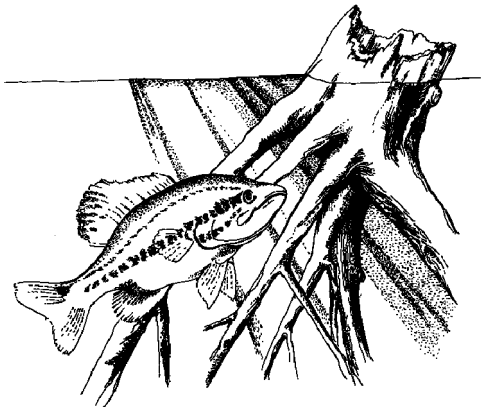
Maintaining a buffer strip from 100 to 200 feet wide or wider on each side of the waterway will help provide homes for wildlife, prevent erosion, and maintain water quality. The buffer will slow siltation of the stream and absorb pesticide and fertilizer runoff. You can improve the existing buffer or create a new one by planting trees, grasses, or shrubs. In southern Michigan, silver maple, red maple, cottonwood, and basswood can all be grown from seedlings. In northern Lower Michigan and the Upper Peninsula aspen, black ash, alder, balsam fir, and white spruce are good species to consider. In really wet areas black spruce and tamarack might be better choices. If beaver are undesirable because of possible tree damage on your property, consider planting evergreens although beaver might even girdle and kill a few of them. Refer to the chapters in the **Forest Management** section for more information on tree species and their requirements. Gray dogwood, silky dogwood, red-osier dogwood, hawthorn, ninebark, serviceberry, elderberry, and highbush cranberry are fruit-bearing shrubs that offer good sources of streamside food and cover for songbirds, pheasants, and ruffed grouse.

If you want to create a grassland instead of forest or brush, wildflowers and certain grasses like timothy, orchard grass, or switchgrass may be suitable choices. Depending on soil conditions, you could also plant alfalfa, medium-red clover, and other legumes, which will attract birds as well as rabbits, woodchucks, mice, and other small mammals. Planting wildflowers is also a good option. If you fertilize or mow streamside areas, stay back from the water's edge a distance of at least 100 feet. For more information, refer to the **Grassland Management** section or to the chapter on **Wildflowers** in the Backyards section.

Doing nothing, of course, is also an option. If you choose not to mow, cultivate, or selectively log the riparian corridor, natural processes will eventually change that area with no effort on your part. The disadvantage to the natural process of succession is that changes may not be what the landowner wants. However, if the natural changes fit within the landowner's goal, then doing nothing is the right management option and will also benefit the riverine wetland.

Any harvest of streamside timber must be done with great care. The trees and shrubs that grow along Michigan's waterways are critical components of wildlife habitat. They attract insects that fish and wildlife feed upon, help cool water temperatures, and provide shade. Fallen trees provide loafing areas for ducks, snakes, and turtles and protective cover for fish. They also provide important habitat for insects and smaller forage fish and are a natural source of nutrients. Besides food in the form of nuts and berries, riparian cover offers dens, roosts, and nesting sites as well as safe travel lanes. For these reasons cutting timber in riparian zones can seriously damage the stream and its value to wildlife if done improperly.

However, if timber harvesting is part of your overall plan, arrange logging trails and roads as far away from the waterway as possible to avoid erosion and any alteration to the stream flow. Also, use extreme caution when cutting within 100 feet of a stream, lake, pond, or open water wetland. Logging can be conducted in the suggested 100-foot buffer area without harming nearby waters if good management practices are employed. Key things to keep in mind when logging within the buffer area are



keeping soil disturbance to a minimum and not operating wheeled or tracked logging equipment when soils are wet. Further, use selective harvesting techniques as they result in the least amount of disturbance. Try to spare most nut and fruit producing trees and leave at least one to six snags or den trees per acre for those birds and mammals that rely upon them. Dead trees about to fall into the stream should be left alone. Remove in-stream logs and fallen trees only if they are causing problems.

Improve In-stream Habitat

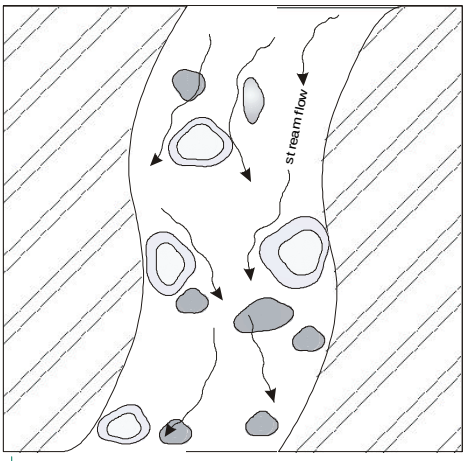
The goal of most landowners who improve habitat within a stream is to improve fish populations, but many of the improvements they make will also benefit wildlife. Stream management is an exacting science, the objectives of which are often to create a diversity of habitat with a variety of water depths, remove sediments by flushing action, add cover for fish, and increase substrate and other food-producing habitats. Wildlife is a secondary beneficiary of these improvements. For example, increasing the amount of insects for fish means more food for turtles, frogs, and birds. Producing more fish enhances the food supply for herons, mink, and otter.

Improving in-stream conditions can be as simple as adding rocks, logs, and rootwads to create hiding cover, or as work-intensive as building wing dams and bankside cribs. Costs can range from no expense to very expensive, especially if earth-moving equipment must be used. Remember, it is important to receive guidance from a professional before starting any of the projects listed below so as to not cause damage to the stream or river. The Department of Environmental Quality (DEQ) Land and Water Management Division is responsible for administering Michigan's Inland Lakes and Streams Protection Regulations. A permit is required to do any in-stream work. This protects streams and inland lakes larger than five acres from unauthorized dredging, filling, or construction of permanent structures below the ordinary high-water mark. The law also requires a permit for dredging within 500 feet of a lake or stream. Alerting Michigan DEQ officials to illegal excavation activities is also an excellent means of stream and river conservation.

The following are five basic project suggestions to consider when improving in-stream habitat:

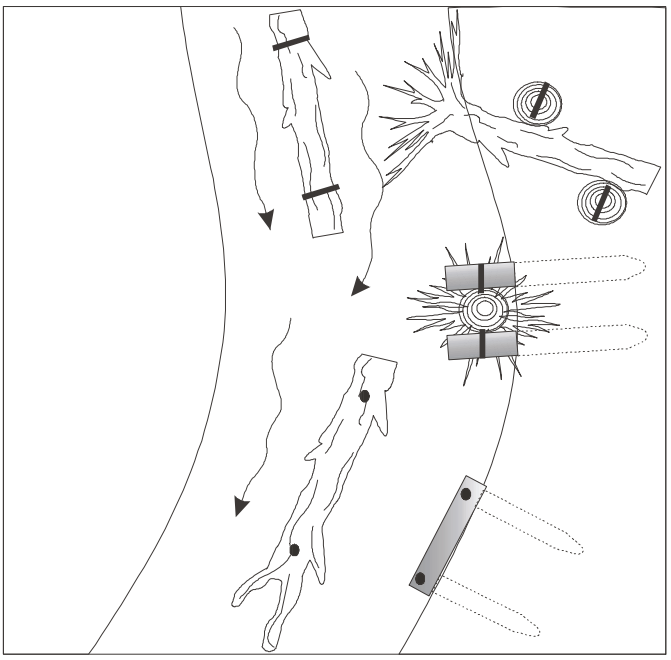
1. **Boulder placement**. Adding large boulders with irregular surfaces creates overhead cover and resting pockets for fish to hide. It also increases water depth from the natural scouring that occurs downstream of the boulders. The best results occur when boulders are placed in groups anywhere in the stream where currents exceed 2 feet per second.

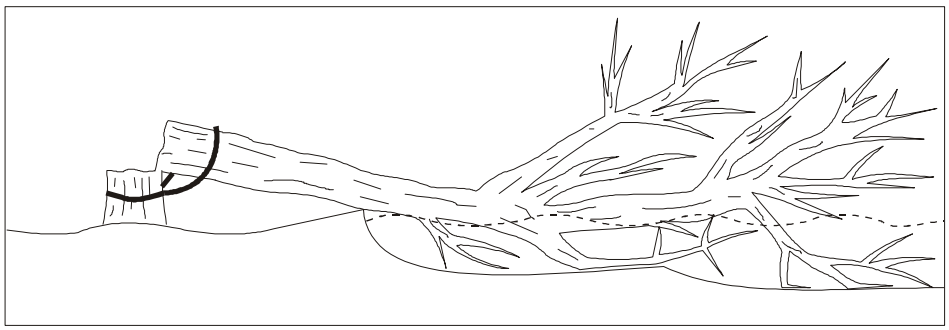
2. **Cover logs**. These structures provide overhead cover where water depth is adequate but cover is lacking. Logs with diameters larger than 10 inches work best in open pools, rapid currents, or flat water where the water is at least 8 inches deep. Crooked logs and those with protruding limbs of several inches produce turbulence and spot scouring, both of which are advantageous. Use logs already in the stream or roll a few felled logs from the bank into the stream. Place them parallel to the flow or at a slight angle. Anchor with stakes (construction rebar works best) to prevent washing away during flood periods.



stream boulder placement

3. **Rootwads**. When trees fall over from windstorms or erosion, their complex root systems, or

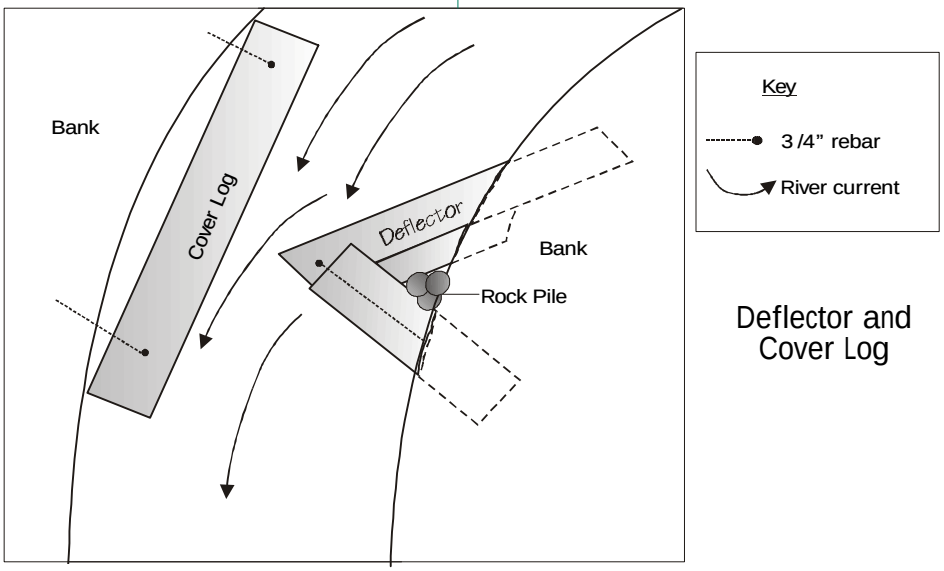

Cover logs and root wads



Hinge-felled tree cover

rootwads, usually become exposed. When submerged, these rootwads can create ideal habitat for fish. If rootwads exist in your stream, leave them. If they lie along the banks, consider pulling them into the stream, especially in places where the waterway meanders to prevent washing away during flood periods.

4. **Tree covers**. Felled trees placed in wide, shallow streams with sand or gravel substrates provide excellent overhead cover for fish and good substrate for insects. They may also help to increase water velocity by serving as deflectors to constrict wide, shallow channels. The increased velocity helps flush sediment out and creates deeper scour pools that create good fish habitat. Individual trees can be hinge-felled so they topple into the stream but remain connected to the stump. Adding a cable from trunk to stump will ensure stability. Choose trees that can be spared without creating an erosion problem. These trees should always be placed nearly parallel to water flow. Placing the tree perpendicular may cause erosion around the ends.



Deflector and Cover Log

5. **Deflectors**. Deflectors constrict and divert water flow to create meanders in the stream. In addition, pools are formed in the stream bed by the scouring and relocation of fine sediment and gravel. Deflectors work well in places where the banks are too low or too wide for dams, and they are much more cost-effective than dams. Various designs abound--the simplest ones involve placing heavy boulders or anchored logs across the stream to create a narrow opening through which rushing water creates the desired effect. Care must be taken not to direct water flow into the opposite bank, thus creating a new erosion problem.

In summary, rivers and streams and their adjacent riparian communities are among the most important of all wildlife habitats. Managing these waterways as part of the overall plan for your property can produce relatively fast, long-lasting benefits that are cost-effective and enjoyable.

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WORKING TOGETHER FOR WILDLIFE

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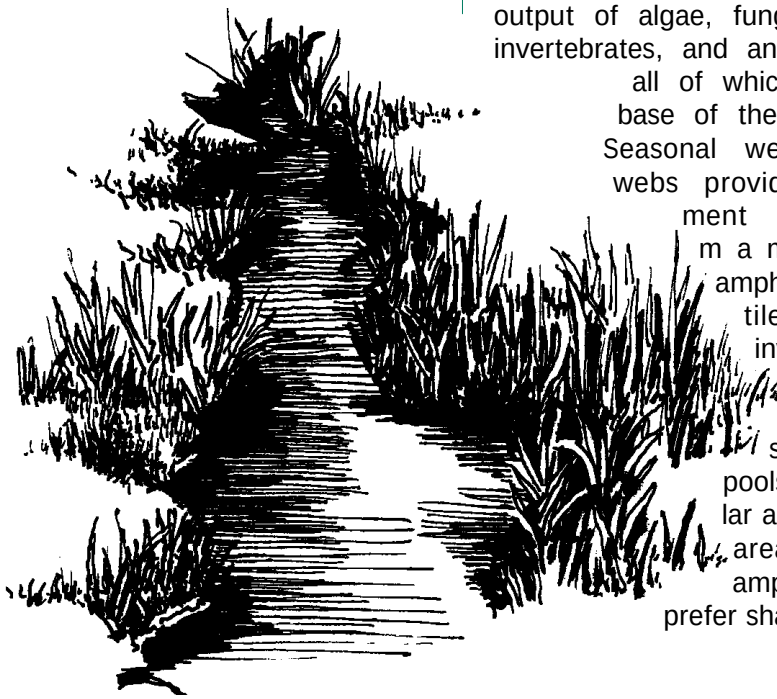
SEASONALLY FLOODED WETLANDS

Scattered throughout Michigan are thousands of small seasonally wet areas that may only hold water from late fall to late spring or early summer. Seasonal wetlands result from winter snowmelt and spring rains, and typically occur in low areas in woods and open fields. Some of these seasonal wetlands may not have visible standing water, but instead they have waterlogged soils. By mid-summer, most seasonal pools have dried out or are just barely moist. Although many of these seasonal wetlands may be less than a half-acre in size, they provide an important food source for migratory songbirds, waterfowl, breeding and feeding areas for amphibians and reptiles, and critical winter food supplies for wild turkeys, deer, and other birds and mammals. There are many different types of seasonal wetlands including seasonal pools, springs and seeps, coastal plain marshes, and lake plain prairies. If you are lucky enough to own any of these seasonal wetlands, you will notice they are used by a wide variety of wildlife.

Seasonal Pools

Seasonal pools are most often found in low, wooded areas that collect runoff water after spring thaw and heavy storms. Although usually found in woodlands, seasonal pools also occur in grasslands and active crop fields. These sites are rich in plants and invertebrates because of their shallow depth and warm temperatures, as well as the build up of decaying organic material. Such conditions lead to a large output of algae, fungi, bacteria, invertebrates, and annual plants, all of which form the base of the food web. Seasonal wetland food webs provide nourishment for birds, mammals, amphibians, reptiles, and invertebrates.



Wooded seasonal pools in particular are important areas for amphibians that prefer shallow water

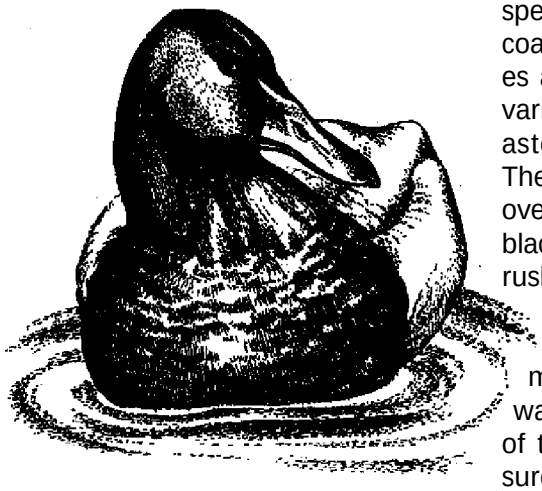
because they are free of predatory fish. Birds migrating through the area often rely on the large amount of insects found in these sites to help them get to their summer nesting area. Local birds also eat the insects to build up energy reserves for nesting and brood rearing. Because these areas are wet for only a short period, the pools generate a large and diverse array of plants including jewelweed, iris, marsh-marigold, skunk cabbage, and blue-joint grass. Plant species found in more open areas include smartweed, beggarticks, nut-grasses, and wild millet. Many wildlife species depend upon seasonal pools for part of their life history. Examples are spotted salamanders, chorus frogs, spring peepers, leopard frogs, wood ducks, yellowthroats, swamp sparrows, muskrats, raccoons, deer, and turkeys.

Springs and Seeps

Springs and seeps occur in rolling or hilly topography where ground water percolates through

smartweed

the soil and emerges from the ground on lower slopes. This ground water develops into either small streams or small bodies of pooled water. Springs are identified by their faster discharge rate and their tendency to come from a single, concentrated source forming a stream, while seeps are identified by their slow discharge rates usually forming pools. These areas are often surrounded by wet meadows, which may not be noticed in the summer due to dryness. Because many springs and seeps do not readily freeze during winter months, they offer a dependable source of water year around. Wildlife depend on springs and seeps when rivers, creeks, ponds, and other water sources are dry or frozen. The ground water that percolates at lower elevations often creates a snow-free area in winter and provides wildlife with access to green vegetation. As flocks of turkeys and herds of deer disperse from winter haunts, they seek these lush food areas. Because these small wetlands--some of which are so tiny as to be hardly noticeable--produce insects, they are attractive to many kinds of songbirds. Further, the constant, always-moving shallow water is favored by reptiles and amphibians, including several kinds of salamanders.



canvasback

Coastal Plain Marshes

Coastal plain marshes are an unusual and unique kind of seasonal wetland. Though called marshes, these wetlands are more like wet meadows, which are very wet in the spring, yet sometimes dry by late summer. Dating to an earlier geologic time, coastal plain marshes occur primarily along the western side of the Lower Peninsula and as far inland as the middle of the state. Ranging in size from a half-acre to over 20 acres, they do not necessarily exist along the Great Lakes shoreline. They are named after, and are unique because they boast a large number of plant species found along the Atlantic coastal plain. Coastal plain marshes are usually dominated by a rich variety of vegetation such as bushy aster, twigrush, and bulrush. These marshes are also home to over 45 rare plant species such as black fruited spike rush, dwarf bulrush, meadow beauty, and prairie dropseed. Coastal plain marshes usually dry up by late summer to the point were standing water only remains in the center of the wetland. No one knows for sure why they exist in Michigan or how their unusual plant species, most of which are annuals, appeared. The natural periodic reduction of water levels favors these species and helps them to persist by exposing bare substrate for germination.

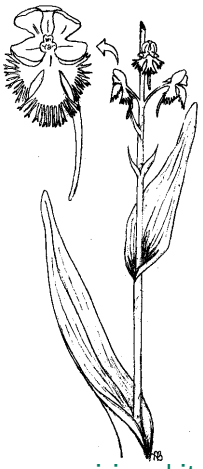
Lake Plain Prairies

Lake plain prairies are coastal wet meadows occurring in scattered fragments along Lakes Michigan, Huron and Erie. These wetlands vary dramatically in their level of wetness from season to season, and even year to year.

Many of these shallow wetlands function as a first step in the transition zone from upland vegetation to deeper wetlands. They are the wet prairies leading to shallow marshes, deep marshes, and shallow open-water zones. Often used as feeding, breeding, and brood-rearing areas for shorebirds, wading birds, waterfowl, amphibians, and reptiles, lake plain prairies can also serve as spawning grounds for muskellunge, smallmouth bass, yellow perch, northern pike, and other fish during years when high Great Lakes water levels flood these areas. Big bluestem, prairie cordgrass, bluejoint grass, and New England aster are examples of wet prairie plants that can withstand occasional, temporary flooding. This community is home to several rare plant species including prairie fringed orchis, tall green milkweed, creamy wild indigo, dwarf bulrush, and globe-fruited seedbox. In addition, several rare wildlife species exist in these prairies such as the fox snake, king rail, least bittern, and red-legged spittlebug.

However, as the shoreline drops in elevation and the soils become more saturated, the vegetation composition changes and red-top grass, giant golden rod,

SEASONALLY FLOODED WETLANDS



prairie white fringed orchis

h aster, and other et meadow plants begin to domi- nate. Bottle- brush sedge, lake edge, and other edges then take over where the soils saturated most of year. Depending the slope of the reline and the ater table, this zone between wet prairies and sedges may be 30 feet wide or hundreds of feet wide. Human development of shorelines have destroyed many of these lake plain prairies that are valuable to wildlife.

Management Considerations

The following are options to consider when managing seasonal wetlands:

•Protect wetland water sources and surrounding uplands to provide critical habitats for wildlife. Draining or filling them for agriculture, housing projects, or other human use fragments wildlife habitat and alters water courses. Logging activities and livestock grazing around seasonal pools can have a major negative impact on water supply, temperature, and ground cover. Altering water courses to raise water levels or duration may reduce plant diversity and insect production and can turn seasonal wetlands into more permanent wetlands such as marshes and swamps. On the other hand, reducing water levels or duration through draining or building roads can turn a temporary wetland, into an upland. Although practices that destroy one cover type may create another, the unique combination of ingredients found only in seasonal wetlands will be gone.

•Protect seasonally flooded wetlands from off-road vehicle (ORV) use. Coastal plain marshes and their associated mud flats, in particular, are prime targets for ORV users who like the "mud holes" but who often damage the soil surface, destroy valuable plants, and alter the hydrology or water resource.

•Restore degraded or drained seasonal wetlands by providing a consistent source of water during the period of late winter through spring. Several organizations and agencies are interested in helping landowners manage seasonal wetlands. For additional information, see the **Wetlands Restoration Techniques** chapter in this section.

•Maintain or establish vegetation in a strip at least 100 feet wide around the wetland to help protect them. Because of their low elevation on the landscape, wetlands are sinks for nutrients, sediments, and pollutants. Manage surrounding uplands to trap erosion and prevent nutrient overloading.

•Never use any wetland as a dumping ground for refuse and debris, including logging waste, because these activities lead to contamination of the water, soil, plants, and animals. Before draining or filling any wetland, contact the Land and Water Management Division of the Michigan Department of Environmental Quality, which is responsible for regulating certain activities in wetlands.

•Remove exotic nuisance plants such as purple loosestrife, reed canary grass, and glossy buckthorn. These aggressive species have little or no value for wildlife and can quickly out - compete native plants in small seasonal wetlands.

•Build loafing platforms to attract turtles and certain species of waterfowl. Nesting structures for ducks, geese, and songbirds, in or near seasonal wetlands, is normally unnecessary. However, nesting structures may help these species to use some areas.

In summary, to the casual observer seasonal wetlands may not appear to be important. Dry during much of the year, they nevertheless provide key food and cover for many kinds of animals during late winter through early summer when wildlife need high energy foods for the start of the breeding season. These wetlands are unique, provide important wildlife habitat, and are part of our diverse landscape. Because they figure importantly in the production and welfare of Michigan wildlife, seasonal wetlands should be protected at all times and restored whenever possible.

bullfrog

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FOR ADDITIONAL ASSISTANCE: *CONTACT YOUR LOCAL CONSERVATION DISTRICT*

PRIVATE LAND PARTNERSHIPS
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WETLAND RESTORATION TECHNIQUES

Wetlands come in a wide variety of types and sizes, and support a great diversity of wildlife. We have come to realize that collectively wetlands are of great benefit to society by providing wildlife habitat, improving water quality, reducing flood damage, and offering recreational opportunities and aesthetic value. In the past, we had less understanding of the functions of wetlands and often placed little value on them. As a result, many were drained, filled, or otherwise degraded for other land uses.

Historically, Michigan had an estimated 11 million acres of wetlands, or about one-third of the state's land mass. Since European settlement, over 35 percent of these wetlands have been lost. In southern Michigan the loss is even greater -- more than 75 percent in some counties. In some cases, the loss is permanent. In others, we are able to reverse these impacts, such as drainage, and restore the wetland.

Wetland restoration techniques provide private landowners with an opportunity to benefit wildlife, themselves, and their community. If at one time a wetland existed on your land, you might be able to restore it. This chapter explains how.

Wetland Ingredients

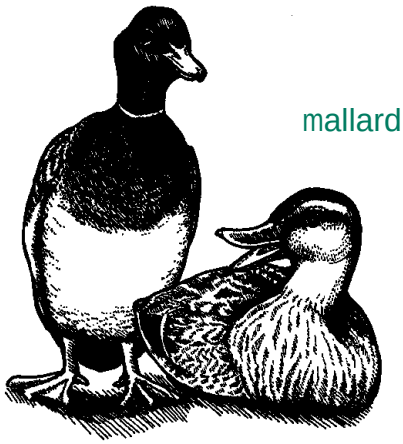
There are three characteristics that every wetland posesses.

1) Hydrology: A supply of water that is at or near the ground surface at least a portion of the growing season.

2) Hydric soils: Soils that develop under saturated conditions. Hydric soils have the capacity to hold water on or near the ground surface for at least a portion of the year.

3) Wetland vegetation: Plants that are adapted to grow in wet soils.

Wetland restoration involves returning one or more of these three characteristics to a site. Hydric soils form over a long period of time and the soil characteristics are very difficult to create. For this reason, restorations take place where the hydric soils remain but the hydrology or vegetation has been altered.



mallard

Wetland Creation Versus Restoration

Wetland creation involves impounding water with berms and dikes or by excavating depressions in areas that did not previously contain wetland soils or vegetation. Essentially, all three key characteristics are missing. Adding these characteristics where they do not exist is difficult, costly, and often unsuccessful. Financial assistance to land owners is not generally available. For these reasons, landowners are often discouraged from undertaking creation projects. However, it is possible to create a small shallow pond for wildlife on upland areas. Refer to the chapter on **Building and Managing Ponds** in this section for more information.

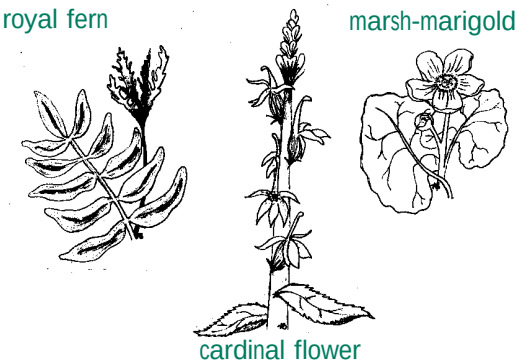
Wetland restoration involves returning one of the wetland ingredients, generally water retension, to a degraded or drained wetland site. Sites that have been ditched, tiled or leveed, or degraded from excessive logging, uncontrolled cattle grazing, or unrestricted off-road vehicle use are all candidates for restoration. Projects can span the spectrum from curtailing these or other damaging practices to restoring the water source and/or other wetland properties. Because the degree of current damage will vary, the effort needed to restore sites will also vary. For instance, a partially drained wetland may be fairly simple to restore to its natural

water level. The remainder of this chapter will focus on restoring wetlands that have been fully or partially drained.

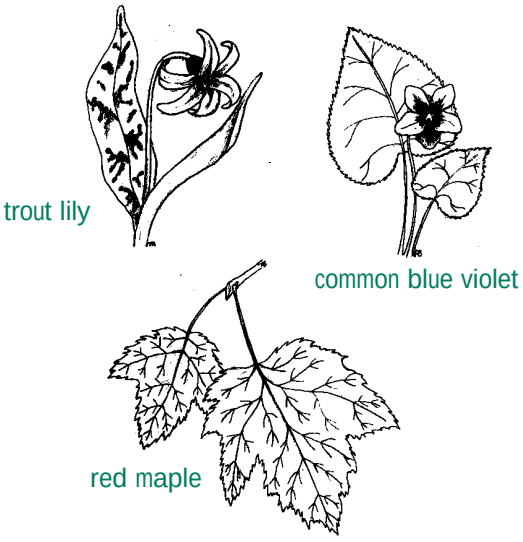
Locating Restoration Sites

Identifying a drained wetland is the first step in restoring it. Some degraded or partially drained wetlands are readily apparent, while others may be apparent only through review of soil maps, photographs, or other records. Drained wetland sites will have hydric soils. You can obtain a copy of the County Soil Survey from your local Conservation District (CD) office and ask a staff person to help indicate any hydric soils on your property. You can also ask the CD staff if aerial photographs are available for review. On photos, degraded wetlands or wet spots appear as dark areas and field tiles appear as dark, linear marks. Reviewing photos taken from several different years, and those taken 20 years ago or more may help identify areas that were wet at one time. In addition, records from, or conversations with, previous landowners or neighbors may help to identify past drainage.

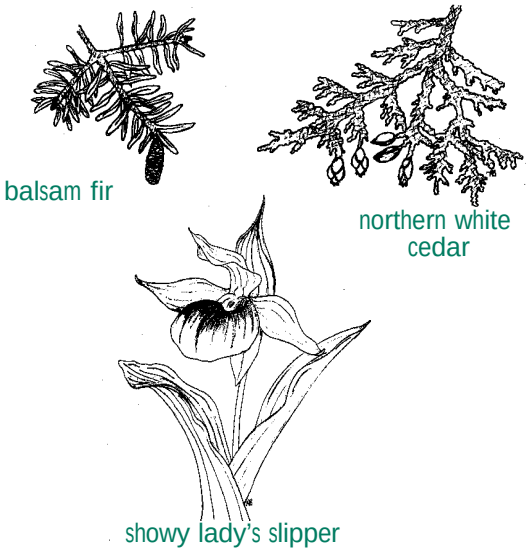
A field inspection can also help to identify restorable wetlands. Hydric soils often display similar field characteristics (see **Introduction to Wetland Management**). Also, drainage ditches or evidence of drain tiles may be apparent. Spots in fields that hold water briefly after a heavy rainfall may be tiled and drained wetland basins. Also, look for clumps of wetland vegetation in existing fields, low areas where crops are stressed or do not grow, or wet areas where farm machinery has been stuck. On fields no longer farmed, look for changes in vegetation including the presence of wetland vegetation, and depressional areas that are wet or hold water at least a portion of the year.



Wetland plants that occur in wetlands 99 percent of the time.



Wetland plants that occur in wetlands 67-99 percent of the time.



Wetland plants that occur in wetlands 34-66 percent of the time

Before Beginning

Wetland restoration is typically NOT a do-it-yourself project. A wildlife biologist or wetland specialist can help assess the project area, look for potential impacts to others, and determine if hydric soils and a water source are present. Voluntary programs offering technical and financial help may be available to help restore your wetland - check with your local CD staff for initial assistance before proceeding any further. You can probably save yourself time and money by working with the CD staff.

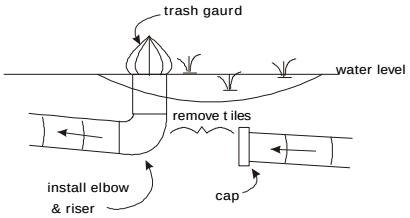
Projects begin with planning to determine feasibility and design. Without proper planning, projects may lead to problems for you or your neighbors. Develop a reasonable management goal and stick to it. Safety is a primary concern both during and after construction. Also, the good neighbor policy applies -you don't want to flood a neighbor's crop field or basement, or interrupt their drainage. By talking with your neighbors you can address their concerns, and may find they want to join in on the project. In addition, watershed size is important - too much water or too little water may mean the project is not workable. If a project looks like a "go," survey equipment will be used to determine water levels for the completed project and to help design structures, such as ditch plugs,

dikes, or spillways. Finally, local, state, or federal permits may be needed. In Michigan, permits are required from the Michigan Department of Environmental Quality (DEQ) for any work in a stream, flood plain, and most existing wetland areas.

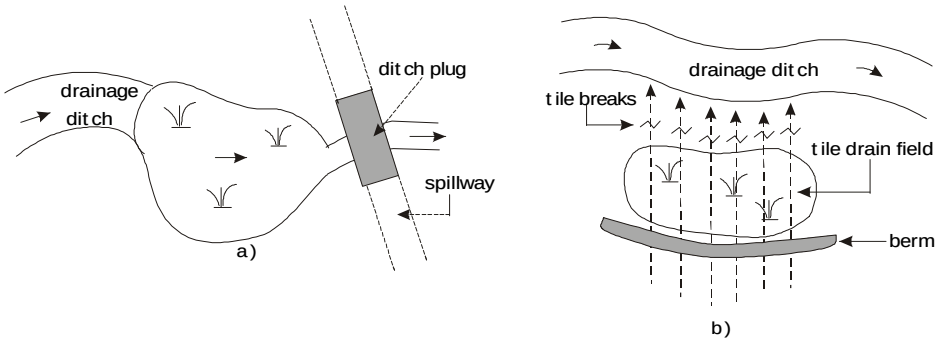
Restoration Techniques

Typical projects restore water to a fully or partially drained wetland basin by removing underground drain tiles, plugging open ditches, or building small dikes. Projects are often one to three acres in size, and have an average water depth of about 18 inches. Many small-basin wetlands of this type that were drained for agriculture, provide opportunities for restoration today. Generally marshes or swamps, with seasonal or permanent water, are most often restored.

The simplest restoration, a "tile break," involves removing a section of underground agricultural tile that is draining a wetland basin. Drain tile, or field tile as it is often called, is usually made of clay or perforated plastic and buried at a depth of two to six feet. Generally, a contractor with a backhoe is used to remove or crush a 25 to 50 ft section of tile downstream of the basin. The downstream end or outlet pipe is then plugged with a bag of redi-mix concrete or clean



Removing tiles from a drain field to restore a wetland



Examples of restoring drained wetlands a) drainage ditch stopped with ditch plug, and spillway b) tile drain field broken, and berm constructed to prevent flooding in areas that are to remain dry.

clay fill, and the trench is filled. Sometimes, a portion of unperforated tile, called a “riser”, is connected to the downstream end of the tile line and brought to the surface in order to control the water level. Water will fill the wetland basin until it reaches the mouth of this riser where it will then flow back through the tile line into the ditch. This may work well when you wish to maintain downstream drainage.

A “ditch plug” restoration builds an earthen wall to impound water. This type of restoration uses equipment to fill a portion of a drainage ditch to natural ground level. Again, a riser may be used to let water flow through a tube once it reaches a certain level. A small dike or berm may also be used, which will impound the water that will begin to collect once the drain has been plugged. A dike prevents the drainage of water downstream and requires a spill way or other water-control structure to regulate the water level and prevent the dike from being washed away during periods of heavy runoff.

Typically, a berm or dike is constructed with a top width of eight to 10 feet and a maximum side slope of 3:1 (three feet of horizontal width to each foot of rise). A three foot high dike would have a bottom width of 24 to 30 feet. When constructing a low-level dike, soil is often pushed up or excavated from within the former wetland site. This helps to form a deeper pool within the basin. Sod and topsoil are stripped from the construction site and stockpiled. The dike or berm is then constructed with subsoil, often with a good clay component. Topsoil from the basin, which is a good seed source for wetland plants, is then spread back into the basin and on the dike or berm. Disturbed upland areas, including areas of the ditch plug, dike, or berm, are seeded with grasses to minimize erosion and provide cover. Generally, nothing is planted in the wetland basin as wetland vegetation usually re-establishes itself quickly from seeds that have remained dormant in the soil.

Managing water, especially excess water, is important on restoration projects. A water-control structure can be used to manage water levels within a project. Examples include plastic or metal risers, and corrugated metal or plastic stop-log structures. These help to manage the normal flow of water. An emergency spillway, which is a wide trough-like opening in the side of the dike, should be designed into wetland restoration projects if excess water is expected

during flood events. Emergency spillways are sized according to the watershed but typically are at least eight feet wide and one to two feet below the top of the ditch plug, dike, or berm. These spillways allow water to pass through without damaging the retension structures in high-water events. Since water management is critical, consult a professional for design specifications suitable for your wetland.

Most restoration projects involve open-area wetlands, but forest and shrub wetlands are also important and can be restored too. Restoration of wooded sites should be done cautiously, however, to avoid killing the trees and shrubs that normally grow in wetlands. Woody wetland plants can often withstand brief flooding during the growing season, but be aware that prolonged inundation may stress trees and kill them.

Maintenance of the Restored Site

Simple basin restorations should be relatively maintenance-free. However, some restored wetlands, particularly those with water-control or earthen structures, require some maintenance. Water-control structures should be checked periodically. Fallen leaves, twigs, or other debris may build up around the mouth of the structure. An accumulation of debris may partially obstruct the flow causing the water level to rise. Inspection of the site, particularly during and after a big storm, will allow you to remove materials before problems develop.

Ditch plugs, dikes, and berms also require some care. Established seedings of grasses should be periodically mowed or burned to prevent woody vegetation from invading. Root growth from woody vegetation will allow water to penetrate the earthen structure, which will cause it to leak and may contribute to a future washout. Annual maintenance also means keeping muskrats, beaver, and woodchucks in check by filling their excavations, and removing some through trapping if necessary.

As you enjoy your restored wetland, you can also keep an eye open for potential problems and address them quickly. It is much easier to solve a problem while it is small than to wait until it is out of hand. Also, remember that a restored wetland is most often only four feet deep at its deepest spot and averages only two feet deep throughout the basin. This is not a fish pond. If you want to create a fish pond, see the chapter on **Building and Managing Ponds** in this section.

State and federal agencies and conservation groups often have programs that may be able to assist you in identifying potential restoration sites and in wetland restorations. These programs may provide technical assistance and cost-share expenses. Start with your local CD office staff as they will be able to direct you to available assistance programs.

In summary, restoring wetlands may require more time, effort, and money to complete than many other wildlife projects. Fortunately, technical and financial help is available, and the rewards are well worth the effort. Most landowners are quite pleased to see how quickly the wetland is re-established when water is restored. They also often report rapid use by wildlife. You will also have the satisfaction of returning to health a part of Michigan's natural history.

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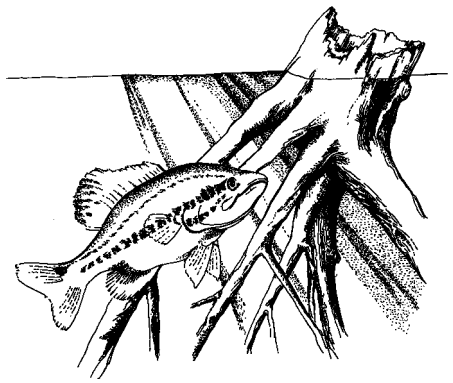
PRIVATE LAND PARTNERSHIPS
WORKING TOGETHER FOR WILDLIFE

BUILDING AND MANAGING PONDS

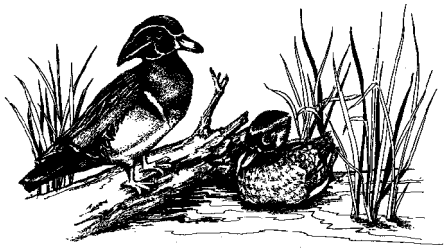
Small and large, deep and shallow, ponds abundantly dot Michigan's landscape. People, fish, and wildlife love the resources that these small bodies of water provide. Michigan landowners have built an estimated 50,000 ponds on farms and near rural households to store water for irrigation and livestock, to provide fire protection, to attract wildlife, and to raise fish for recreation. Deep water ponds are great places for fish production because of their cooler temperatures and reduced vegetation. Although shallow ponds are not as valuable for fish production, they provide suitable sites for cattails, bulrushes, and other vegetation that create food and cover for wildlife.

The type of pond to construct depends upon your goals. If you want to raise bluegills, bass, or trout, then make the pond deep. If your goal is to attract ducks, frogs and wetland birds, then build it shallow. Some landowners try to achieve both goals with a single project and usually fail, especially if the pond site is smaller than several acres. For more information on creating shallow water ponds for wildlife, see the chapters on Marshes and Wetland Restoration Techniques. Landowners interested in pond development for other uses should consult with their Michigan State University Extension office or the U.S. Natural Resource Conservation Service.



Deep Water Ponds

To successfully raise fish you must ensure a balanced fish population, provide appropriate water temperature, and limit growth of emergent (cattails and bulrushes) and submergent (pondweed and milfoil) plant species. The Michigan Department of Natural Resources Fisheries Division has information about how many fish and what species to stock to meet your pond's size and shape. Minimum depth for sustaining warm water species like bass and panfish is 10 feet. For trout and other cold water species, the minimum is 12 feet or more unless a cold spring or stream feeds the pond. The entire pond need not be this deep, but unless 25 to 50 percent of its surface area lies at such depths, the pond will not provide the right amount of dissolved oxygen in winter and range of temperatures in summer that fish need to survive. Even though some fish may live in shallower ponds, they will not grow as fast nor as large as they would in better habitat. In addition, they



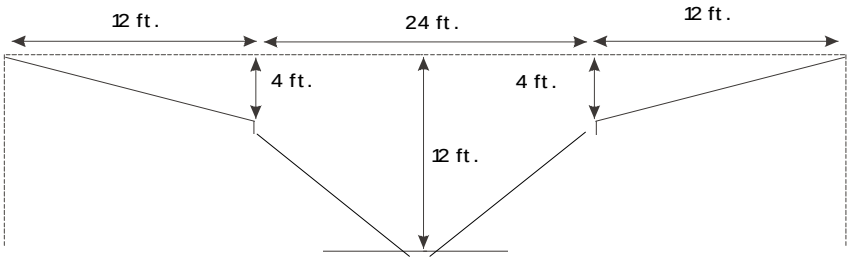
wood duck

are vulnerable to winter and summer kills. Fish ponds should be 1/2 acre or more in water surface area.

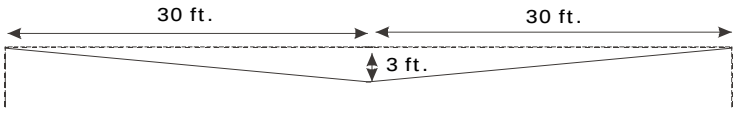
Minimizing the amount of shallow edge around your deep water pond will reduce emergent vegetation, most species of which grow in water less than four feet deep. For this reason, create steep slopes to a depth of four feet or more. Slopes should range from a minimum ratio of 2:1 (2 feet of horizontal per 1 foot drop) to a maximum of 3:1 (3 feet of horizontal per 1 foot drop). Minimize the amount of edge by constructing a circular or rectangluar shaped pond.

Shallow Water Ponds

Wildlife species attracted to constructed shallow water ponds (depending on size) include waterfowl, songbirds, shorebirds, wading birds, amphibians, and reptiles, as well as some upland birds and mammals. Although a portion of the pond can be six feet or deeper--to reduce emergent plant growth and to maintain an opening useful to waterfowl and other wetland birds--depths ranging from six



Example of a deep water pond with minimal shallow edges, due to a 3:1 slope reaching 4 ft deep, a deep water level of 12 ft. to facilitate a diversity of fish species, and a 25% open water area, 24 ft. across, which provides the correct temperatures and amounts of dissolved oxygen, depending on the season.



Example of a shallow water pond with maximum shallow area due to a 10:1 slope reaching 3 ft. deep at a horizontal length of 30 ft. The total width of the pond is 60 ft. to reduce impact of predators on young birds.

inches to four feet are most productive for a variety of wildlife. Ponds deep enough to house fish can have a negative impact on the production of wildlife such as frogs, toads, salamanders, and even ducklings. Wildlife ponds often host some of the same plants as marshes, including cattails and bulrushes in the shallow areas and pondweed and other submerged plants in the deeper spots.

For shallow ponds, increasing the amount of edge makes the pond more productive for wildlife. Irregular-shaped projects or long, rectangular ones with scalloped edges will have more edge, increasing its wildlife value. Slope design should be flatter, ranging from 3:1 to 10:1 (horizontal:drop), and projects that are at least 60 feet wide reduce the impact of predators on ducklings and other young birds.

Constructing a Pond

Generally, ponds should be dug on fairly level areas not suited for wetland restorations. Many parts of Michigan are favorable because of the flatter topography and groundwater which lies close beneath the soil surface. Water will slowly seep through gravel, loam, and sand layers of a dug depression with a high water table. Conversely, surface run-off will readily fill basins constructed on clay soils. While some people have excavated springs to create ponds, we do not recommend it. Remember that springs provide important wildlife habitat to wild turkeys, frogs, salamanders, and turtles. For more information on springs, see the chapter on Seasonal Wetlands.

Most landowners thinking of building a pond assume that low areas offer the best location. Actually, upland sites may be better because the groundwater table generally follows the land's contours, and it may be fairly close to the surface at higher elevations. Upland excavation most certainly will be better than in the low spots, as they may be muck-filled and more difficult to work with. Excavation projects in lowlands or wetlands should be avoided and may require a permit from the Land and Water Management Division of the Michigan Department of Environmental Quality. Marshes, lowland woodlands, brushy wetlands, bogs, and other wetland types provide important wildlife habitat, and converting them to deep or shallow ponds is not recommended.

The Natural Resources Conservation Service, an agency of the U.S. Department of Agriculture with offices in most Michigan counties, have soil surveys on record that can tell landowners how well certain soils on their property will hold water. Soils for pond construction should contain a minimum of 20% clay. It is important when constructing ponds to know water-holding capacity, depth to water, and expected fluctuations of water in the soil because excavation will have to go below that level to maintain water. This information is also helpful if the source of water for the pond is runoff.

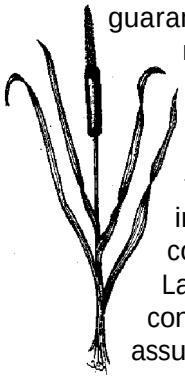
The best way to determine water table depth is to review a soil survey with an NRCS staff member to get an idea of expected normal conditions, then dig test holes when the water table is likely to be at its lowest, usually in the hot, dry

leopard frog

part of the summer. Spring and summer groundwater depths often vary by two to four feet or more in Michigan, which is why many shallow ponds dry up in summer. This condition typically occurs where the soil is sandy or the slope too great. Although the drying process may have a negative impact on fish stocks in deeper ponds, it actually helps promote a diversity of plant growth in shallow ponds. When water returns to the site, typically in fall, wildlife will greatly benefit.

In addition, be sure not to dig the pond too deep. A thin layer of impermeable soil, such as clay, may be what holds the water table where it is. Puncturing this soil layer is much like pulling the plug of a bathtub.If this layer of soil is broken, the water table will no longer exist at the previous level and the created pond will be dry.

Operators of earthmoving equipment all too often do not take groundwater tables into account when they contract with landowners. An agreement to create a pond that is 15 feet deep, for example, could produce a pond with only 12 feet of water if the groundwater table lies three feet below the surface. In this instance the operator would have to dig to a depth of 18 feet in order to satisfy the agreement. Landowners are advised to get a written agreement from the contractor that guarantees water depth, not depth of the excavation. Another misconception is the common belief that water seeping into a test hole must come from springs. Landowners and their contractors all too often assume the "spring-fed" depression they dig will fill with water. In truth, the water flowing into the test hole is probably groundwater seeping through sand or gravel. This water will fill a depression only to the level where it currently exists.



An option is to create a pond by impounding existing surface water. For example, field ditches that furnish a constant flow of water can be dammed with an earthen berm. Adding a spillway will allow you to control water depth. For more information, refer to the brochure on Wetland Restoration Techniques. However, such ponds usually require the periodic removal of silt and other sediments. Also, such projects require a permit from Michigan Department of Environmental Quality and may also need to be coordinated with the county drain commissioner's office. Further, runoff and stream water are rarely as pure as groundwater, which has been well filtered and is free of phosphorus and other pollutants. On the other hand, groundwater may be low in oxygen and contain iron, copper, or other minerals that are detrimental to fish. For this reason, if a fish pond is desired, one should test the water source before 'building' the pond.

The actual design of your project will be based on your goals. Also, design considerations will have to take into account the soil type and terrain and the aesthetics desired. Keep ponds away from woodlots to minimize loading from leaves and other nutrients, and locate them away from homes and buildings for maximum wildlife use. Keep in mind excavating costs can soar if dirt must be moved farther than 150 feet. The most cost-effective ponds, then, are those

invasive species: garlic mustard, glossy buckthorn, and purple loosestrife

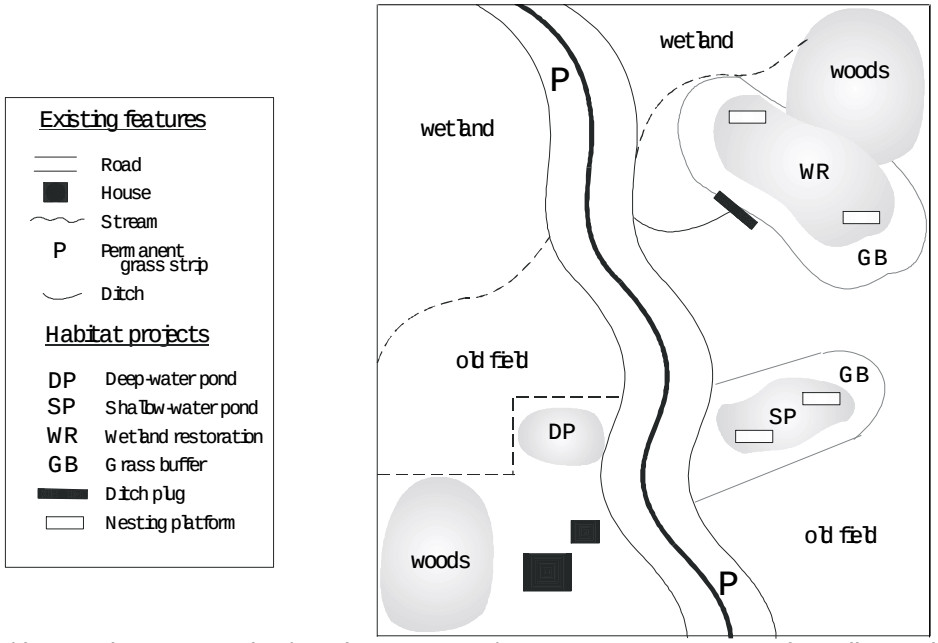
that are no wider than 300 feet. However, they can be bigger if the budget allows.

The least-expensive ponds are usually those that require the removal of excavated dirt (spoil) only once. With the help of the contractor, plan where you will put the spoil. Many landowners are amazed at the large volume of spoil, which typically takes up 20 percent more storage volume once it is removed because it loses its compact nature. A half-acre pond, for example, with a quarter-acre that is 18 feet deep, may easily require a full acre of land for spoil disposal. Place the spoil on an upland site and take precautions to prevent erosion back into your pond.

Management Considerations

Ponds offer opportunities for wildlife and fish management. Those that have a reliable supply of water year around function natural-

BUILDING AND MANAGING PONDS



This map is an example that demonstrates the many management options discussed throughout this chapter. The option(s) you choose should depend not only on your goals, but the location, condition, and present use of your land.

ly and can best be managed by protecting the water source. The hydrology (water availability) of your pond is critical in maintaining the water quality and quantity. A berm around the pond that is one foot high by four feet wide and is vegetated will help to filter surface water from sediments and contaminants before reaching the pond.

Within at least 100 feet of the pond, avoid the application of pesticides and fertilizers, and do not continuously plow or mow to the water's edge. Creating a buffer zone of grassy vegetation at least 100 feet around the pond will help protect the pond. For seeding rates and other information, refer to the Grass Planting chapter. Fence the pond and buffer zone to restrict livestock access. Continuous use by cows, horses, and sheep can damage vegetation and pollute the water source with manure. Do not let the pond become a collection point for trash or debris. Consider building loafing platforms to attract waterfowl and turtles. To learn more, refer to the chapters on Frogs, Turtles, and Snakes, and Homes for Wildlife.

Unavoidable problems could include the invasion of garlic mustard, glossy buckthorn, or purple loosestrife. The latter is a beautifull, purple-flowered invader that can quickly take over a wetland by outcompeting native plants. This noxious weed has little value to wildlife and can be difficult to eliminate because of its strong root-stock. The best method is to dig it out by hand before it becomes firmly established. If already established over a large area this plant may be cut in winter, and then sprayed with the herbicide Rodeo until June. However, it may be easier to identify the plant after June when it blooms, at which time Rodeo can also be used. Be sure to follow all label directions.

In summary, deep ponds can hold fish and shallow water ponds can attract wildlife to your property. However, landowners should think about the many considerations involved, including construction and maintenance costs. Government cost-sharing programs for pond creation are rare. If your property is located in a lowland area, you may be able to restore a wetland instead of creating a pond. This option wold most likely create better habitat for a variety of wildlife. Because of the high priority for restoring drained wetlands and the relative lower cost of these projects compared to pond creations, there are several programs that cost share restorations. Refer to the other chapters in the Wetlands Management section for more information.

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