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Shoreline Protection

Because shore protection structures can have negative effects on natural resources and other shoreline properties, shore protection structures should only be installed when they are needed to address erosion problems and the type of shore protection used should be carefully considered. Near shore shallow waters provide habitat for a greater variety of organisms than all other aquatic zones and are essential in the life cycles of many of Michigan's fish and wildlife. Northern pike, bluegill, bass and other fish spawn in shallow shoreline areas. Loons, ducks, geese, water birds, songbirds, and wildlife such as amphibians, reptiles and insects live along near shore areas.
Shoreline hardening that occurs with the construction of vertical walls (seawalls) has significant adverse effects on the fishery, wildlife and the overall water quality of a lake. Where vertical walls are built the gradual transition from shallow water to upland is destroyed, wave reflection off vertical walls causes bottom scour to occur, stirs bottom sediments, increases water turbidity, and impacts spawning areas and aquatic vegetation. Vertical faces block access to and from the water for turtles, frogs, and other fauna that need access to the uplands to feed, rest, and nest. Seawalls damage or destroy these important habitat areas and weaken the ecosystem.

Because of these negative effects of vertical walls the DEQ recommends the use of natural shoreline treatments. New shoreline hardening should be avoided where alternate approaches such as plantings and natural stone can be used to protect property from erosion. The purpose and benefits of plantings/stone are to provide a natural transition between the open water and upland, while providing habitat.

Many problems can be avoided with proper placement of structures to minimize loss of natural vegetation and changes to topography. Leaving a natural transitional area or adding deep rooted plants, including natural (unmowed) vegetation, can minimize the effects of waves, ice and fluctuating water levels. In order to prevent ongoing erosion your property may benefit from the addition of deeper rooted plants such as shrubs and trees. A natural, vegetated shoreline is less expensive to construct, absorbs and disperses the energy of waves, provides habitat and tends to be self healing.

Construction of any type of shore stabilization structure such as a sea wall, bulkhead, revetment, bioengineering. at or below the ordinary high water mark of a lake or stream requires a permit.

The Water's Edge

Inland Lakes and Streams Permits

List of the Michigan Natural Shoreline Partnership's Certified Natural Shoreline Professionals

Natural Shorelines for Inland Lakes

Inland Lake Shoreline Permitting Webinar

Related Conten
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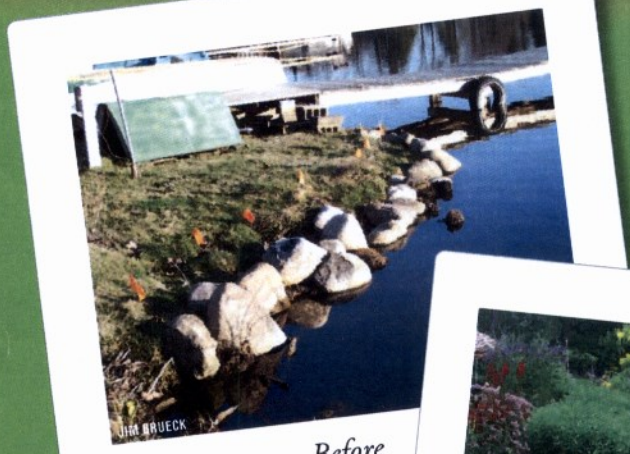
NATURAL SHORELINES for Inland Lakes



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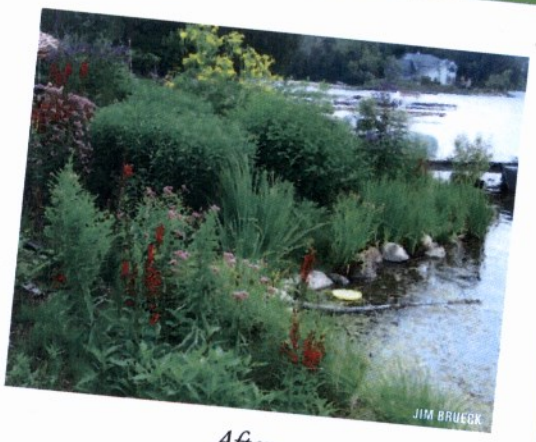
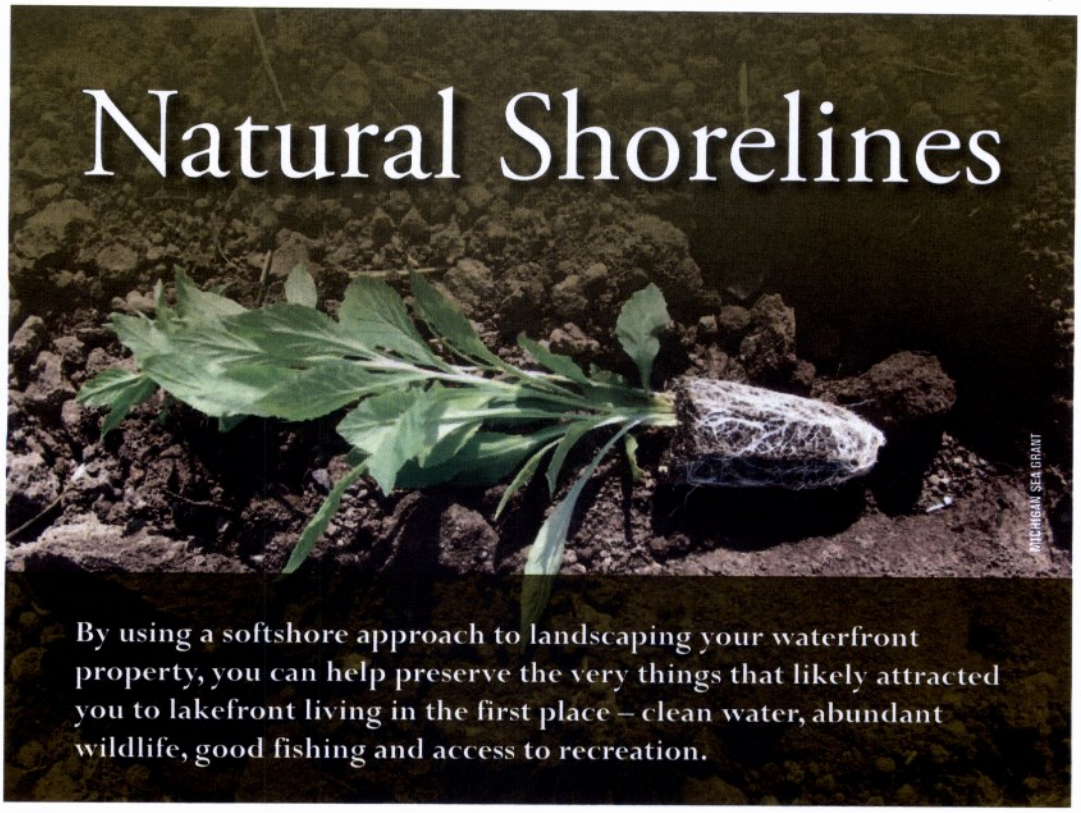


After

A SIMPLE SOLUTION FOR LAKEFRONT PROPERTY OWNERS

Natural Shorelines



By using a softshore approach to landscaping your waterfront property, you can help preserve the very things that likely attracted you to lakefront living in the first place – clean water, abundant wildlife, good fishing and access to recreation.

Homeowners and lake stewards can help keep their lakes healthy by using ecological principles to assess, design, construct and maintain natural shorelines. This publication explains why lakeshore property owners should consider natural shorelines and ways they can incorporate sound bioengineering practices into the landscape.

WHAT IS BIOENGINEERING?

Bioengineering, often called softshore engineering or lakescaping, is a method of using native plants, biodegradable products and other natural materials to provide a stable shoreline. The goal is to protect the property from waves and erosion, while improving ecological features and the integrity of the shoreline. Bioengineering methods are often used when creating a natural shoreline – which acts as a living buffer that changes throughout the seasons and years.

WHY CONSIDER A NATURAL SHORELINE?

The primary purpose of a buffer at the shoreline is to protect the property from erosion. Erosion may result in loss of shoreline property and increased sediment in the water – leading to poor water quality. Seawalls and natural shorelines are two types of buffers.

Seawalls are in use all over Michigan. A seawall is any hard-surfaced wall installed along the shore to block the waves from reaching the land. The walls are typically parallel to the shore with a vertical surface facing the water. They are made out of many

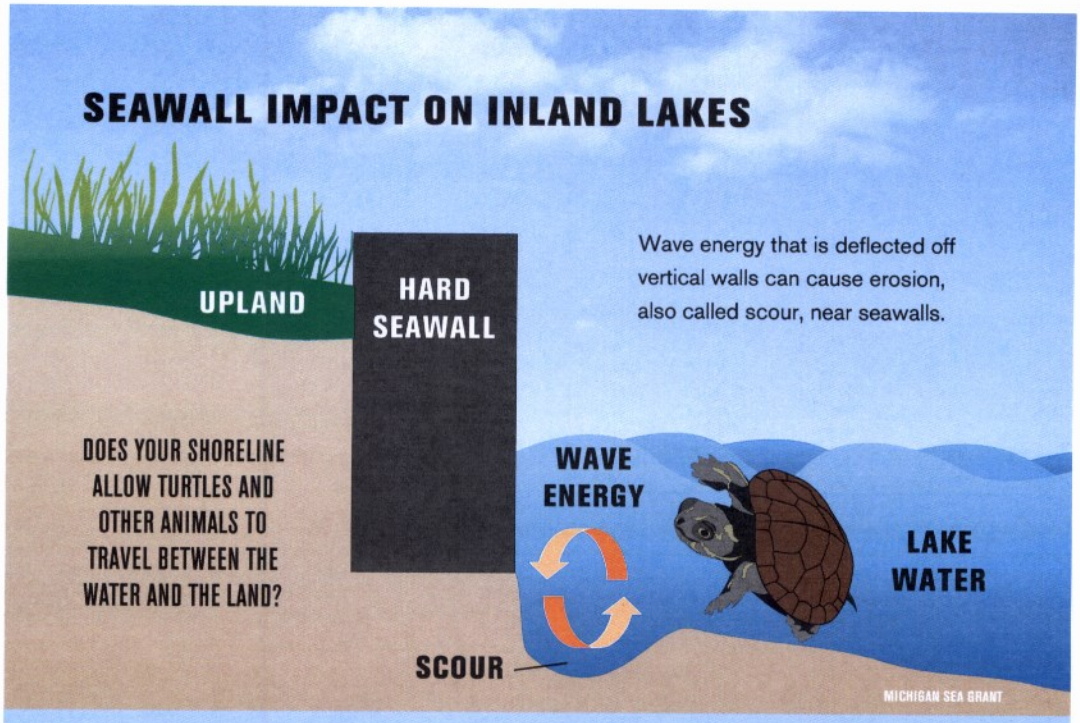
materials, including concrete, steel sheet pile, wood and rock-filled wood structures.

Natural shorelines are buffers that may include erosion-control fabrics, native vegetation and rocks. Some natural shorelines use living and nonliving plant materials in combination with natural and synthetic support, like biologs, to stabilize the shore. The techniques – called bioengineering – are not new. For example in the 16th century, willow branches were used to stabilize irrigation channels.

WHAT DO WE HAVE TO LOSE?

Michigan's inland lakes contain 154 species of fish, including 23 species that are threatened, endangered or of special concern. Five species are already extirpated, meaning they can no longer be found within Michigan.

Many property owners are drawn to seawalls because they are perceived to be more stable. However, they can often cause shorelines to be less stable than those protected by natural landscaping. Seawalls do not allow for absorption of the energy that waves bring in – waves hit the seawall, and the energy is bounced back out to the water. In the process, wave energy that has bounced off the wall scoops out soil and sand and causes erosion at the base of the wall. This kind of erosion is called scour. Scour contributes to a less stable waterfront,



In addition to deflecting wave energy, seawalls also disrupt the natural transition between the water and the land. Vertical walls physically block access to and from the water for turtles, frogs and other animals that need contact with the land to feed, rest and nest.

decreases water clarity, and has a negative effect on fish, animals and aquatic plants near the shore. In contrast, bioengineering along the shore absorbs some or all of the wave energy, which helps thwart shore erosion and scour.

BEFORE AND AFTER

The top image shows the impact of erosion before using native plants for shoreline stabilization. The erosion is visible along the shoreline, and the neighboring seawalls intensify the erosion. In contrast, the bottom image shows a shoreline protected by native plants that have established a root system and created a natural, stable buffer.


JANE HERBERT


MICHIGAN SEA GRANT

WHAT ARE NATIVE PLANTS?

Native plants are grasses, flowers, shrubs and trees that are indigenous to a particular area. A few reasons to use native plants:

- Native plants provide food and habitat for birds and other wildlife, and they help maintain natural biodiversity.
- Since they are adapted to living in their native territory, native plants require minimal maintenance and watering once established. Many are perennial.
- Native trees and shrubs can be hardier than non-indigenous varieties. They offer shade and help lower air and water temperatures.
- Native plants attract birds, which prey upon insects, decreasing the need for pesticides.

ALONG YOUR SHORELINE

Planting is a relatively easy, affordable and attractive way of incorporating bioengineering into lakeshore design. Native plant species, which are well adapted to local climate and soil conditions, are particularly good options for landscaping. The use of native plants can have significant positive benefits for the lake and the shoreline. For example, plants that overhang and create shade improve water quality for fish, waterfowl and other aquatic life by providing food close to the water's edge. A vegetated buffer along the shore can also help absorb the extra nutrients (like those from fertilizers) and pollutants in surface runoff as the water drains to the lake.

Plants in the water and along the shore like lily pads and cattails (called emergent and floating vegetation) help limit the amount of erosion by absorbing wave energy as waves come into the shore. Native plants like sedges and rushes (grass-like plants along the shore) often have extensive root systems that help anchor the soil in place and stabilize the shoreline better than non-native plants like turf grasses (lawn). Maintaining native vegetation sustains natural biodiversity, and may help keep out nuisance species like the invasive purple loosestrife (*Lythrum salicaria*) and phragmites (*Phragmites australis*).

COST COMPARISON

Installing native plants along the shore and creating a natural shoreline is often more affordable than installing other types of buffers. Additional items needed to brace the shore in a native planting area – like erosion-control fabrics, biologs, twine, wood and rock – are also affordable. The estimated cost of installing a natural shoreline, including bioengineering materials, averages from $10-20 per linear foot. Unlike with bulkheads and hard armoring along the shore, property owners can often implement bioengineering methods themselves rather than hire a contractor. The cited cost per linear foot includes area preparation, purchasing and planting vegetation, additional stabilizing natural materials, watering and maintenance.

The financial cost of hard armoring the shore (using seawalls and bulkheads) can range from $45-200 and up per linear foot. Bulkheads need to be installed by a professional contractor, after the correct permits have been obtained. The cost estimate includes the materials needed for the wall and typical labor. However, costs can vary widely, depending on site preparation, engineering expenses, backfill and if other materials are used.

Natural Shoreline (vegetation)	Bioengineering (biologs and vegetation)	Riprap (rocks)	Bulkheads (concrete)
Installed by resident/ contractor: $10-15/linear foot.	Installed by resident/ contractor: $15-20/linear foot.	Installed by contractor: $35-75/linear foot. Installed by resident: $20-30/linear foot.	Installed by contractor: $45-200/ linear foot.
Cost depends on number, type and size of plants used and labor.	Cost varies depending on materials and labor.	Costs vary widely depending on grading.	Costs do not include backfill and some labor.

Sources: Reston Association (www.reston.org); Coastal Systems International, Inc.; U.S. Army Corps of Engineers.

ARE YOU READY TO TRY BIOENGINEERING?

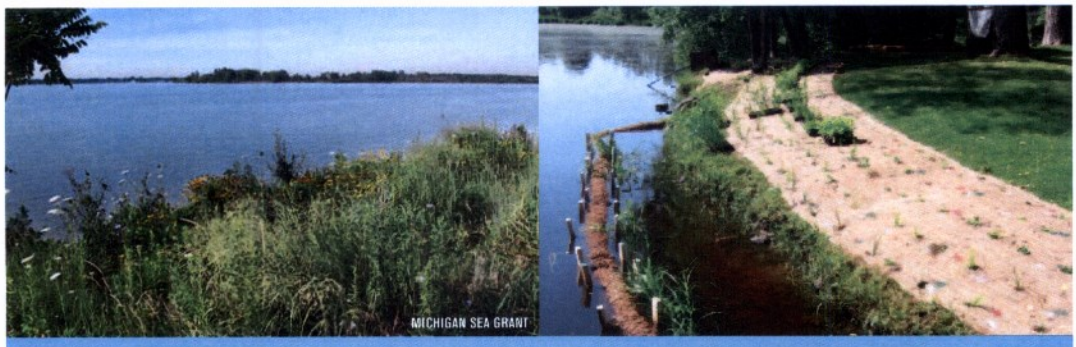
Constructing a structure or dredging on the bottomlands of an inland lake requires a permit under Part 301, Inland Lakes and Streams, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended. However, the MDEQ has created a minor project category to allow expedited permit application processing for specific bioengineering practices for stabilization of inland lake shorelines. The objective of the minor project category is to reduce the inconvenience and cost of the permit process for applicants proposing minor activities while protecting aquatic resources. More information on the minor project category and an application with directions can be found at: www.mi.gov/joint permit

BENEFITS OF BIOENGINEERING: A SUMMARY

- Natural vegetation serves as a filter between lawn and lakeshore, preventing pesticides and fertilizers from running directly into the water.
- Native plant roots filter more water than the turf grass varieties typically planted in Michigan. They help prevent flooding or standing water.
- Vegetation and natural and biodegradable items are often less expensive to implement than structural methods like concrete seawalls.
- Plants, shrubs and trees can provide an attractive privacy screen for property owners, while maintaining views of the lake.
- Vegetated strips using native plants often require little to no maintenance once established, leaving more time to enjoy lakefront living.
- Plants in the water and along the shore help absorb the wave energy, which helps keep soils and sands settled and makes for clearer (less turbid) water.
- Bioengineering is an attractive and environmentally healthy way to landscape, with a living buffer.

TIRED OF GEESE IN YOUR YARD?

Maintaining a vegetated strip along the shore can act as a natural deterrent for Canada geese. Taller plants like native grasses, wildflowers and shrubs (2-3 feet tall) along the shore are less inviting to the geese, which favor open expanses of manicured lawns and unrestricted access to the lakeshore.



HEALTH MEASURES

- 36% of lakes nationwide have been graded with "poor" lakeshore habitat.
- Lakes with poor surrounding vegetation are about three times more likely to also have poor biological conditions.

— *U.S. Environmental Protection Agency, National Lakes Assessment*

CONTACT INFORMATION

Michigan Department of Environmental Quality Environmental Assistance Center
(800) 662-9278
deq-assist@michigan.gov

ADDITIONAL RESOURCES

The Michigan Natural Shoreline Partnership provides many additional resources on natural shorelines and landscaping. The following publications feature techniques on how to incorporate native plants, example design plans, lists of native plants and more, and are available for free or low-cost through the shoreline partnership library webpage.
The library is accessible through the main site at:
www.mishorelinepartnership.org.

- *Natural Shoreline Landscapes on Michigan's Inland Lakes: Guidebook for Property Owners*. Book available.
- *The Water's Edge: Helping Fish and Wildlife on Your Lakeshore Property.* PDF available.
- *Understanding, Living With, and Controlling Shoreline Erosion: A Guidebook for Shoreline Property Owners (Third Edition)* PDF available.
- *Landscaping for Water Quality.* PDF available.

DEQ
www.michigan.gov/deq

Sea Grant Michigan
www.miseagrant.umich.edu

MICHIGAN NATURAL SHORELINE PARTNERSHIP
www.mishorelinepartnership.org

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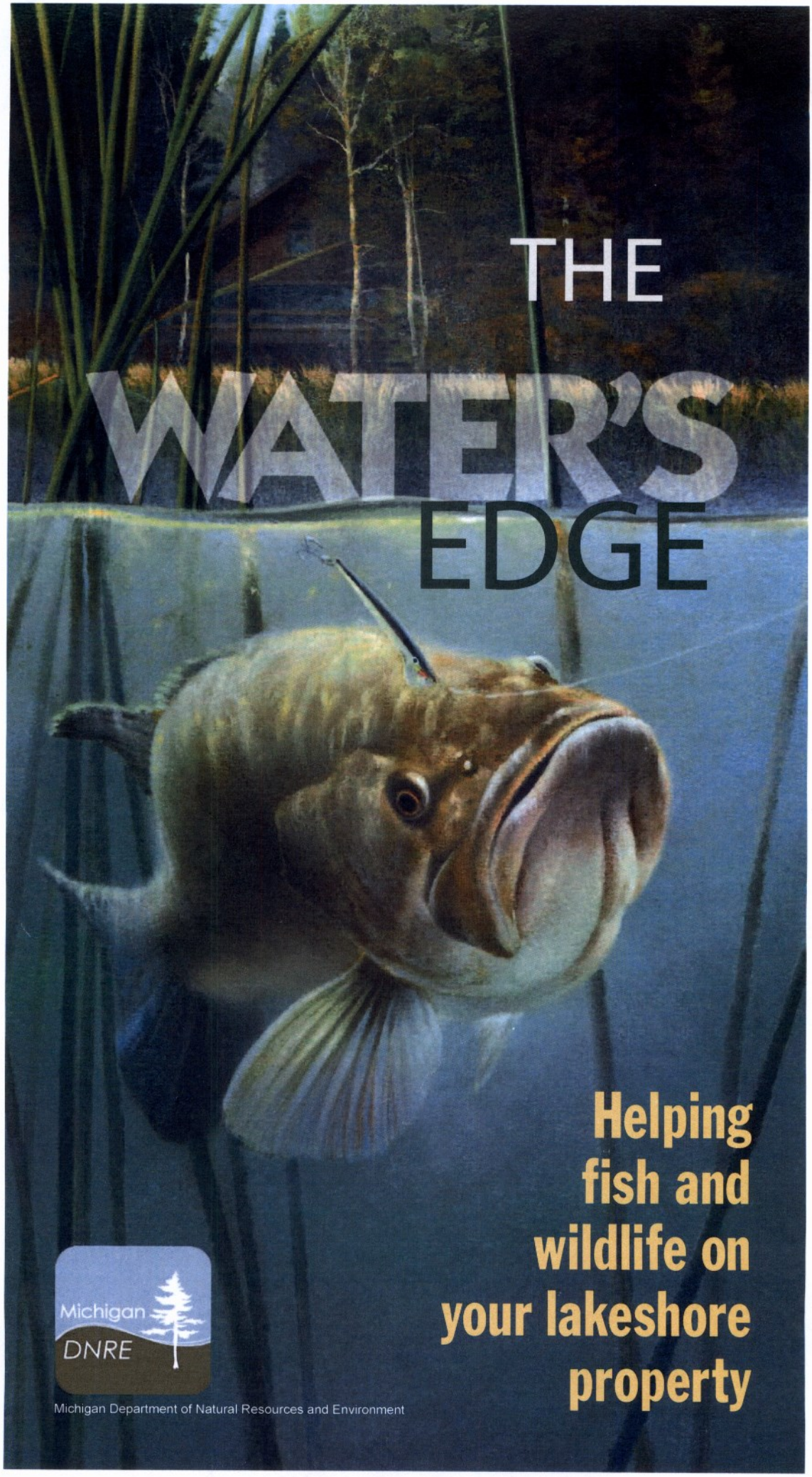

THE
WATER'S
EDGE
Helping fish and wildlife on your lakeshore property
Michigan
DNRE
Michigan Department of Natural Resources and Environment

Shoreline habitat

The water's edge is a busy place. Northern pike, bluegills, bass, and other fish spawn in the shallow water along the shore. Loons, ducks, sandhill cranes, and other water birds nest along the banks. Wildlife such as frogs, otters, and mink live there, too. Shoreline areas—on land and into the shallow water— provide essential habitat for fish and wildlife that live in or near Michigan's lakes. Overdeveloped shorelines can't support the fish, wildlife, and clean water that are so appealing to the people attracted to the water's edge.

Unfortunately, that's exactly what's happening to many Michigan lakes. The problem is poorly planned lakeshore development. Bit by bit, the cumulative effects of tens of thousands of lakeshore homeowners "fixing up" their property are destroying one of the state's valuable resources - its fragile lake habitats. Some examples:

Sand trucked in for swimming beaches covers underwater gravel or silt used by:

- fish for spawning
- mayflies for burrows
- frogs for laying eggs

Aquatic vegetation removed to create swimming and boating areas eliminates shoreline-stabilizing plants that are also habitat for:

- bass and other fish that hide among the plants and spawn in areas protected from waves
- loons that nest on floating vegetation
- waterfowl that feed on underwater plants
- insects that live among underwater vegetation

Shoreline shrubs and "unsightly" fallen trees are removed to create golf course-type lawns, thus eliminating habitat for wildlife such as:

- songbirds that use these shrubs for nesting
- ducks that lay eggs in native shoreline grasses
- turtles that sun on fallen logs
- bass and panfish that hide in the shade under toppled trees.

"Recent studies have shown how critical shoreline habitats are to the health of the entire lake. If you want great fishing you need to protect the shoreline."

Rebecca A. Humphries
DNRE Director

In-Fisherman

Roger Darden

In-Fisherman

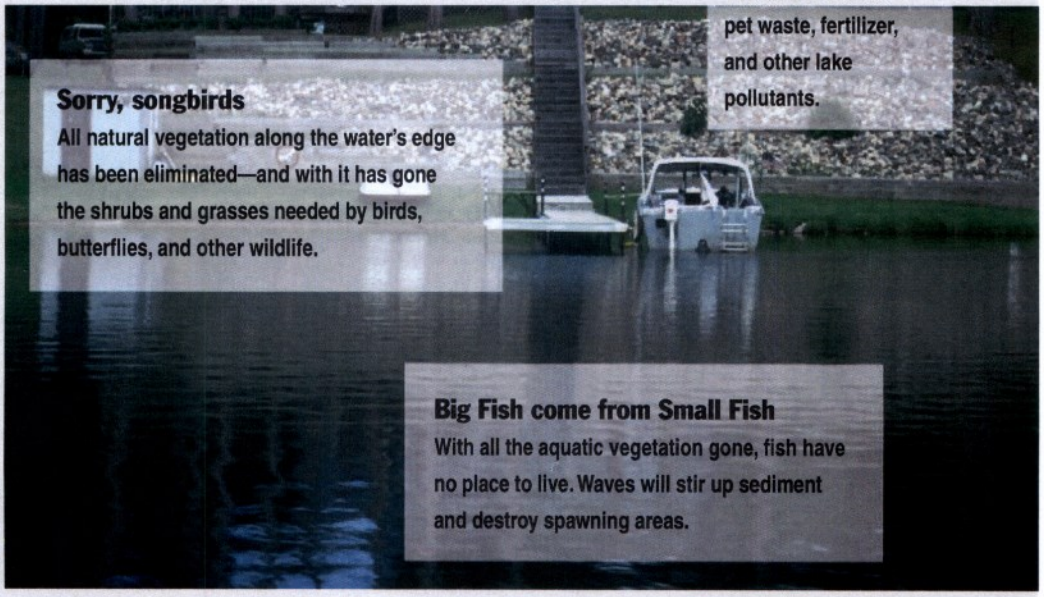
"Clean" lawns can make dirty lakes

Owners of shoreland property often bring with them traditional landscaping ideas that strive for the conventional, suburban "clean" look of a golf course or a beach. Yet, besides eliminating fish and wildlife habitat, this type of landscaping also creates problems for homeowners such as:

- **Green water:** A mowed lawn sends rain runoff carrying fertilizers, pet waste, and lawn clippings to the water where they fuel algae blooms that make swimming less enjoyable.
- **More erosion:** Water plants such as bulrushes, cattails, and coontail soften the erosive effects of waves along shores. Removing these plants increases erosion.
- **Nuisance wildlife problems:** Traditional lawns attract geese, which are grazers. In one week, an adult goose can produce 15 pounds of slippery, smelly droppings.

The combined effect of shoreline alterations by many property owners on a lake destroys habitat and causes declines in fish and wildlife populations. It's ironic that many lakeshore property owners buy their lots because they enjoy nature and then unknowingly harm habitat by altering the natural landscape. Most species of fish and wildlife don't thrive along sandy swimming beaches or on mowed lawns. They do best within the tangles of aquatic ("weeds") and shoreline cover ("brush") that lakeshore owners frequently remove.

Landscaping that's unfriendly to fish and wildlife



Rocky future
Rain that would seep into the soil flows more quickly off rocks and lawns straight into the lake. The runoff carries pet waste, fertilizer, and other lake pollutants.

Sorry, songbirds
All natural vegetation along the water's edge has been eliminated—and with it has gone the shrubs and grasses needed by birds, butterflies, and other wildlife.

Big Fish come from Small Fish
With all the aquatic vegetation gone, fish have no place to live. Waves will stir up sediment and destroy spawning areas.

Chris Frieburger

The value of shoreline habitat

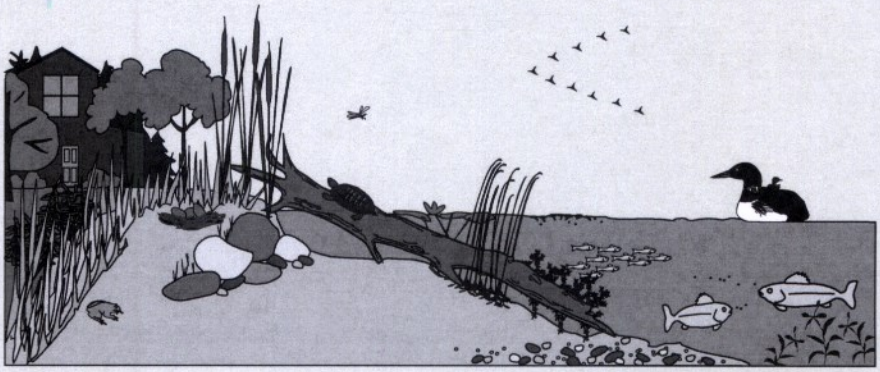
What can you do?

A growing number of lakeshore owners are switching from traditional mowed lawns to native grasses and wildflowers. In addition to helping wildlife, native plants require little to no maintenance. That frees up more of your time to go fishing, watch wildlife, and otherwise enjoy being at the lake.

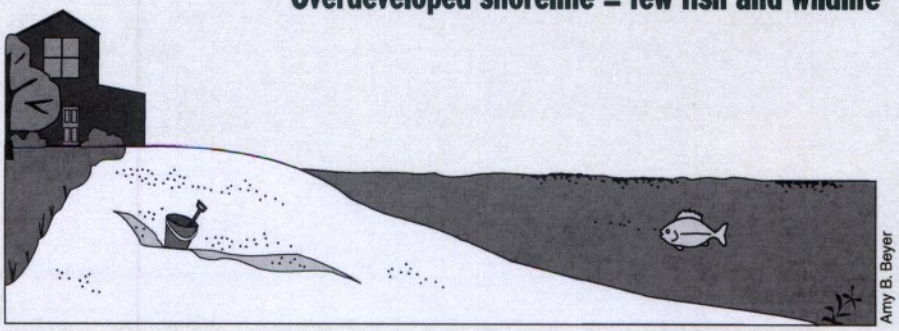
Shoreline habitat consists of many natural elements woven into the lake ecosystem to form a web of life. Native vegetation, bottom materials, and natural debris play essential roles in the life cycles of a lake's fish and wildlife. Nearshore alterations that damage or destroy these habitat components sever essential strands in the web. As a result, the lake ecosystem is weakened, wildlife and fish numbers decline.

Jane Herbert

Lightly developed shoreline = lots of fish and wildlife



Overdeveloped shoreline = few fish and wildlife



Amy B. Beyer

Shoreline buffers

Nearshore vegetation provides habitat for many wildlife species. Waterfowl nest in shoreline grasses, while songbirds build their nests in trees and shrubs. Natural shorelines are wildlife highways, or travel corridors, for animals such as mink grasshoppers, ants, and other insects that live in shoreline vegetation are blown into the lake, where they are eaten by bluegills and other fish.

A tidy lawn and a sandy beach make great spots for sunbathing and swimming, but they provide little habitat for fish and wildlife. By leaving a buffer of natural vegetation along the shoreline, property owners can reduce erosion, help maintain water quality, and provide habitat and travel corridors for wildlife.

The width of the buffer strip depends upon the terrain. On a gentle slope, having a 35 to 50 foot strip of natural vegetation between the water's edge and the lawn will accommodate the needs of many shoreline wildlife. On steeper grades, leaving even more natural vegetation in place will stabilize soils and reduce the need for retaining walls or other erosion prevention. Trees and shrubs in the buffer strip can muffle noise from watercraft while providing nesting areas for songbirds.

Avoid using pesticides or fertilizers in the buffer strip because harmful chemicals can leach into the lake. Pesticides kill beneficial insects living in shoreline vegetation that are important foods for fish, birds, and other wildlife.

Have your lawn—and wildlife, too.

You don't need to give up a lawn and beach to create a natural, wildlife-friendly lakeshore.

If you have 100 feet of shoreline, consider reverting 75 feet back to its natural condition and keeping 25 feet for a boat dock and swimming area. Additionally, if you restore the area near the lake to natural grasses and shrubs, you can still keep plenty of lawn up near the house or cabin while helping ducks, songbirds, butterflies, and other wildlife.

Along your shoreline, try to maintain a buffer of native grasses, wildflowers, shrubs, and trees. Native plants especially good for wildlife are sugar maples, bur oaks, cranberries, dogwoods, native grasses, and wildflowers. Beneficial aquatic plants include bulrushes, wild rice, arrowhead, cattails, and bur reeds.

Kathleen Preece

Woody cover

What can you do?

Leave fallen trees in the water to provide habitat for fish and wildlife.

Because most Michigan lakes are surrounded by trees and shrubs, storms and winds often blow dead or dying branches, limbs, and trees into the water. This woody debris is important to lake ecosystems. Beneath the water's surface, woody material is critical habitat for tiny aquatic organisms that feed bluegills, turtles, crayfish, and other critters. Water insects such as mayflies graze on the algae that grows on decomposing wood. Dragonfly nymphs hunt for prey among the stems and branches. Bass find food and shelter, and nesting sites among fallen trees.

Above water, a fallen tree is like a dock for wildlife. Ducks and turtles loaf and sun themselves on the trunk. Muskrats use the tree as a feeding platform. Predators such as mink and otter hunt for prey in the vicinity of the tree. Dead trees that remain along the shoreline are used as perches by belted kingfishers, ospreys, and songbirds.

Many lakeshore owners consider this woody debris unsightly and remove it from their shoreline. Yet this takes away hiding and feeding areas for many fish and wildlife species. Unless the fallen tree is a hazard to navigation or swimming, consider leaving it in the water to improve fish and wildlife habitat, fishing, and wildlife observation.

Waterfowl, turtles, and other wildlife use fallen trees as loafing sites.

David Howell

Bottom materials

Local geography and geology determine what natural materials exist on lake bottoms and shorelines. Hard lake bottoms and beaches made up of sand or gravel are usually in open areas exposed to waves. Soft bottoms composed of muck are usually in shallow, sheltered bays. Areas with lots of rocks and boulders were left by receding glaciers 10,000 years ago.

Bottom material, called substrate, is used by fish and other aquatic life. Walleyes spawn on the clean gravel of wave-swept shorelines. Mucky bottoms support insects and other invertebrates that provide food for fish and wildlife. Crayfish, smallmouth bass, and other species hide and forage among rocks.

Pure sand is the least ecologically productive lake bottom substrate. Yet lakeshore dwellers frequently buy property and then alter the shore and bottom by dumping sand to improve a swimming area. Creating sand beaches on soft bottoms is expensive, and covering rock-rubble bottoms with sand destroys fish spawning areas.

Before creating a large beach, lakeshore owners should know that their shoreline alteration will take away fish and wildlife habitat from the entire lake ecosystem and may require permits from the DNRE.

What can you do?

- **Minimize the size of your sandy beach to allow for more natural shoreland and underwater vegetation.**
- **If buying property, look for shoreline and lake bottom that match your desires. Don't expect to change it into something it isn't.**

Rock and gravel bottoms are important spawning areas for game fish such as walleyes and forage species such as suckers, darters, and some minnows.

In-Fisherman

Aquatic vegetation

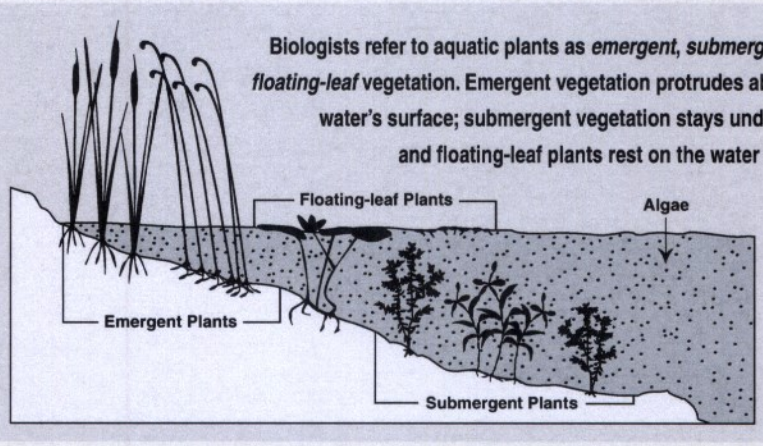
Often dismissed as "weeds" by many lakeshore property owners, aquatic plants provide essential fish and wildlife habitat and help keep lakes clean and healthy. Through photosynthesis, aquatic vegetation produces oxygen for the lake. These plants also use nutrients that can otherwise fuel midsummer algae blooms and they provide food, shelter, and nesting areas for fish, invertebrates, and wildlife.

Removing aquatic vegetation to improve boating or swimming eliminates fish habitat and damages the root network that holds bottom sediments in place. For example, bulrushes keep silt carried by waves from covering bottom gravel used by bass and panfish for spawning. When bulrush beds are removed, waves also begin to erode the shoreline.

Wave action and boat wakes also stir up sediment, causing the lake water to become murky. If sunlight cannot penetrate the cloudy water, many healthy and vibrant lakes can eventually turn into a green soup, devoid of most desirable fish and wildlife species.

What can you do?

- **Leave aquatic plants along the shoreline.**
- **Consider re-establishing aquatic plants along the lakeshore.**
- **Utilize docks & swim platforms rather than removing vegetation for access.**



Biologists refer to aquatic plants as *emergent*, *submergent*, and *floating-leaf* vegetation. Emergent vegetation protrudes above the water's surface; submergent vegetation stays underwater; and floating-leaf plants rest on the water surface.

Shoreline vegetation provides critical habitat for beneficial insects, such as this mosquito-eating dragonfly.

Amy Peterson

Wetlands

Wetlands help keep lakes clean by filtering sediments and excess nutrients. Acting like natural sponges, wetlands slow down water. This function reduces flooding, stabilizes lake levels, and provides recharge for groundwater.

Shoreline wetlands are habitat for a diverse community of plants and animals such as northern pike, which spawn among aquatic vegetation. Nutrient-rich sediments and soils in wetlands support insects, frogs, and other small animals eaten by fish and wildlife. Wetland vegetation provides food and cover for waterfowl, muskrats, and other wildlife.

Marshes, bogs, bulrush beds, and other shoreline wetlands have been disrupted by lakeshore property owners to create boat docks and swimming beaches. The loss of a lake's wetland areas leads to poorer water quality, lower game fish populations, and flooding.

What can you do?

- **Don't fill or alter wetlands, even if they are only wet in the spring.**
- **Consider restoring drained or filled wetlands.**

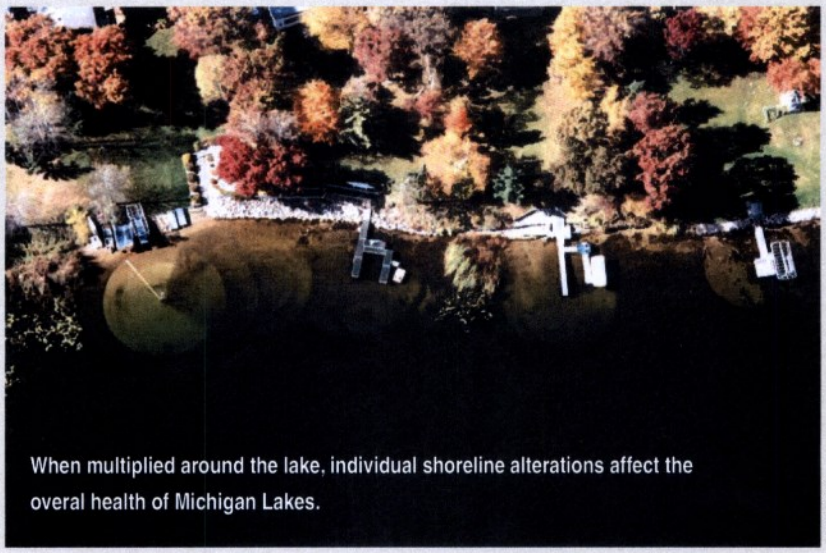
Amy Peterson

Healthy wetlands attract nesting and migrating waterfowl.

We're all responsible

It's up to everyone who values lakes to keep them healthy and productive. Many lakeshore owners wonder what difference alterations to their one lake lot could possibly make. But when the actions of dozens or hundreds of individual property owners are added up, the sum effect can alter the habitat and water quality on that lake. The cumulative harm from shoreline alterations by many lakeshore property owners affects swimming, fishing, wildlife watching, and the overall health of the lake.

It's like walking in a garden. If a neighbor kid came through once, that would be no big deal but if the whole neighborhood came through, the garden would be trampled.

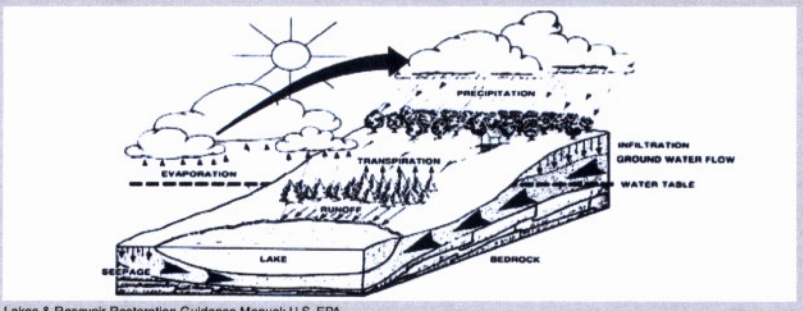


When multiplied around the lake, individual shoreline alterations affect the overal health of Michigan Lakes.

Dick Stoltman

Protecting watersheds

A watershed is a basin that collects water from the surrounding landscape. A healthy lake depends on a healthy watershed. Logging, farming, livestock grazing, and urban development occurring in a watershed can affect a lake's water quality. Some lake associations map the lake's watershed to inventory and evaluate activities taking place. When activities that degrade water quality are discovered, people living in the watershed work together to find a solution.



Lakes & Resevoir Restoration Guidance Manual; U.S. EPA

Pollutants and eroding soil within the entire watershed can easily end up in the lake. Poor land use even several miles away can end up harming fish and wildlife habitat in a lake.

Prescription for a healthy lake

A healthy lake is a functioning ecosystem. The water is safe for swimming and fishing. The aquatic habitat supplies food, cover, and spawning areas for fish. Natural shoreline vegetation supports songbirds, small mammals, and other wildlife. Throughout this lake's watershed, land management activities are planned to improve water quality.

A healthy lake doesn't just happen. It comes about when shoreline property owners and others living in the watershed take steps to ensure the lake's ecological health. Only if more lakeshore owners manage their shoreline in a natural condition can fish and wildlife populations on Michigan lakes stay healthy and abundant.

More things to know:

Several state laws and rules protect shorelines, wetlands, and floodplains. For example, it is illegal to construct seawalls and beaches wihout a permit. To learn which shoreline alterations are prohibited without a permit, call your local DNRE office.

Steve Largent

John Gregor, Coldsnap Photography

Good fishing doesn't just happen. It's the result of clean water and abundant spawning habitat found in lakes that still have plenty of natural shoreline.

For more information

The DNRE is responsible for the protection of the natural resources and public trust of inland lakes. You can get information on permits and laws from the DNRE through their Environmental Assistance Center, the DNRE's web site **www.michigan.gov/dnreinlandlakes**, or by contacting your local DNRE office. The DNRE staff are happy to discuss your project so that it meets both personal and environmental concerns.

The Michigan Natural Shoreline Partnership (MNSP) is an organization made up of experts from the DNRE, universities, resource conservation groups, and industry designed to assist lakefront property owners who wish to restore natural shoreline habitat along their waterfront. The MNSP educates contractors and landscape professionals on natural shoreline methods, and provides workshops for landowners. Visit **www.mishorelinepartnership.org** for more information.

Michigan DNRE
Questions About Permit Applications?
Call
ENVIRONMENTAL ASSISTANCE CENTER
800-662-9278
DNRE Internet: www.michigan.gov/dnre
Email: dnre-env-assist@michigan.gov

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Rebecca A. Humphries, Director
Michigan Department of Natural Resources and Environment

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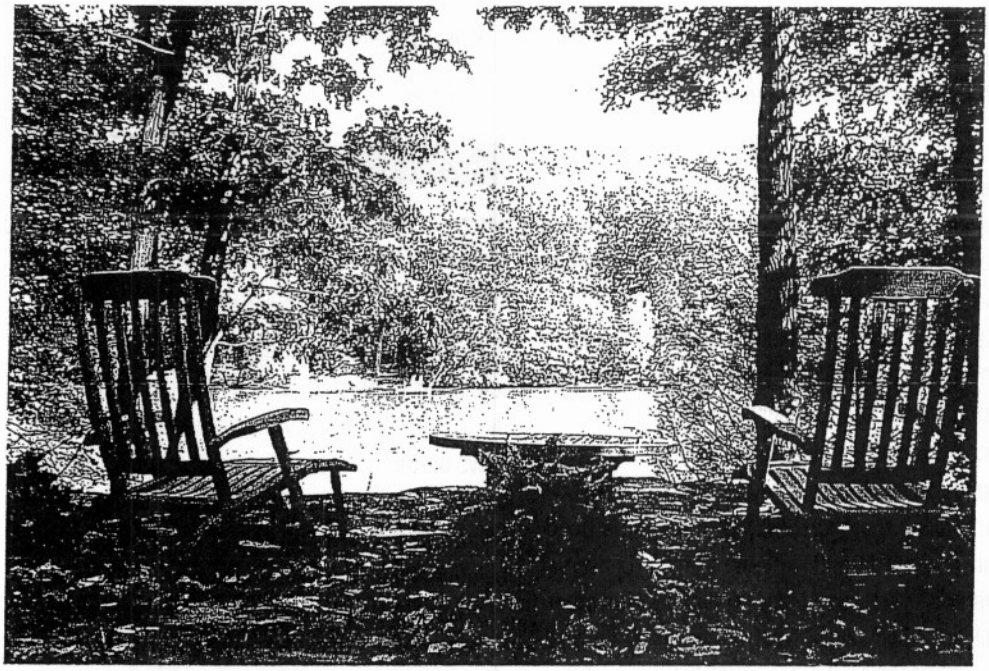
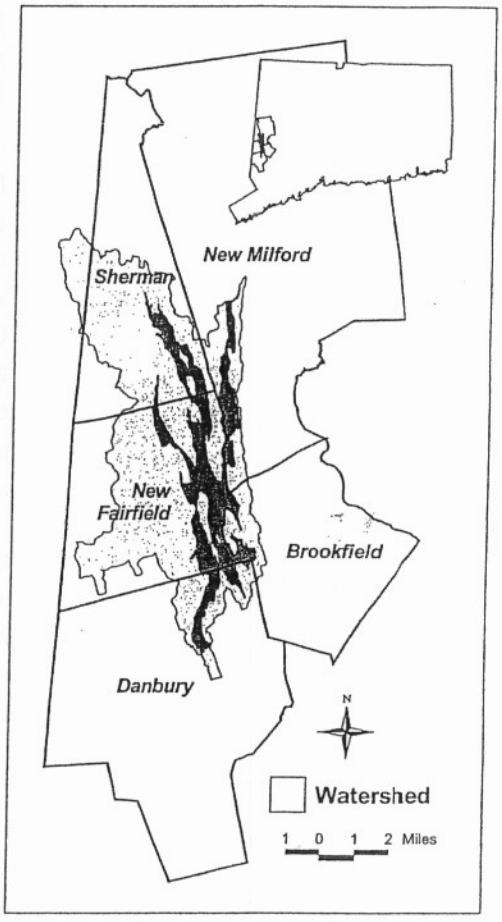
CANDLEWOOD LAKE NEWS
SPECIAL EDITION

Candlewood Lake Buffer Guidelines

Creating environmentally sound, lakeside and stream buffer zones to protect water quality.





If you live or summer on Candlewood Lake, you enjoy one of the greatest aesthetic and recreational resources in all of Connecticut. However, whether your favorite activity is swimming, fishing, or boating, you have likely noticed some of the problems that occasionally affect your use of the lake, such as algae blooms, aquatic weeds or reduced water clarity. What you may not realize is that what you do in your own yard may be contributing to these problems and affecting the water quality of the lake. You also may not realize that you can help solve these problems by following certain landscaping practices on your property!

The natural vegetation in an undeveloped shoreline (also known as a riparian buffer) plays an important ecological role, buffering the lake waters from activities in the surrounding landscape. This undisturbed zone of woody and soft-stemmed (herbaceous) vegetation helps reduce nutrients and other non-point source pollutants from reaching the lake, minimizes erosion, and provides critical habitat for a variety of birds and other wildlife. As residential development around Candlewood Lake dramatically increased over the past several decades, much of the lake's shoreline was cleared and replaced with new homes and large expanses of lawn. Maintaining a riparian buffer will help protect the lake's water quality and increase your property values! Whether you live on the shore or anywhere within the 40.6 square mile watershed (see Watershed Map), you should be taking appropriate measures to help protect the water quality and scenic beauty of Candlewood Lake.

BENEFITS AND DETRIMENTS: BUFFERS VS. LAWNS

Although the single most important step you can take is to create or maintain a vegetated buffer between your home and the lake, there are also several other important management practices to consider. Lawns have become a dominant feature of the American landscape,

(continued on page 2)

Vegetated buffers of 50 to 100 feet remove from 45% to 93% of incoming sediments.

They also remove upwards to 80% of incoming total suspended solids, nitrogen and phosphorus in stormwater.

From *Buffers for Wetlands and Surface Waters*, 1997, by Audubon Society of New Hampshire, University of New Hampshire Cooperative Extension, New Hampshire Office of State Planning and the Natural Resource Conservation Service

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SPECIAL EDITION

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but unfortunately they pose a serious threat to the health of our lakes and streams. During typical new residential construction, most or all of the native vegetation is removed and replaced with cultivated grass lawns that are water and energy intensive to maintain, and require fertilizers and pesticides to keep green and healthy. Without a vegetated buffer, these nutrient-rich fertilizers leach into the lake when it rains, causing algae blooms, reduced water clarity and excessive growth of aquatic weeds in a process known as eutrophication.

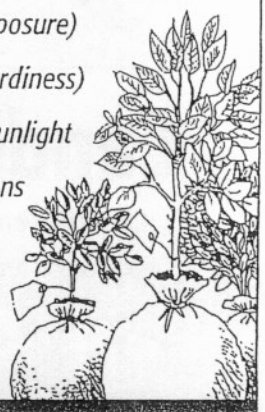
In addition to requiring extensive maintenance, lawns provide poor quality habitat for most wildlife except Canada Geese, who are attracted to these open areas where they are close to water and relatively safe from predators. Canada Geese droppings not only create a mess in your yard, they are also a significant source of nutrients and bacteria in lakes and ponds. Replacing all or some of your lawn with native trees, shrubs, or groundcovers (particularly along the shoreline) will reduce the need for pesticides and fertilizers, help conserve water, attract songbirds, butterflies and other wildlife to your yard, and ***save you time and money.*** Another simple way to help protect the lake is to begin composting your leaves and grass clippings. Composting is the most practical and cost-effective way to dispose of your yard waste and produces rich organic soil. Additional information on ways to protect your lake, also known as Best Management Practices (BMPs), is available from the Candlewood Lake Authority and Connecticut Department of Environmental Protection (DEP).

DESIGNING A VEGETATED BUFFER ZONE

There are a number of factors to consider before you begin designing your vegetated buffer. The first step should be a general assessment of the physical characteristics of your property. These characteristics, such as the slope, amount of light and soil types will help you decide which plants to include in your buffer. You will then need to think about your "viewshed," deciding which views you would like to preserve, and those areas of your property where a buffer could increase your privacy or reduce noise from recreational activities on the lake, surrounding homes, roads, etc.

SITE CHARACTERISTICS TO CONSIDER:

- *Orientation (exposure)*
- *Plant Zones (hardiness)*
- *Availability of Sunlight*
- *Building Locations*
- *Activities*
- *Soil Types*
- *Slope*



Decide what the focal point of your yard is, if screening is needed, and where the important views are. Remember, wide-open panoramic views across cultivated lawns degrade both the water quality and aesthetic beauty of Candlewood Lake; some of the most picturesque residential views of the lake are framed by an array of trees and shrubs. The buffer could be designed to provide additional shade or protection from the prevailing wind, while at the same time creating an oasis for birds and other wildlife. You may also consider the typical uses of your yard (gardening, barbequing, lawn games, etc.), and design your landscape accordingly.

The effectiveness of your buffer will depend upon its width, the slope, and the vegetation you choose to plant. Although any natural vegetation you maintain along the shoreline will provide some benefits, a minimum buffer of 50 to 100 feet is preferable. Ultimately the size of your buffer will depend upon the physical characteristics of your property, but in general the wider the buffer the better, particularly on steep slopes. Allowing the buffer plantings to extend over the water's edge will help cushion the shoreline from erosion caused by the impact of waves and boating while providing important shade in a shallow water habitat for certain fish, birds and other wildlife.

(continued on page 3)

A well designed and executed landscape can be aesthetically pleasing while functioning as a buffer. Your backyard does not have to resemble a forest to help protect the lake, and often the existing vegetation can be enhanced to create an effective buffer. Whether there are currently native species or non-native ornamentals in your yard, leave them as long as they are not exotic invasive plants (such as Japanese barberry or multiflora rose). Using the existing vegetation requires less time and money than total replanting, so enhance what's already there.

Start planning by monitoring the amount of sun and shade in your yard throughout the day. If more light is needed for strong plant growth, now is the time to consult with a licensed arborist or landscape professional. Pruning and very limited tree removal can be beneficial, but never pull stumps which provide soil stability.

Before doing any work, decide how you would like to use the space. Play space and sitting areas are often best sited further away from the lake with a vegetated buffer in between. Footpaths are necessary to provide access to the lake and should be narrow and meandering so they won't become runoff channels. Don't leave the soil bare; use mulch or fine gravel as a walking surface so soils don't erode and end up in the lake. Surface runoff from driveways, roof gutters and drains should always be treated onsite by being dispersed in a level area and allowed to slowly infiltrate. Limiting the amount of impervious surfaces such as paved driveways on your property helps reduce stormwater runoff. Collecting roof runoff in approved rain barrels and using it to water your garden or landscape plantings is a great way to recycle stormwater and protect the water quality of the lake. New rain barrel designs include a cap which prevents use by mosquitoes. Stormwater can also be collected in specially designed "rain gardens" where it can pool and infiltrate. For hard level surfaces such as a patio, dry laid fieldstone, bluestone, brick or pervious paving materials are good alternatives to solid pavement. The landscape does not need to be perfectly level and groomed to be attractive; uneven soil surfaces allow rain and snowmelt to better infiltrate, and a diversity of plant types, sizes and shapes provides habitat for wildlife.

Before beginning work on your vegetated buffer, remember that a permit may be required if any earthmoving or heavy equipment is involved. Also, work proposed within 200' of Candlewood Lake may be a regulated activity and requires a permit from your local inland wetlands commission. Wetlands commissions regulate many activities in or adjacent to the lake and other wetlands, including tree cutting, removal of vegetation or disturbance of soils.

NATIVE PLANTS VS. LAWNS

- *Native plants require fewer pesticides than lawns*
- *Native plants require less water than lawns*
- *Native plants don't require mowing and help reduce air pollution*
- *Native plants provide shelter and food for wildlife*

Wetlands regulations vary from town to town, so it is advisable to consult your local Land Use Enforcement Officer or Wetlands Commission to determine whether you need a permit. They can also give you advice on controlling erosion during construction. Creating any terracing or retaining walls will also require a permit. In most cases Northeast Generation Company owns up to the 440 foot elevation line around the lake (10 to 12 vertical feet above summer lake level), so you must contact them if conducting work below this point. Your local Wetlands Commission staff and the Candlewood Lake Authority can provide guidance on how to best implement your plan.

CREATING THE BUFFER

For Established Yards

Though some lawn is usually desired for recreation, most of us have too much of it. The easiest way to begin the transition to a more functional buffer is to stop mowing all or part of your yard. The grass will grow longer thereby helping to slow down and filter runoff while you're working on other plantings. Other native plants may become established creating a natural meadow. This also creates a better habitat for birds and other wildlife. Think of the time and resources you'll save by not mowing!

Choosing Your Plants

Look around at the surrounding plant communities for clues to the soils and types of plants that will do well in your yard. Whenever possible, use plants that are native to State of Connecticut, grown from locally collected seeds and cuttings whenever possible. Transplanting from a naturally occurring community on your own property can yield only moderate success as plants don't always adapt well. Transplanting from the wild on anyone else's property without permission is illegal.

Remember that just because the plant community is close to the edge of a lake doesn't necessarily mean the soils are damp. In fact, areas near the lake may be very dry, especially if the slopes are steep.

A demonstration Buffer Garden that includes many of the recommended plants has been created at the Candlewood Lake Authority office in Sherman. Feel free to visit the garden for plant and design ideas for your own buffer or check with the CLA staff for a comprehensive list of buffer plants.

The most effective buffers mimic the natural environment and include a diversity of trees, shrubs, and herbaceous plants. Overlapping layers of plants create important microclimates that provide varied habitats and help keep the soils moist. Canopy layers reduce rain impacts on the soil thereby helping reduce erosion. The deeper root systems of woody plants are important for soil stabilization, while the low

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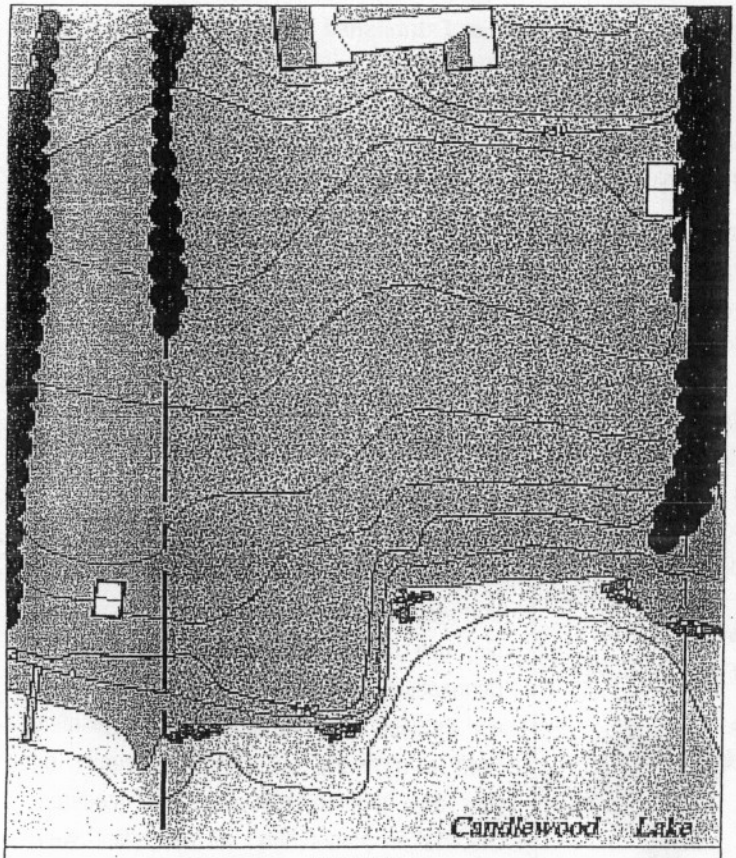

FIGURE 1
Existing Condition: Lawn extends to the Candlewood Lake shoreline.

herbaceous vegetation and duff layer (leaves, pine needles, mulch, etc.) filter sediments and pollutants. The rooted plants help stabilize the soils and absorb nutrients before they can leach into the lake. You do not need to plant large, mature plants as you begin creating your buffer. In fact, smaller plants often adapt more quickly and easily and are less expensive. Be aware of the mature height and spread of the plants you choose, and select and space them accordingly. The plantings should be dense enough to function as a buffer but not overcrowded.

Start Planting!

Decide where you will develop or enhance the buffer in your yard, and choose the plants that are appropriate for your particular conditions. If you are unsure about what to plant, seek assistance with your buffer design from a local garden center or landscape professional.

Use silt fence between the lake and the planting area if any soil disturbance or excavation is required. If working on steep slopes, erosion control netting is recommended to stabilize the soils until the plantings become established. Make sure the netting is biodegradable (no poly netting), pin it properly, and mulch over the entire area. Remember to acquire any necessary permits *before* you begin working!

Planting in the spring or fall takes advantage of the rains and cooler temperatures. Avoid planting during the summer months when excessive watering will be required to maintain your plants.

If you are converting lawn to planting beds (highly recommended!), the sod need not be removed. Several layers of newspaper (not colored) with mulch on top will easily smother the grass over time. Only remove the sod in the areas where you will be planting. Digging and amending individual holes is recommended rather than disturbing large areas.

Dig the hole twice as wide as the rootball and just a little deeper. Spread the roots of container plants, remove any synthetic burlap, and set your plants in the hole at ground level or just an inch higher. Good soil preparation gets plants off to a healthy start, and eliminates the need for additional fertilizers.

Mulching immediately helps reduce erosion and retain moisture, but be sure to keep the mulch about an inch away from the base of plants. Stringy mulches are preferable since nugget-type mulch will wash downhill in a rainstorm. If the slope is very steep, biodegradable erosion control netting is recommended.

Encourage your plants to root deeply by providing properly timed watering. Long, slow watering twice a week for the first few months, then once a week for the rest of the first growing season is advisable. Check to see that the water has indeed penetrated 6-8 inches into the soil. Drip irrigation provides the most efficient water use and helps eliminate runoff. A well chosen, established landscape will not require additional watering.

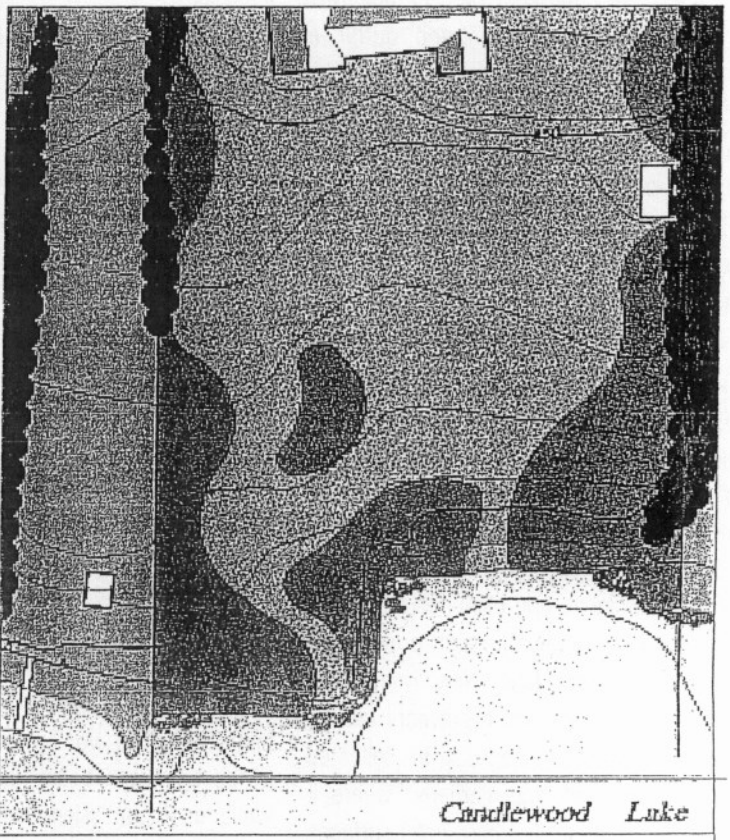

FIGURE 2
Phase One: Define buffer limits. Stop mowing, allow native vegetation to grow.

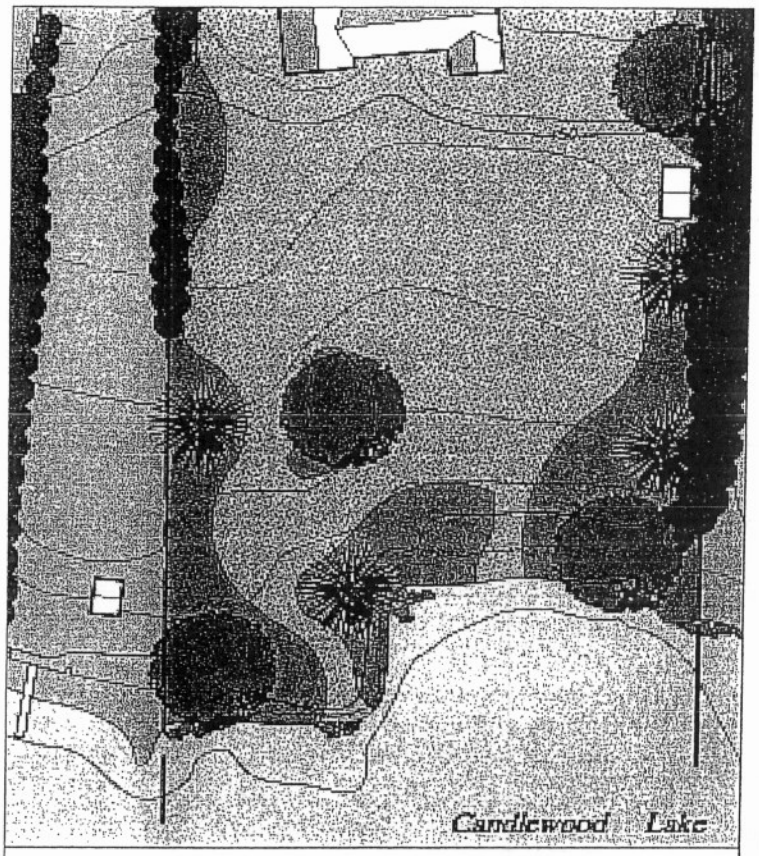

FIGURE 3
Phase Two: Add native trees to frame views and provide shade.

RECOMMENDED WEBSITE RESOURCES

Information on the **benefits of reducing your lawn** is available at **arboretum.conncoll.edu/salt/salt.htm.**

Information on **home composting** is available at **www.dep.state.ct.us/wst/compost/hcompost.htm.**

Information on **establishing a shoreline buffer** is available at **www.ct.nrcs.usda.gov/water.html** **www.pacd.org/resources/lake_notes/effective_strips.htm.**

Guidelines on determining an **appropriate buffer width** is available at **www.co.worcester.md.us/k-casb.htm.**

Information about and a **list of invasive plants in Connecticut** is available at **www.hort.uconn.edu/cipwg/**

Information on Connecticut **native tree and shrub availability** is available at **arboretum.conncoll.edu/treeavailability.pdf**

Information on **rain gardens** is available at **clean-water.uwex.edu/pubs/raingarden/rgmanual.pdf.**

Maintenance

A native landscape does not imply an unmanaged landscape, so be aware that plantings of any kind may require seasonal weeding, pruning, and mulching. Native plants generally require less maintenance than other plants, and can be allowed to develop naturally in forested or otherwise undisturbed areas of your property. Allowing some fallen leaves to remain in these areas provides natural mulch and fertilizer that will help keep the vegetation healthy. Keep your leaf mulch at its natural thickness, which is just thick enough to provide protection to the soil but not so thick that it kills the herbaceous plants. Always keep leaves and grass clippings out of the lake – they make great compost. Allow the skeletons of herbaceous perennials to remain through the winter providing visual interest, buffering qualities and habitat. Leave dead snags and fallen logs as refuge for birds and other creatures. Monitor your landscape for deer browse and spray deer repellents or fence your gardens from the deer if needed. Watch for exotic invasive plants and remove them as they appear.

Creating buffers in your landscape offers numerous aesthetic, environmental, and financial benefits. Responsible design, planting and maintenance of buffers is a way we can all be stewards of Candlewood Lake, helping to keep it clean as a resource we can all enjoy.

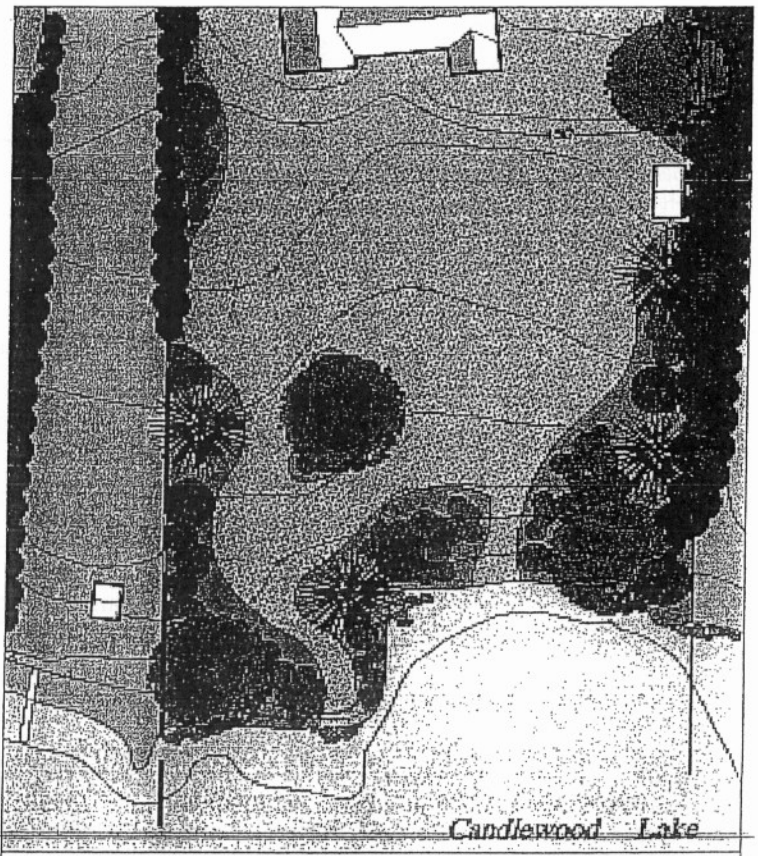

FIGURE 4
Phase Three: Introduce native shrubs and herbaceous plants to provide texture, seasonal interest and habitat to the buffer area.

RECOMMENDED PLANTS: *The following is a list of plants native to the State of Connecticut that are recommended for use in buffer plantings. There are nurseries that specialize in native plants, and the Northwest Conservation District (NCD) sponsors a plant sale every spring that includes a variety of plants appropriate for use in a buffer area. For more information, contact the NCD office at 860-626-7222.*

TREES

Botanical name COMMON NAME	Mature Size	Exposure/ Habitat	Comments
Acer pensylvanicum STRIPED MAPLE, MOOSEWOOD	30'	Ps to sun; average to moist	Interesting understory tree with white striped bark and large, distinctive leaves
Acer saccharum SUGAR MAPLE	120'	Sun to ps; dry to moist	The quintessential New England tree; great silhouette and fall color
Amalanchier arborea, A. canadensis, A. intermedia, A. laevis / SHADBUSH	25-50'	Sun to shade; dry to moist	White flowers in April, berrylike edible fruits; lovely branching and bark; nice fall color
Betula lenta BLACK BIRCH	75'	Ps to shade; dry to moist	Handsome tree with cherry-like bark; good fall color
Betula populifolia GRAY BIRCH	30'	Sun to ps; dry to moist	Beautiful white bark with triangular black markings; usually grows as clumps; yellow fall color
Carpinus caroliniana HORNBEAM, IRONWOOD	35'	Sun to ps; average to moist	Gray twisted trunks; nice fall color
Cercis canadensis REDBUD, JUDAS TREE	30'	Ps; dry to moist	Bright purplish-pink flowers in April; heart-shaped leaves turn yellow in fall
Cornus alternifolia PAGODA DOGWOOD	15-20'	Sun to shade; average to moist	Creamy flower clusters in May and June followed by blue black fruits; good wildlife value; large multistemmed shrub or small tree
Cornus florida FLOWERING DOGWOOD	30'	Ps; average to moist	Beautiful white flowers in May; red fruits loved by birds; horizontal habit; maroon fall color
Crataegus arnoldiana, C. mollis, C. crus-galli / HAWTHORNE	30'	Sun to ps; dry to moist	White flowers in May followed by red fruits; thorny, dense habit
Fagus grandiflora AMERICAN BEECH	90'	Sun to ps; average to moist	Beautiful smooth gray bark; densely horizontal habit; holds leaves late into winter
Hamamelis virginiana WITCH-HAZEL	15-20'	Ps to shade; dry to moist	Yellow flowers in Oct., Nov.; usually multi stemmed; good understory plant; adaptable
Ilex opaca AMERICAN HOLLY	30'	Sun to ps; dry to average	Broad leaf evergreen; need both sexes for red fruits to develop; plant out of wind
Juniperus virginiana RED CEDAR	40'	Sun; dry to average	Fast growing evergreen, many with steely blue fruits; tolerates poor soils; avoid planting near apple trees
Larix laricina LARCH, TAMARACK	50'	Sun; average to wet	Deciduous conifer, pyramidal habit; nice yellow fall color; likes wet but adaptable
Liquidambar styraciflua SWEET GUM	125'	Sun to ps; dry to moist corky twigs	Beautiful star shaped leaves become scarlet in fall; persisting round seed capsules are ornamental as are
Liriodendron tulipifera TULIP TREE	150'	Sun; average to moist	Fast growing; beautiful leaf shape; interesting flowers and seed pods
Nyssa sylvatica SOUR GUM, TUPELO	80'	Sun to ps; dry to wet	Dense horizontal branching; lustrous leaves with great fall color; small blue fruits
Pinus strobus WHITE PINE	100'	Sun; dry to moist	Lovely soft textured evergreen; grows large
Quercus alba WHITE OAK	90'	Sun; dry to average	Beautiful habit; slow growing
Quercus bicolor SWAMP WHITE OAK	60'	Sun; average to wet	Good for moist or wet spots; slow growing
Quercus coccinea SCARLET OAK	75'	Sun; dry to average	Interesting habit; great scarlet fall color; hold leaves late into winter

Botanical name COMMON NAME	Mature Size	Exposure/ Habitat	Comments
Quercus palustris PIN OAK	75'	Sun; dry to moist	Pyramidal habit with distinctive horizontal, dense branching; good fall color
Quercus rubra RED OAK	75'	Sun; dry to moist	Rounded habit; adaptable
Quercus velutina BLACK OAK	100'	Sun; dry to moist	Nice habit; good fall color
Sassafras albidum SASSAFRAS	50'	Sun to ps; average to moist	Mitten-shaped, aromatic leaves with great fall color; green twigs, interesting irregular habit
Thuja occidentalis NORTHERN WHITE CEDAR, ARBORVITAE	60'	Sun; dry to moist	Upright evergreen; many forms available
Tsuga canadensis EASTERN HEMLOCK	90'	Sun to shade; average to moist	Shade tolerant evergreen with soft, pyramidal habit; many forms available; watch for adelgid

SHRUBS

Botanical name COMMON NAME	Mature Size	Exposure/ Habitat	Comments
Arctostaphylos uva-ursi BEARBERRY	6"	Sun; dry to average	Nice evergreen groundcover for well drained soils; white flowers in May, red berries
Aronia arbutifolia, A. melanocarpa, A. prunifolia / CHOKEBERRY	2-10'	Ps; dry to moist	White flowers in late May, red or black fruits in fall; great fall color; good colonizer
Cephalanthus occidentalis BUTTONBUSH	10'	Sun; moist to wet	Good for wet areas; white blooms in summer; rangey habit
Clethra alnifolia SWEET PEPPERBUSH	8'	Ps to shade; average to wet	Fragrant white flowers in July, good fall color; colonizes;likes moisture
Comptonia peregrina SWEET FERN	4'	Sun; dry to average	Aromatic, fernlike foliage; good colonizer
Cornus amomum SILKY DOGWOOD	8-10'	Ps to shade; average to wet	White flowers in June followed by blue berries; open spreading habit
Cornus racemosa GRAY DOGWOOD	6-10'	Sun to ps; dry to moist	White flowers in June followed by white berries on red stalks; spreads vigorously
Diervilla lonicera BUSH HONEYSUCKLE	3-5'	Sun to shade; dry to moist	Suckering, good stabilizer; adaptable to many conditions
Ilex glabra INKBERRY	6'	Sun to ps; average to wet	Nice evergreen with black fruits for wildlife; compact forms available; adaptable
Ilex verticillata WINTERBERRY	10'	Sun to shade; dry to wet	Bright red berries, need both sexes for fruiting; adaptable, spreads
Kalmia latifolia MOUNTAIN LAUREL	15'	Ps; dry to average	White to pink flowers in June, evergreen; beautiful branching; likes acidic conditions
Leucothoe racemosa FETTER-BUSH	5'	Ps to shade; average to moist	Whitish waxy flowers in May, glossy evergreen foliage; adaptable
Lindera benzoin SPICEBUSH	12'	Sun to shade; dry to wet	Adaptable, prefers moisture; early small yellow blossoms followed by red fruits; nice fall color
Myrica pensylvanica BAYBERRY	8'	Sun; dry to wet	Beautiful waxy foliage and blue fruits for the birds; need male and female for fruiting
Potentilla fruticosa CINQUEFOIL	4'	Sun to ps; dry to wet	White or yellow flowers for long periods thru the summer; nice low shrubs, adaptable
Rhododendron maximum ROSEBAY RHODODENDRON	10-15'	Ps to shade; average to moist	Hardy and evergreen, pink flowers in late June and July
Rhododendron periclymenoides (*R. nudiflorum*) PINXTER-FLOWER	6'	Ps; average to moist	Delicate light pink flowers in early May

Botanical name COMMON NAME	Mature Size	Exposure/ Habitat	Comments
Rhododendron prinophyllum (R. roseum) / ROSESHELL AZALEA	8'	Ps; average to moist	Bright pink, fragrant flowers in mid May
Rhododendron viscosum SWAMP AZALEA	9'	Ps; average to wet	White, fragrant flowers in early July; likes moisture but adaptable
Rhus aromatica FRAGRANT SUMAC	3-6'	Sun to ps; dry to average	Attractive foliage; good on slopes, poor soils; colonizes quickly; great fall color; wildlife value
Rhus glabra SMOOTH SUMAC; *R. typhina* STAGHORN SUMAC	9-20'	Sun; dry to average	Vigorous colonizers for poor soils, use only in large naturalistic areas; fruit has wildlife value
Rosa carolina PASTURE ROSE	3'	Sun; dry to average	Single pink flowers in June followed by red hips; stays low, forms thickets
Rosa virginiana WILD ROSE	6'	Sun; dry to moist	Single pink flowers in June followed by red hips; nice fall color and red twigs in winter; strong colonizer
Rubus odoratus PURPLE-FLOWERING RASPBERRY	6'	Sun to shade; dry to average	Fragrant, purple flowers in early July over a long period; red raspberry fruits for wildlife; attractive maplelike leaves; spreads
Salix discolor PUSSY WILLOW	10-15'	Sun to ps; average to wet	Fast growing, likes moisture; ornamental fuzzy flowers in early spring
Sambucus canadensis ELDERBERRY	10-12'	Sun to ps; average to moist	White flowers in late June followed by ornamental blue berries; adaptable
Spiraea latifolia MEADOW SWEET	2-4'	Sun; average to moist	Low, suckering; white to pinkish flowers in summer
Vaccinium angustifolium LOW BUSH BLUEBERRY	1'	Sun to shade; dry to moist	Nice woody groundcover for acidic soils; wildlife value, good fall color
Vaccinium corymbosum HIGHBUSH BLUEBERRY	6-10'	Sun to ps; average to moist	Highly ornamental in habit and fall color; blue fruits; likes well drained and acidic soils
Viburnum acerifolium MAPLE-LEAF VIBURNUM	6'	Ps to shade; dry to moist	White flowers in June, black fruits; can withstand considerable shade
Viburnum alnifolium HOBBLEBUSH	10'	Ps to shade; average to moist	Early, hydrangealike flowers followed by red to black berries; moist woodlands; shade tolerant
Viburnum cassinoides WITHE-ROD	6'	Sun to ps; average to moist	White flowers in early June, beautiful green to red to black berries; red fall color; adaptable
Viburnum dentatum (V. regognitum) ARROWOOD	12'	Ps to shade; dry to moist	Creamy flowers in June, blue fruits; vigorous
Viburnum lentago NANNYBERRY	15'	Ps; average to wet	Creamy flowers in May followed by black berries; arching habit; good fall color
Viburnum nudum POSSUM HAW	10'	Sun to ps; average to moist	Creamy flowers in late June, beautiful blue-black fruits; handsome foliage, nice fall color, adaptable
Viburnum prunifolium BLACK HAW	15'	Sun to ps; average to wet	White flowers in May, blue-black fruits; good fall color; can grow as small tree; adaptable
Viburnum trilobum (V. opulus var. americanum) HIGHBUSH CRANBERRY	12'	Sun to ps; average to moist	White flowers in late May, edible red berries

GROUND COVERS

Botanical name COMMON NAME	Mature Size	Exposure/ Habitat	Comments
Anemone canadensis; also A. cylindrica, A. quinquefolia, A. virginiana / ANEMONE	1-1½'	Sun to shade; dry to wet	Single white flowers in June; spreads aggressively
Asarum canadense WILD GINGER	4"	Shade; dry to moist	Attractive heart shaped leaves; easy spreading groundcover

Botanical name COMMON NAME	Mature Size	Exposure/ Habitat	Comments
Gaultheria procumbens WINTERGREEN	2-6"	Ps to shade; dry to average	Shiny evergreen leaves; white flowers followed by red fruits; spreads slowly
Heuchera americana ALUMROOT	6-8"	Ps to shade; dry to average	Nice foliage; tolerant of shade and dry conditions
Podophyllum peltatum MAYAPPLE	1-1½'	Ps to shade; average to moist	Umbrella like leaves, spreads rapidly; goes dormant in summer
Potentilla argentea, P. tridentata, P. simplex / CINQUEFOIL	3"	Sun; dry	Good for hot, dry spots; spreads
Tiarella cordifolia FOAM FLOWER	3-6"	Ps to shade; average to moist	Small white flowers in spring; makes good groundcover
Viola canadensis CANADA VIOLET	8"	Ps to shade; average to moist	White/lavender flowers over heart shaped foliage in spring; fragrant
Waldsteinia fragariodes BARREN STRAWBERRY	3"	Ps to shade; dry to moist	Strawberry like leaves, yellow flowers in spring; spreads quickly

VINES

Botanical name COMMON NAME	Mature Size	Exposure/ Habitat	Comments
Clematis virginiana VIRGIN'S BOWER	to 18'	Sun to ps; average to moist	Small, white flowers in late August, attractive seedheads
Lonicera sempervirens TRUMPET HONEYSUCKLE	to 30'	Sun to ps; average to moist	Orange to scarlet flowers in summer attract hummingbirds
Parthenocissus quinquefolia VIRGINIA CREEPER	High climbing	Ps to shade; average to moist	Open habit, climbs by tendrils or crawls along ground; brilliant red fall color

PERENNIALS

Botanical name COMMON NAME	Mature Size	Exposure/ Habitat	Comments
Actaea rubra, A. pachypoda BANEBERRY, DOLL'S EYE	2-3'	Ps to shade; dry to moist;	White clustered flowers in May followed by striking red or white fruits; easy
Agastache scrophulariaefolia PURPLE GIANT HYSSOP	3-5'	Sun to ps; average to moist	Purple flower spikes in summer, fragrant foliage
Angelica atropurpurea PURPLE ANGELICA	6'	Sun; moist to wet	Striking flower heads in summer
Apocynum androsaemifolium DOGBANE	2-3'	Sun to ps; dry to average	For larger areas
Aquilegia canadensis WILD COLUMBINE	1-2'	Ps; dry woods and ledges	Delicate nodding red and yellow flowers in spring; self seeds; attracts hummingbirds
Aralia hispida, A. nudicaulis SARSAPARILLA	1'	Ps to shade; dry to moist	Greenish white flowers followed by black berries; spreads
Aralia racemosa SPIKENARD	2-6'	Ps; average to moist	Large leaves; whitish flower clusters in June/July followed by dark purple berries
Arisaema triphyllum, A. dracontium JACK-IN-THE-PULPIT	1'	Shade; moist	Interesting spring blooms followed by clusters of red fruits
Asclepias incarnata, Asclepias syriaca SWAMP, COMMON MILKWEED	3-5'	Sun; dry to wet	Pink flowers in summer, attracts butterflies
Asclepias tuberosa BUTTERFLY WEED	2'	Sun; dry to average	Bright orange flowers in summer; attracts butterflies

Botanical name COMMON NAME	Mature Size	Exposure/ Habitat	Comments
Aster cordifolius BLUE WOOD ASTER	2-4'	Ps to shade; dry to average	Pale violet flowers in fall; good for dry shade
Aster divaricatus WHITE WOOD ASTER	1-2'	Ps to shade; dry to average	White flowers Aug./Sept.; good for dry shade, spreads
Aster novae-angliae NEW ENGLAND ASTER	4-6'	Sun; average to moist	Purple, pink, or white flowers in fall; very showy
Aster novi-belgii NEW YORK ASTER	3-4'	Sun; dry to average	Purple, pink, or white flowers in fall
Baptisia tinctoria WILD INDIGO	3-4'	sun; moist to dry	Blue flower spikes in spring over attractive glaucous foliage
Caulophyllum thalictroides BLUE COHOSH	2'	Ps to shade; moist;	Yellowish flowers followed by beautiful blue berries; nice foliage
Chelone glabra TURTLEHEAD	3'	Sun to ps; average to moist	White flowers, interestingly shaped, in late summer
Dicentra canadensis, Dicentra cucullaria SQUIRREL CORN, DUTCHMAN'S BREECHES	6"-1'	Ps to shade; moist	Heart shaped white flowers in April/May; ferny foliage; goes dormant
Eupatorium dubium ,E. fistulosum, *E. maculatum, E. purpureum* JOE-PYE WEED	5-8'	Sun; average to wet	Showy pink to purple flowers in late summer; attracts butterflies
Eupatorium perfoliatum BONESET	4'	Sun; average to wet	White flowers July/Aug.
Eupatorium rugosum *(Ageritina altissima var. altissima)* WHITE SNAKEROOT	2-5'	Ps to shade; dry to average	White flowers in late summer; good for dry shade, spreads
Helenium autumnale SNEEZEWEED	4-6'	Sun; average to moist	Yellow/ red flowers in late summer
Liatris borealis NEW ENGLAND BLAZING STAR	3'	Sun; average to moist	Magenta purple flower spikes in late summer
Lupinus perennis WILD LUPINE	2'	Sun; dry	Blue flower spikes in spring; beautiful foliage; likes poor soils
Mitchella repens PARTRIDGE BERRY	1-2"	Ps to shade; dry to moist	Creeping evergreen; red berries
Monarda fistulosa, M. punctata WILD BERGAMONT	3-4'	Sun to ps; dry to moist	Purple/lavender flowers in summer; minty smelling foliage; spreads
Polygonatum biflorum, P. commutatum SOLOMON'S SEAL	1-5'	Ps to shade; moist to dry	Attractively arching stems; creamy pendant flowers in May/June followed by blue fruits
Pycnanthem incanum, P. muticum, *P. tenuifolium, P. verticillatum,* *P. virginianum* MOUNTAIN MINT	2-3'	Sun to ps; dry to moist	Summer blooming; very tolerant, spreads
Rudbeckia laciniata TALL CONEFLOWER	5-7'	Sun; average to moist	Bright yellow flowers in summer; spreads
Sanguinaria canadensis BLOODROOT	6"	Ps; moist	White flowers in spring; goes dormant in summer; spreads
Scutellaria integrifolia SKULLCAP	6-18"	Sun to ps; average	Blue flowers in summer
Smilacina racemosa *(Mianthemum ramosum spp. ramosum)* FALSE SOLOMON'S SEAL	2-3'	Shade; moist to dry;	Feathery white flowers in June, red speckled berries in fall

Botanical name COMMON NAME	Mature Size	Exposure Habitat	Comments
Solidago spp. GOLDENROD	2-5'	Sun to ps; dry to moist	Bright yellow flowers in late summer/fall; vigorous
Thalictrum polygamum, T. dioicum, *T. dasycarpum* MEADOW RUE	2-8'	Ps to shade; wet to dry;	Attractive foliage; airy clusters of flowers in spring and summer
Tradescantia virginiana SPIDERWORT	1-2'	Sun to shade; dry to moist	Purple or white flowers in summer
Trillium erectum, T. cernuum TRILLIUM, WAKEROBIN	1-1½'	Shade; moist	Maroon or white flowers in spring; disappears in summer
Uvularia grandiflora, U. perfoliata, *U. sessilifolia* / BELLWORT	1-2'	Shade; average to moist	Nodding pale yellow flowers in May/June; spreads
Vernonia noveboracensis IRONWEED	3-5'	Sun; average to wet	Red/purple flowers in late summer; showy
Veronicastrum virginicum CULVER'S ROOT	4-6'	Sun to ps; average to moist	White flower spikes in July to Sept.
Zizia aurea, Z. aptera GOLDEN ALEXANDER	1-2'	Sun to ps; average to moist	Yellowish flowers in May/June; spreads

FERNS

Botanical name COMMON NAME	Mature Size	Exposure Habitat	Comments
Adiantum pedatum MAIDENHAIR FERN	1-2'	Ps to shade; average to moist	Delicate palmate fronds; likes neutral to alkaline soils
Athyrium felix-femina LADY FERN	2-3'	Ps; average to moist	Adaptable
Dennsteadtia punctilobula HAYSCENTED FERN	1-2'	Ps to shade; average to moist	Vigorous and adaptable; needs plenty of space
Dryopteris spinulosa, *D.intermedia* / WOOD FERN	1½ - 2½'	Ps to shade; average to moist	Almost evergreen; adaptable
Matteuccia struthiopteris OSTRICH FERN	3-4'	Ps to shade; average to moist	Spreads quickly; dies down earlier in fall than other ferns
Onoclea sensibilis SENSITIVE FERN	2-3'	Ps to shade; moist to wet	Ornamental fertile fronds; spreads
Osmunda claytoniana INTERRUPTED FERN	3-5'	Ps to shade; dry to wet	Handsome and adaptable
Osmunda cinnamomea CINNAMON FERN	3-5'	Ps to shade; average to wet	Beautiful form; cinnamon colored fertile fronds are ornamental
Osmunda regalis ROYAL FERN	3-5'	Ps to shade; moist to wet	Broad fronds emerge wine colored; stately plant
Polystichum acrostichoides CHRISTMAS FERN	1-2'	Ps to shade; average to moist	Evergreen; spreads slowly

KEY

MATURE SIZE	Size at maturity; dependent on conditions	
EXPOSURE	• Sun = minimum of 6 hours of direct sun per day • Shade = little or no direct sun but good light	• Part sun (Ps) = a few hours of direct sun
HABITAT	• Dry = dry, well drained soils • Moist = rich, fertile soils that are not saturated	• Average = average garden conditions • Wet = soils that stay moist most of the year

Most plants will flower and fruit more profusely with more light though some plants can tolerate less. Certain plants have higher wildlife value due to the fruits, seeds and habitat they provide. Various forms of certain plants are available to suit space constraints.

Some plant species have been grouped so particulars are general. Consult botanical references for more complete information.

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