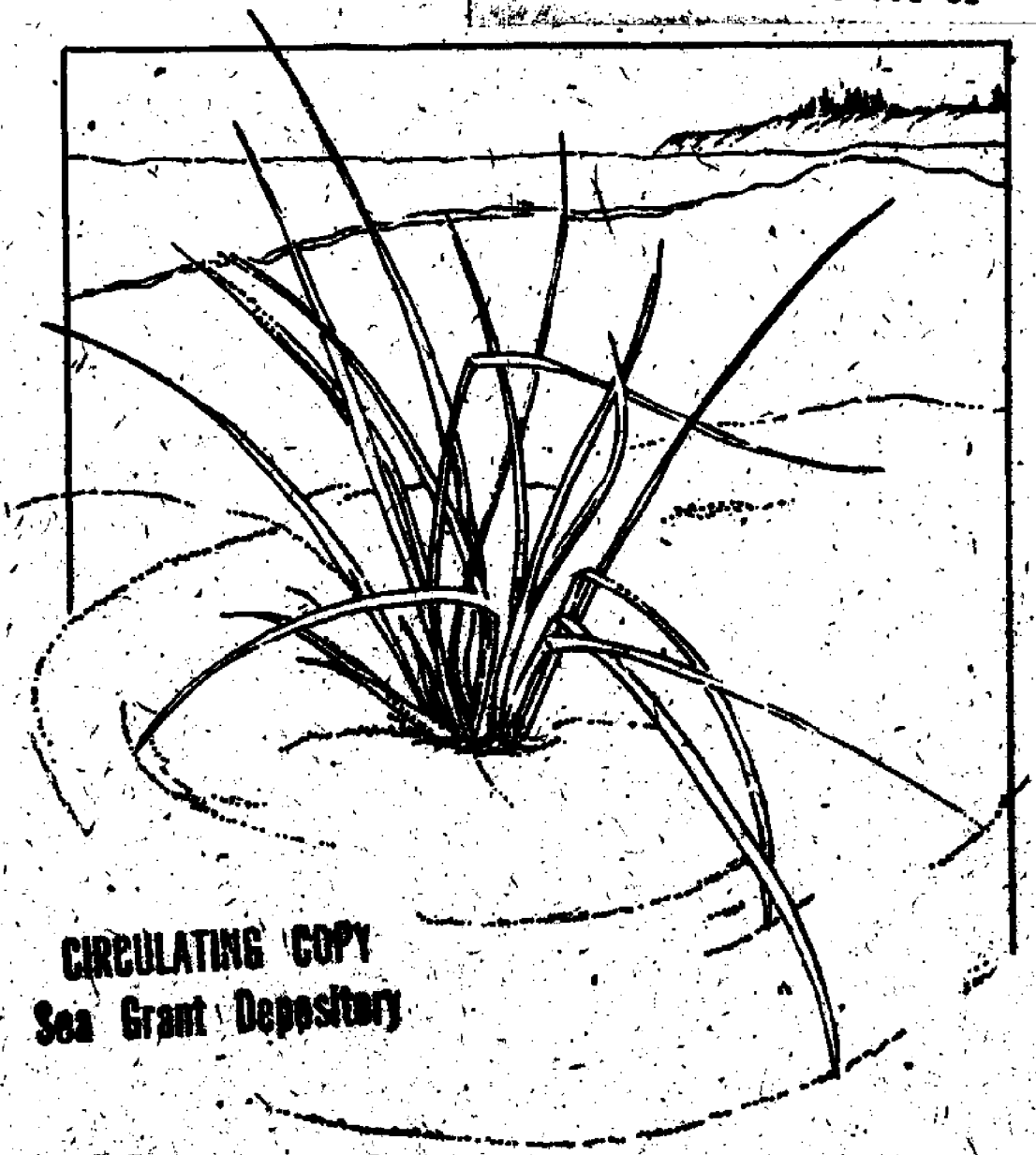

Vegetation and its role in reducing Great Lakes shoreline erosion

A guide for property owners

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The information in this booklet was adapted from "The Role of Vegetation in Shoreline Management," Great Lakes Basin Commission, 1978 and from "Bluff Slumping & Stability: A Consumer's Guide," Michigan Sea Grant, 1982. Information on beach grass was provided by Dorian A. Carroll, Plant Materials Specialist, U. S. Soil Conservation Service, East Lansing, Michigan.

INTRODUCTION

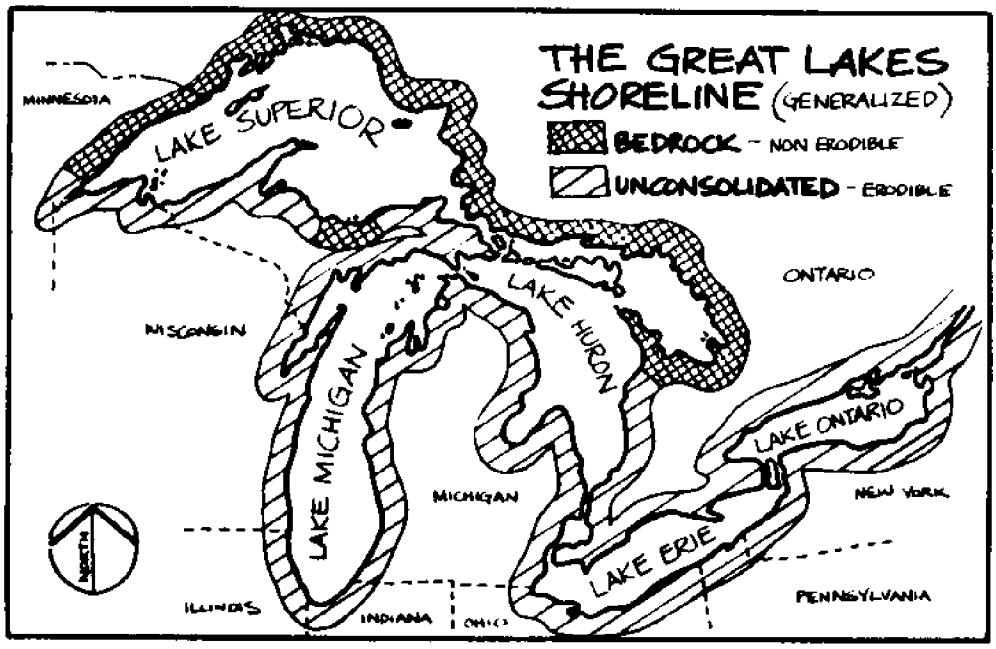
This booklet has been prepared to provide the shore property owner on the Great Lakes with some basic guidelines and information about the role of vegetation in an overall shoreland management strategy. With the increasing costs of structural devices for shore protection (both for installation and maintenance), it is necessary and desirable to develop complementary and economical shoreline stabilization techniques such as the establishment of a vegetative cover.

It is important to realize that vegetation cannot control waves striking the backshore area. During periods of wave attack vegetation will be lost. The property owner may use beach nourish-

ment or structural shore protection to try to reduce wave impacts or wait until water levels drop before attempting to restabilize the dune or bluff.

The shores of the Great Lakes vary greatly in their composition. It is important to recognize the variety of shore types if we are to understand, in a general sense, the erosion problems associated with each type and the appropriate solution(s).

This guide addresses only the unconsolidated, erodible shore, which constitutes the greatest extent of the Great Lakes shoreline. Only the northern shores of Lake Superior and Georgian Bay and a few isolated areas are composed predominantly of bedrock and do not suffer severe erosion problems. See general areas indicated on the map below.



Formation of the Great Lakes Basin

The series of ice lobes and larger ice sheets that carved out the present Great Lakes basin between 10,000 and 1,000,000 years ago are also responsible for the layers of glacial sediments that cover the Great Lakes region and make up a large portion of the shoreline. These unconsolidated glacial deposits are made of clays, silts, sands, gravels, and boulders which were eroded, transported, and deposited in many forms by the advancing and retreating glaciers. On the geologic time scale, this glacial activity is a relatively recent development.

Thus, the shorelines, through the action of wind, waves, and rivers, are still changing, particularly in response to fluctuations in lake levels. What appears to be a recent problem to shoreline property owners, could be more accurately regarded as a natural process which has been occurring for several thousand years but which affects and is affected by the actions of man.

The major shore types that have evolved within the erodible portion of the Great Lakes shoreline include the following:

Low erodible bluffs range in height from 9 to 30 feet and are mainly composed of glacially derived gravels, sands, silts, and clays. They are found along all five of the Great Lakes, interspersed among the other shore types. Drainage and slope stability are problems commonly associated with this shore type.

High erodible bluffs are those greater than 30 feet in height and composed of glacial materials. The Scarborough Bluffs near Toronto are among the highest of these, reaching 295 feet above Lake Ontario.

High erodible bluffs are found on all five lakes but are most prevalent along the Lake Michigan and Lake Erie shorelines. Drainage and slope stability are problems commonly associated with this shore type.

Low erodible plains refers to those unconsolidated stretches of shoreline less than 9 feet in height. They are found predominantly on the north shore of Lake Ontario and on the shores of Lake Huron and Lake Michigan. They are commonly associated with wetlands and are subject to erosion when exposed to wave attack. Flooding is a common problem.

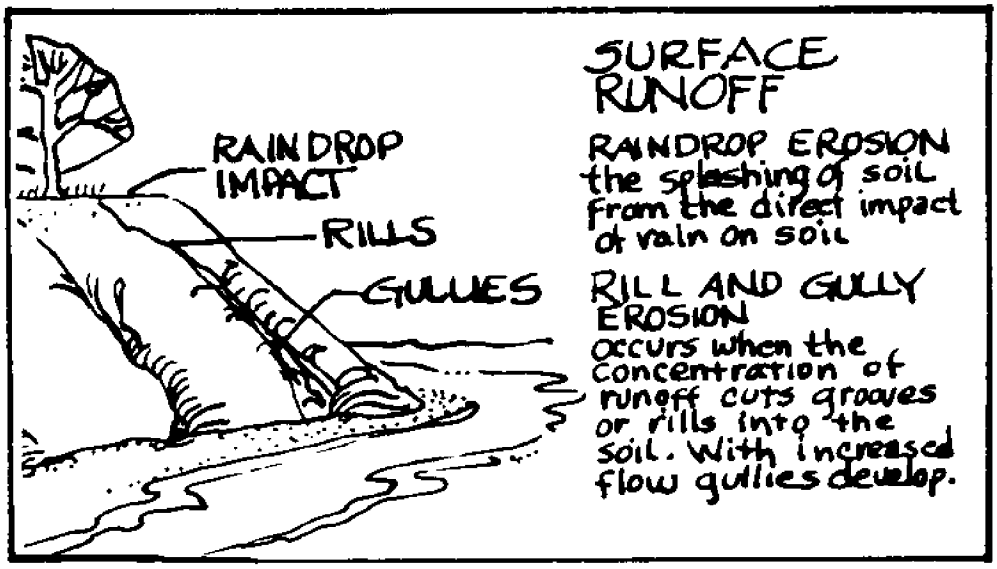
Sand dunes make up roughly a sixth of the Great Lakes erodible shoreline and present special considerations for development and protection. Low dunes are found on all the lakes, but high dunes reaching over 450 feet are found primarily along the eastern Lake Michigan shoreline, where human activity and wind erosion are the primary concerns.

Wetlands make up almost one-fifth of the Great Lakes erodible shoreline but are primarily confined to large bays such as Green Bay and Saginaw Bay, and other shallow areas of the lakes such as Lake St. Clair and the western end of Lake Erie. Dredging and filling operations have reduced wetlands and the shore protection they provide.

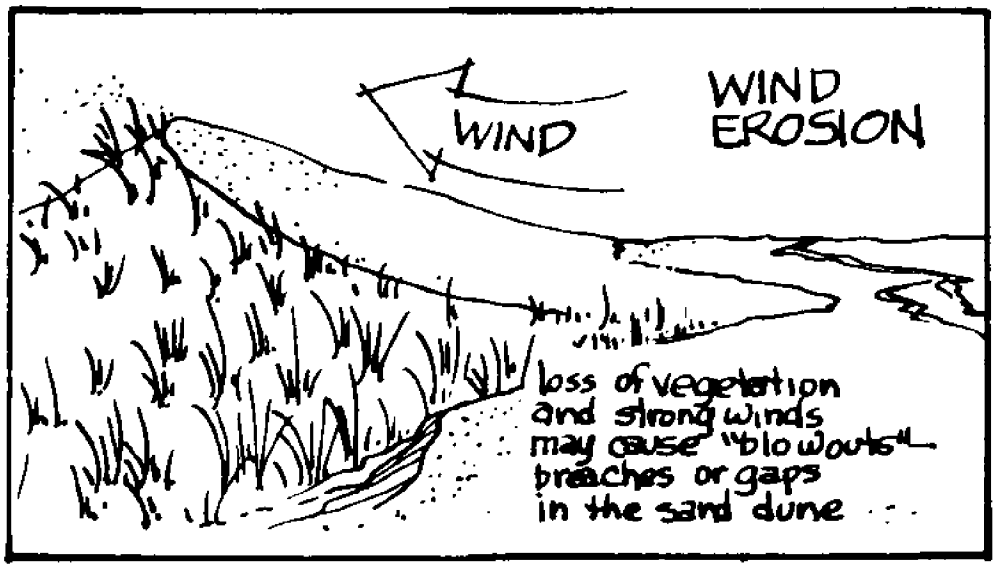
Principal Types of Shore Erosion

These erodible shore types are subject to three principal types of degradation: (1) wave action, (2) groundwater seepage and bluff slumping, (3) surface runoff, and (4) wind erosion. These four kinds of shore erosion may occur individually or in some combination. The third and fourth types, surface runoff and wind erosion, contributes to the surface degradation of the lakeshore, and are the processes most easily controlled by vegetation.

The primary agents of slope surface erosion are rain, surface runoff, and wind. All of these are capable of removing sediment from unprotected slopes and, unless they are controlled, can result in large losses of materials over an extended period of time.



The action of wind as an erosive agent is especially important in the sand dune areas of the Great Lakes. Wind is the force responsible for building the dunes and likewise, it is capable of shifting and/or removing the sand dunes when they are left unprotected. In dune areas where natural vegetation has been disturbed by development or traffic, winds have eroded the unprotected fine-grained sands and transported them elsewhere.



VEGETATION

Vegetation can play a key role in an erosion control program. Vegetation works best in the coastal zone when used in conjunction with structural measures that protect the toe of a bluff and with drainage measures that intercept seepage and relieve excess pore water pressures.

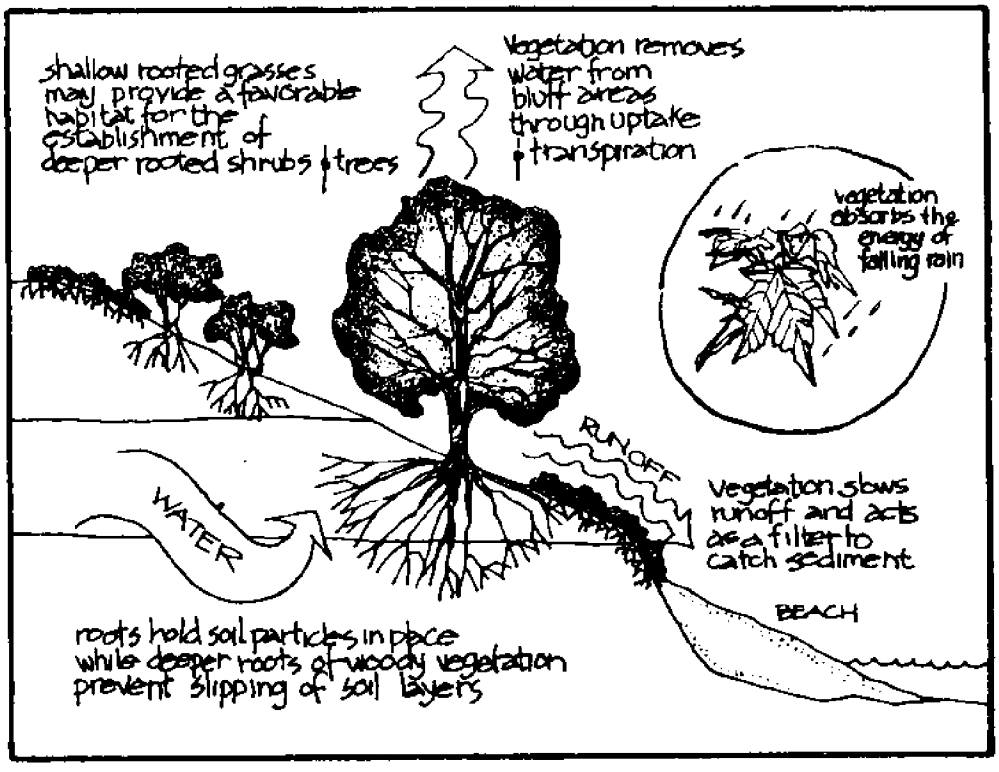
Vegetation alone is of little use against wave attack at the base of a bluff or against slumping of a bluff crest caused by groundwater seepage. Before planting vegetation, be sure the bluff is protected from wave attack and that the bluff is graded back to a stable slope angle. The presence or absence of vegetation is a good indicator of the stability of the slope. Vegetation is ex-

tremely difficult to maintain on very steep unstable slopes. Slopes steeper than 1:1 (see illustration on page 12) rarely have vegetation since the soil is not stable at such steep angles. Slumps often carry large trees to the beach along with all the grasses and other covering vegetation. If there are large seeps in the bluff face, vegetation will not establish itself readily.

Compared with structural means of controlling erosion, establishing vegetation is inexpensive. However, when planning an erosion control program it is important to budget sufficient money for seed, nursery stock, fertilizer and mulch. Sometimes it is necessary to use professional services such as hydroseeding.

How Plants Control Erosion

Vegetation is useful in the battle against surface erosion caused by the washing action of runoff, the heaving action of spring thaws, and the impact of raindrops.



Grasses trap moving soil particles and intercept raindrops. Plant root systems hold soil particles in place. Deep roots penetrate lower soil layers and draw water up through the tree to the leaves where it is transpired into the atmosphere. This moisture removal can help stablize the soil.

USE OF VEGETATION IN EROSION CONTROL

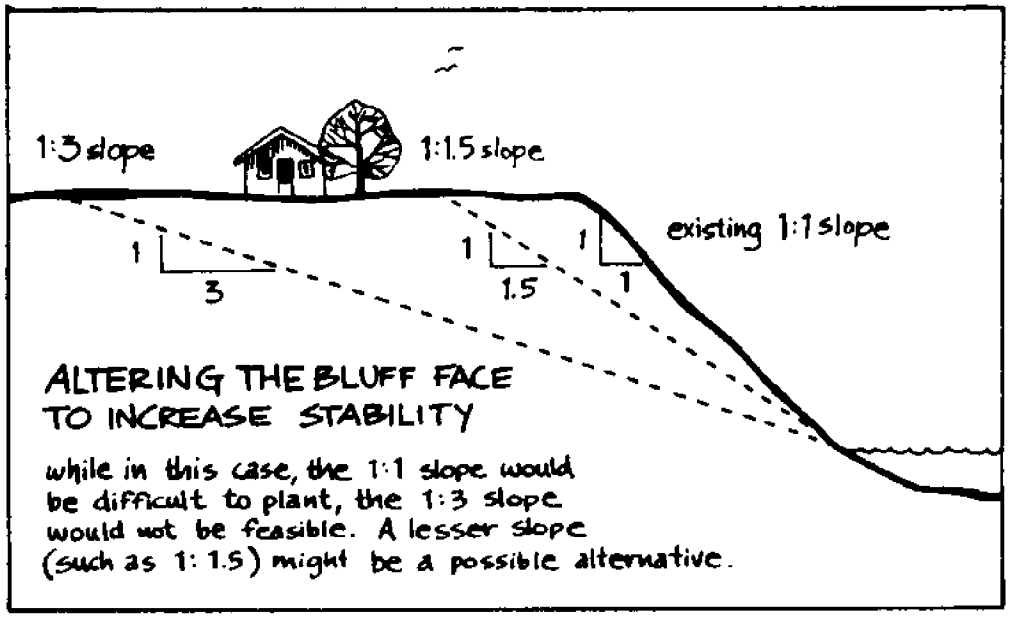
Role of Vegetation	Type of Vegetation		
	Herbs	**Shrubs**	**Trees**
Intercept rainfall	good	good	good
Retard runoff	good	good	poor
Filter surface soil particles	good	good	poor
Root penetration	very shallow to medium	shallow to medium	shallow to deep

PLANNING CONSIDERATIONS

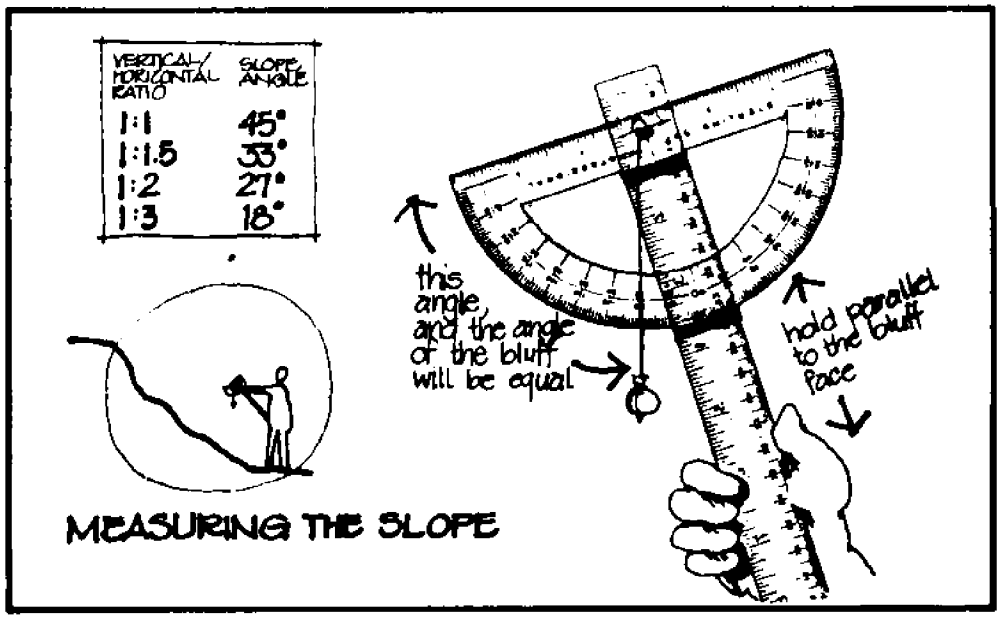
Slope Angle

The vegetation that can be established on a slope depends on the slope angle. If that angle is steeper than 1:1, the soil is likely to be unstable and it will be practically impossible to establish vegetative cover. Slopes steeper than 1:1-1/2 are likely to require specialized professional planting services. On slopes between 1:1 and 1:3, vegetation will grow, if groundwater and wave attack problems have been corrected. On slopes flatter than 1:3 it is possible to use lawn mowers, so planting a lawn is feasible.

To determine the slope of your bluff, you can use the method suggested in the accompanying diagram. This is a simple



device which can be constructed with a protractor and a yardstick. The protractor should be fastened securely to the yardstick as shown, with a string and weight attached accordingly. When the yardstick is held up and aligned with what appears to be the average slope of the bluff, the slope angle can be read directly from the protractor. This slope angle can then be converted to the appropriate vertical/horizontal ratio.



Climate

The climate of the Great Lakes coastal regions is modified by the large water mass of the lakes. Thus the hardiness zone for vegetation along the shore may be at least one zone more tolerant than adjacent inland areas. But remember that the bluff face is going to be exposed to wind and water runoff, making tough conditions for plants.

The Great Lakes region covers several latitudes and takes in several hardiness zones for plants. For advice on establishing vegetation you can rely on the expertise of local people such as your Sea Grant agent, county cooperative extension agent, or the Soil Conservation Service. They will know which species of plants do well in your location.

Existing Vegetation

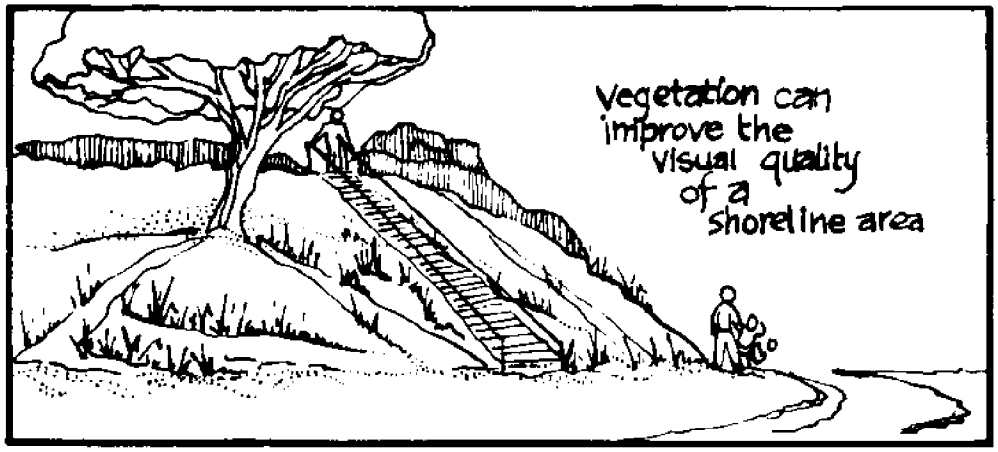
Survey the slope to determine what healthy vegetation currently exists on your shore property. Look at what thrives naturally in unmanaged areas. Is it compatible with your preferred uses of the property? If your slope has bare patches even though the rest of the area is well vegetated, you can use selective planting to fill in.

Soil Limitations

Droughtiness, fine textures, claypan soils, wetness, alkalinity, acidity, shallowness, toxicity, and nutrient imbalance all affect how well any particular species will grow in your soil. You should know the condition of your soil and the adaptability to it of any plant species you have in mind. The local contacts mentioned above can help you analyze your situation.

Functions

Plants can help you achieve desired effects. If a view of the lake is desired, consider the eventual height of the plants you choose. Some vegetation, such as chokecherry, can help you attract wildlife. Other vegetation, such as brambles, can help discourage foot traffic over your bluff. If topsoil is your goal, a fast growing species with a wide-spreading root system should be chosen.



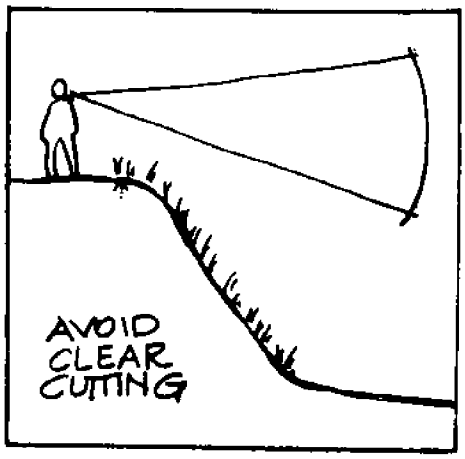
Aesthetics

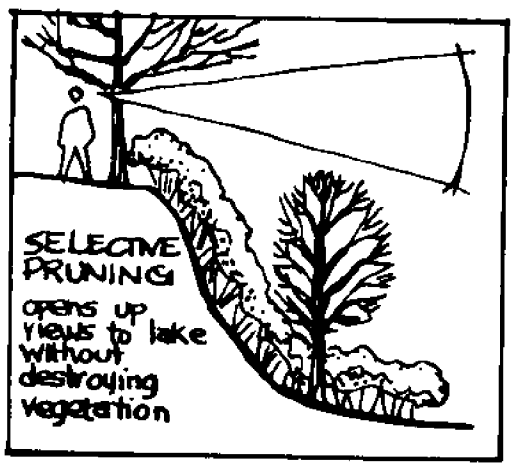
Plants have different colors, sizes, shapes, and textures. These characteristics can be taken into consideration for pleasing combinations of living material.

Human Activity

Success or failure of vegetation depends to some extent on the human activity to which it is subjected. Choose plants that are appropriate for the use you intend to make of your property. You might consider altering your uses to better allow the vegetation to establish itself. For example, you may need to control traffic over the bluff face with a stairway so that the plants can get started.

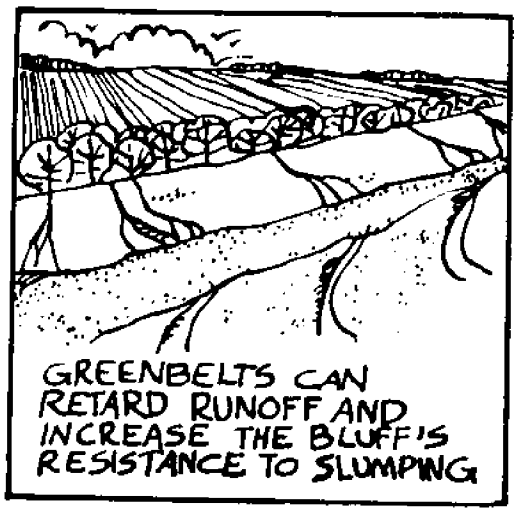
One major reason for living along the Great Lakes shore is to have a view of the lake. Clearcutting the trees for a better view of the lake may lead to slope failure as those roots no longer hold the soil or remove water from the soil. It is possible to use vegetation in creative ways to enhance the views you want while screening out undesirable sights and blocking the view of your house from the beach.





Location of Vegetation

Bluff top - Because vegetation on the bluff top forms a protective buffer for the bluff face, a greenbelt should be maintained along the bluff edge. In areas where nearshore lands are used for agriculture, such as along Lake Michigan and Lake Erie, it would be too costly to vegetate the bluffs on these long shoreline reaches. But farmers can maintain wide strips of dense, natural vegetation along the edge. These strips control traffic, keeping it away from the edge, and they retard runoff from plowed fields. If the bluff edge is currently cleared you should consider leaving it undisturbed. Shrubs and trees will naturally invade the area and reestablish the greenbelt; or you can speed the process with your own plantings.



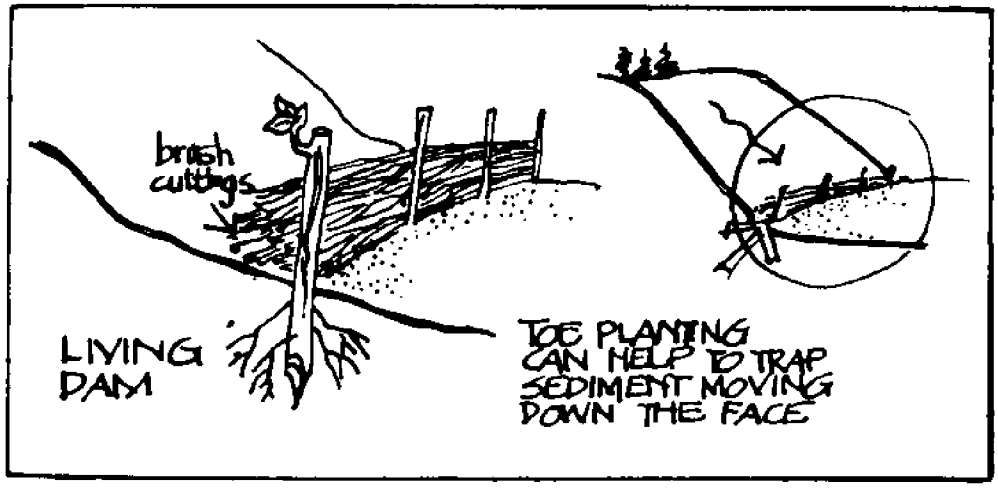
Very large trees near the edge of a steep bluff can be a mixed blessing. If the roots are showing on the bluff side, the tree is probably unstable. When the tree topples, it may carry away a large chunk of the bluff top with it. If you have such trees, you may wish to cut them down so that they don't fall down during a storm. You can leave the roots in the bank to hold the soil temporarily until new vegetation becomes established.

Bluff face - Vegetation traps sediment, controls runoff, and holds soil in place on the slope face. Trees, shrubs and grasses can all be used on the bluff face. If the slope is too steep to mow, consider ground covers other than lawn grass.

Cottonwoods and willows can be planted as cuttings or saplings and are particularly good for seep zones and other wet areas of the slope face. However, avoid planting willows near drainage systems because the roots seek water and may eventually clog or break up your drains.

Bluff toe - If you have sufficient beach to dissipate wave energy, you may increase bluff toe protection by planting vegetation in conjunction with structural support. This can be done through the use of vegetation behind living dams, stone riprap, or railroad tie cribbing.

A living dam consists of live willow posts connected by wire fencing constructed along the toe of the bluff. Willow and poplar brush cuttings are then piled between the fencing and the bluff to trap materials sliding down the face of the bluff. Because willows root in moist soil, the posts and cuttings become part of the vegative growth and help to anchor the toe and protect the base of the bluff.



Native Versus Introduced Species

Both native and introduced species thrive in the Great Lakes region. Some people believe native species do better than introduced species because they have successfully adapted to local environmental conditions. Whether you should plant native or introduced species depends on the effect you are trying to achieve. If you want a "natural" look, then you may want to consider only native species. Combinations of native and introduced plants are appropriate in landscaped settings. Whichever you choose, be sure the plants meet your requirements for appearance and maintenance, and grow well under the conditions on your property.

Species Selection

For the same type of plant, you often will have a choice of species. One species may do better than another for the particular conditions on your slope. Take into consideration the following factors:

- ultimate size
- rate of growth
- ease of establishment
- suitability to soil type and moisture levels
- susceptibility to insect and disease problems
- longevity
- appearance
- cost
- habits such as dropping limbs in storms
- compatibility with other vegetation

Maintenance Requirements

Some plants are care free once established; others require constant attention for shaping, watering, fertilizing, and the like. Select plants which require no more maintenance than you are willing to give them.

PREPARING YOUR SITE

Soil Tests

Before you select vegetation, find out what kind of soil you have. Is it clay, sand, or silt? Does it tend to dry out or stay wet? Is it acid or alkaline? Does it need fertilizer?

Surface Preparation

Proper surface work is essential to successful planting. Remove all debris that could smother vegetation. Smooth out all rills and gullies. Be sure surface drainage is being controlled. Based on your soil tests, add fertilizer and other soil conditioners.

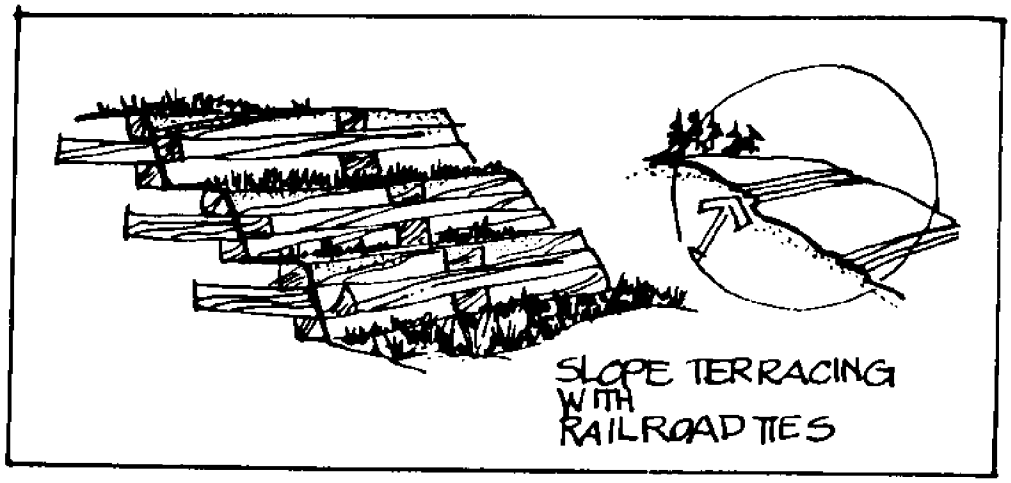
Slope Stability

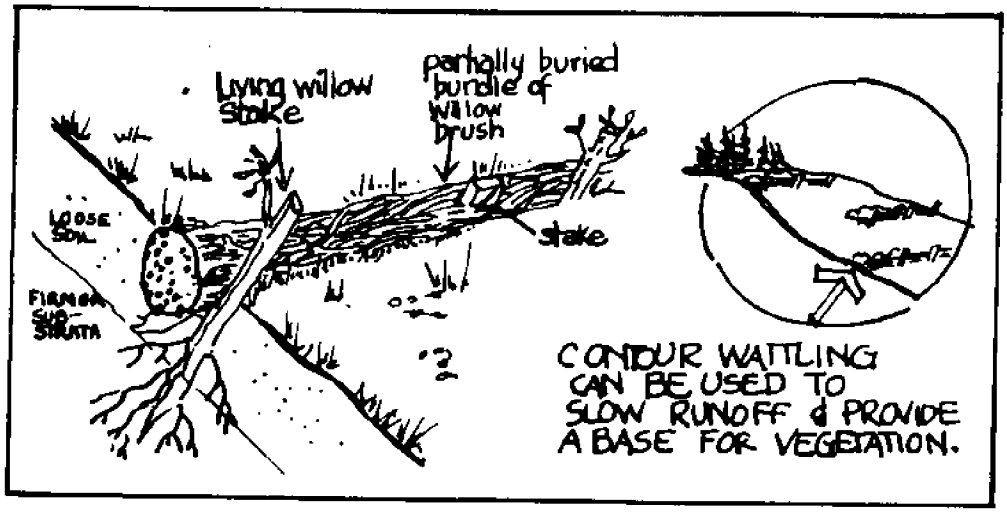
Is the slope presently stable or will it be when you add the plantings? If you are unsure, consult your local contacts mentioned on page 13.

If regrading to a gentler slope is too costly or impractical, consider slope modifications which will allow vegetation to become established. Two possible ideas are illustrated below.

Slope terracing provides horizontal steps in which to plant vegetation. Contour wattles consists of bundles of live willow cuttings which are anchored into the bluff face with either construction or live willow stakes.

This bundle traps surface runoff and soil particles and lets vegetation become established. Furthermore, the willow stakes are capable of rooting in the bluff soil if there is enough moisture.



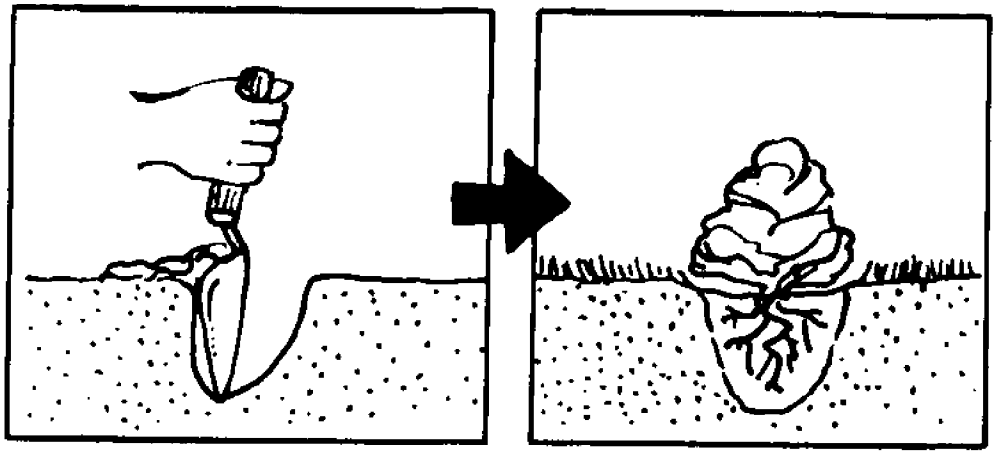


PLANTING GRASSES AND GROUNDCOVER

Seeding and Planting

Once the area is prepared, seeding and planting should be carefully handled. In many cases grass mixtures can be seeded by scattering the seed along the bluff face by hand. For large scale planting and steep slopes, machines called hydroseeders which spray mixtures of seed, water, and mulch are recommended. These are generally used by the Soil Conservation Service.

Groundcovers are usually available as small container-grown plants, and must be individually planted. Dig small holes with a trowel, forming a staggered pattern. The number of plants required depends on the variety of groundcover used.



Watering

Even though excess soil moisture problems can lead to a slope disaster, initial plantings and seeding often will require some judicious sprinkling and watering to get the plants going.

Mulching

Mulching is particularly important for slope plantings. Mulch protects against rain and wind while seeds are germinating and plants are reestablishing roots. Mulches also reduce moisture loss during dry spells.

The accompanying table lists common mulch materials and methods for anchoring the mulch.

MULCH MATERIAL	ANCHORING METHOD
Hay or straw (1 1/2-2 tons/acre)	peg and twine network punched into slope with spade
Jute Netting	staked according to manufacturer's specifications
Plastic Netting	staked according to manufacturer's specifications
Manure or Compost	no anchoring necessary
Glass fiber	follow manufacturer's instructions

Timing

The Great Lakes region has a typical pattern of wet and dry spells which affect plant success. Your efforts to establish vegetation should take this into consideration. Seeding of grasses and legumes should be avoided in July and August because long dry periods are most likely to occur then. Legume-based mixtures should be planted as early as possible, but no later than mid-June. Grass-based mixtures can be seeded before and after July and August.

GRASS & LEGUME SEED MIXTURES

SPECIES	LBS/ACRE
Perennial Rye Grass* (Lolium perrene)	5
Redtop* (Agrostis alba)	4
Smooth Bromegrass* (Bromus inermis)	12
Orchard Grass* (Dactylus glomerata)	8
Canada Bluegrass (Poa compressa)	8
Sweet Clover (Melilotus alba)	4
Red Clover* (Trifolium pratense)	6
	Total: 47 lbs/acre**
Creeping Red Fescue* (Festuca rubra)	10
Kentucky Bluegrass* (Poa pratensis)	2
Redtop* (Agrostis alba)	1
Tall Fescue* (Festuca arundinacea)	20
Timothy* (Phleum pratense)	2
Birdsfoot Trefoil* (Lotus corniculatus)	10
	Total: 45 lbs/acre**
Reed Canarygrass (Phalaris arundinaceus)	15
Garrison Creeping Foxtail (Alopecurus arundinaceus)	5
Redtop* (Agrostis alba)	5
Birdsfoot Trefoil* (Lotus corniculatus)	10
	Total: 35 lbs/acre***

*indicates introduced species
**can be planted in well-drained soils
***can be planted in imperfectly drained soils

Stabilizing Dunes with American Beachgrass

American Beachgrass has proved to be the best plant for initial stabilization of moving sand. It differs from European Beachgrass in being strongly rhizomatous, less sensitive to high temperatures immediately after transplanting, and somewhat longer lived. It is a tough, coarse, erect perennial with hard, scaly, creeping rhizomes and dense, spikelike flower clusters or panicles. Stems from the plant form a barrier and provide a favorable environment for the establishment of other native species of dune vegetation. The seed is generally infertile.

Site

American Beachgrass should be planted on the landward portion of the beach, on and between existing dunes, or immediately lakeward of an established duneline. Slopes should not be steeper than 2:1.

Planting Method

Plant 2 to 3 culms (a single stem with roots attached) of American Beachgrass in holes 8 to 10 inches deep. This depth is suggested so that the buds at the base of the stem do not dry out or blow out in a heavy wind. Sand should be firm and moist around roots with no air pockets near base of plants. When planting by hand, firm the sand around plants with a good heel blow. A narrow tile spade or planting bar may be used for planting small areas and a tree planter can be used for large, nearly level areas. On extensive areas, on-site assistance should be obtained to determine the best system of planting to use.

Rate of Planting

Space holes about 18 inches apart where wind velocities and sand movement are high (about 20,000 clumps or 40,000-60,000 culms per acre). The holes should be staggered to get maximum erosion control. A spacing of 24 inches may be used in areas not directly exposed to strong winds (about 11,000 clumps or 22,000-33,000 culms per acre).

A pattern that covers a small percentage of the area may be used in extensive plantings to reduce costs. However, this is not recommended for those areas where rapid stabilization is required or where the resulting ridges would be objectionable.

On large blowouts, scattered or "skeleton" planting reduces the cost but requires more time for complete control. An average of 1,200 clumps per acre are needed for this type of planting. Patterns can vary from wheel to lattice shape depending on the shape of the blowout. Plant first on the windward side, using a close spacing. On the rest of the area, bands of 2 or 3 rows each can be planted 20 to 40 feet apart. The grass clumps should be spaced 18 inches apart in the bands.

Fertilizer

Because of the sterile nature of sand, fertilizer is necessary for satisfactory growth. In absence of a soil test, application of about 500 pounds per acre of 12-12-12 is suggested. Because of water quality concerns in the Great Lakes it is advised that this fertilizer be applied in 50 pounds per acre doses every two months starting in April, rather than all at once. If a soil test has been made and if phosphorus and potassium are moderate to high, then an application of about 60 pounds of nitrogen per acre is all that should be needed.

Date of Planting

Plant only in early spring or in the fall when weather is cool. Average temperature should not exceed 50 F. for two weeks after planting.

Maintenance and Management

Beachgrass should be carefully maintained to provide a complete, dense cover. If any portion of the cover is lost or destroyed it should be replanted immediately or a blowout could result. People are the chief cause of beachgrass destruction. Pedestrian and vehicular traffic should be restricted to designated areas.

A year or two after planting beachgrass, when all surface sand movement has ceased, other trees and grasses may be planted in the beachgrass. Cherry, cottonwood, Scotch pine, and black

locust are some of the suggested trees. Tall fescue or creeping red fescue are good grass choices.

In the few instances where fertility level is so high that beachgrass would shade out seedlings, this follow-up planting should be deferred until the beachgrass plants weaken enough to allow light to reach the ground.

When sand movement stops, the beachgrass will weaken and other plants will normally invade the planting. For this reason the beachgrass should be considered a temporary measure. Its usable life will normally be between 5 and 15 years.

PLANTING TREES AND SHRUBS

Handling

Trees and shrubs are available four ways: as seedlings, bare root, balled and burlapped, and container-grown. Easily transplanted species can be handled as seedlings or with bare roots. More sensitive species need to have undisturbed roots. Balled and burlapped and container-grown plants are expensive, but the plants suffer less shock from being moved and the roots are better protected from drying out. The root ball can be heavy. Thus, on a steep slope it is usually impossible to plant a balled and burlapped tree with a root ball larger than 18 inches in diameter. In any transplanting, always be careful to prevent the roots from drying out.

Spacing

For maximum erosion control, trees and shrubs should be planted after grass has been established. Plants should be spaced to prevent dense shade. Trees should be planted at least 50 feet apart and shrubs, 15 to 25 feet apart. If trees and shrubs are going to be mass planted to achieve total ground cover, then the trees can be 6 feet apart and shrubs, 3 to 4 feet apart.

Timing

Evergreens, shrubs, and small trees are best planted in spring before they have begun new growth. Plant them after the ground thaws and the air temperature exceeds 35 degrees. You can also plant in late autumn after the plants are again dormant, but before the ground freezes.

Fertilizer

It is not absolutely necessary, but fertilizer can be added when planting trees and shrubs. Use a small amount and be careful to prevent it from coming into direct contact with the roots. It is best to mix it into the backfill for the hole.

What to Plant

The following page lists suggested shrubs and trees which are suitable throughout the Great Lakes region. Your local Sea Grant agent can also assist you or recommend a local specialist in vegetation or soil conservation.

For more information on planting, consult any good gardening or landscaping book. Cooperative Extension Service offices, libraries, and bookstores all carry planting guides. Also, plants are often sold with planting instructions.

SUITABLE SOILS FOR TREES AND SHRUBS

SHRUB SPECIES	SOIL MOISTURE TYPES			
	Droughty	Well-Drained Good Moisture	Imperfectly Drained	Poorly Drained
Bearberry (Arctostaphylus uva-ursi)	X	X		
Chokecherry (Prunus virginiana)		X		
Gray Dogwood (Cornus racemosa)	X	X	X	
Red-Osier Dogwood (Cornus stolonifera)			X	X
Wild Grape (Vitis reparia)	X	X	X	
Common Juniper (Juniperus communis)	X	X		
Staghorn Sumac (Rhus typhina)	X	X		
Sandbar Willow (Salix interior)		X	X	X
Heartleaved Willow (Salix cordata)		X	X	X
TREE SPECIES				
Cottonwood (Populus deltoides)		X	X	
Black Locust (Robinia pseudo-acacia)		X		
Silver Maple (Acer saccharum)		X	X	X
Willow (Salix spp.)			X	X
Red Maple (Acer rubrum)		X	X	
Box Elder (Acer negundo)		X	X	

MAINTENANCE

Lawns

Healthy, vigorous grass will be maintained only with annual fertilizer applications. Light applications will keep an established lawn healthy. But don't overdo it or water quality problems may result. *Use care to prevent fertilizer from reaching the lake.*

Trees and Shrubs

Newly planted trees and shrubs require care until they are established, usually one to two years after planting. Slopes are often very dry in summer, so water the trees about twice a month. Keep competing vegetation cleared away from the base of the tree. Many plants are susceptible to insects and diseases.

Healthy, vigorous plants are seldom bothered, but declining plants may be attacked. A yearly inspection and a little maintenance can keep plants vigorous. When short-lived species have been established for several years, you may wish to introduce some long-lived species.

Selective Topping and Thinning

A dense, heavily wooded slope effectively controls erosion. However, such woods often block the lake view. Selective pruning, topping and removal of some trees opens up the view without endangering slope stability. Thinning will also allow more sunlight into the existing trees, which will strengthen them. Handle thinning gradually, a little bit each year. Leave brush and shrubs undisturbed. Never cut down all the vegetation at once. Clearcutting the slope will rob the slope of all the benefits of the vegetation, and make it vulnerable to erosion.

Debris

Remove all debris that is covering the soil to be vegetated. Cut down dead trees, cutting them so that they fall across rather than up or down the slope, leaving the trunk and roots in place. Remove dead shrubs. Don't use your slope as a dumping ground. Leaves, grass clippings, or other debris dumped over the edge of the slope will smother the vegetation you are trying to establish.

SOURCES OF INFORMATION

Great Lakes Sea Grant
Shore Erosion and Flooding Assistance

The Sea Grant programs provide accurate up-to-date information through publications and they provide technical assistance to individuals and communities through on-site visits by advisory agents.

Sea Grant Extension agents visit individual property owners to analyze site characteristics and evaluate erosion or flood control options. They also work with local officials to protect public properties.

Publications include information about shore erosion control measures and their effectiveness, tips on how to prepare for and clean up after coastal flooding, and legal considerations in buying and protecting lakefront property.

Michigan District Extension Sea Grant Agents

Upper Peninsula

Ron Kinnunen
Upper Peninsula Extension Center
1030 Wright Street
Marquette, MI 49855 (906) 228-4830

Northwest Lower Peninsula

John McKinney
Governmental Center
400 Boardman Avenue
Traverse City, MI 49684 (616) 922-4620

Southwest Lower Peninsula

Charles Pistis
County Extension Office, Rm 101
Ottawa County Building
Grand Haven, MI 49417 (616) 846-8250

Southeast Lower Peninsula

Steve Stewart
Cooperative Extension Service
County Building, 11th Floor
Mount Clemens, MI 48043 (313) 469-5180

Northeast Lower Peninsula

Jon Peterson
Cooperative Extension Service
P.O. Box 599
Tawas City, MI 48764 (517) 362-3449

Great Lakes Sea Grant Programs

For information and referrals in your locality, contact:

Illinois-Indiana Sea Grant Extension
University of Illinois
1010 Jorie Blvd., Suite 300
Oak Brook, IL 60521 (312) 990-0809

Minnesota Sea Grant Extension
208 Washburn Hall
University of Minnesota, Duluth
Duluth, MN 55812 (218) 726-8106

New York Sea Grant Extension
52 Swetman Hall
SUNY Oswego
Oswego, NY 13126 (315) 341-3042

Ohio State University Sea Grant Program
The Ohio State University
1314 Kinnear Road
Columbus, OH 43212 (614) 292-8949

University of Wisconsin Sea Grant Institute
1800 University Avenue
University of Wisconsin-Madison
Madison, WI 53705 (608) 262-0644

Other Local Agencies

Information on soil and plants can be found through your local Soil Conservation Service County Field Office (look under U.S. Government, Department of Agriculture, in your phone directory), or your county Cooperative Extension Service. For technical assistance and permits contact the natural resources department in your state.

Publications on Shore Erosion

Please check with the source for cost.

Buying Shoreline Property

Shore Erosion: What to Do

Bluff Slumping & Stability: A Consumer's Guide

Shoreline Erosion - Questions and Answers

Michigan Sea Grant Communications
The University of Michigan
2200 Bonisteel Boulevard
Ann Arbor, Michigan 48109-2099 (313) 764-1138

Low Cost Shore Protection

Monthly Bulletin of Lake Levels for the Great Lakes

United States Army Corps of Engineers
Detroit District
Public Affairs Office
P.O. Box 1027
Detroit, Michigan 48231 (313) 226-6413

A Hydrograph of Lake Levels
(gives monthly levels from 1860 to date)

Distribution Branch, (N/CG33)
National Ocean Service
Riverdale, Maryland 20737 (301) 436-6990

Water Level Changes: Factors Influencing the Great Lakes

Great Lakes Shore Erosion and Flooding Assistance Programs

Great Lakes Commission
The Argus II Building
400 S. Fourth Street
Ann Arbor, MI 48103-4816 (313) 665-9135

Biotechnical Slope Protection and Erosion
(describes the combined use of vegetation and structures to deal with slope and erosion problems)

Gray, Donald H.; Leiser, Andrew I., 1981.
Van Nostrand Reinhold Co. 1982.

DO'S & DON'TS

If you own shoreline property then. . .

Do

— Plant vegetation on barren slopes if your beach and toe are stable

— Seek competent local advice on technical matters such as engineering, drainage, or soils

— Consult with your neighbors as to the best coordinated approach to solving shore erosion problems

— Take care of the trees, shrubs, and grasses already growing in your shoreline and bluff areas

— Consider carefully how your shore protection measures appear to and affect others

Don't

— Remove existing vegetation from the top, face, or toe of the bluff

— Throw rubbish over the bluff

— Build structures on the beach without consulting your neighbors or seeking advice of experienced professionals

— Run drainage ditches or pipes over or through the bluff without any means of conducting the flow to the lake level

— Encourage activities which result in destruction of vegetation or increased erosion of bluff areas (i.e., pedestrian or vehicular traffic)

Before undertaking any major construction or slope regrading project, be sure to consult with local, state, provincial, and federal authorities in case permits are required for these types of activities.