SAR Supplemental Support Document No. 1

VEGETATION

Its Role Along Pennsylvania's Lake Erie Shoreline

Coastal Zone
Funded and Coordinated through
Dept of Environmental Resources
Office of Resources Management
Bur of Water Resources Management
Div of Coastal Zone Management

Erie County Conservation District Staff

Manager	LeRoy W. Gross
Technician	Sean Gill
Graphics	Adah Ellis
Design	Adah Ellis
Typing	Marie Gallagher

The preparation of this report was financed in part through the Pennsylvania Coastal Zone Management Program under provisions of the Coastal Zone Management Act of 1972, administered by the Division of Coastal Zone Management, Bureau of Water Resources Management, Pennsylvania Department of Environmental Resources.

Technical Review

Fred Bubb	U.S.D.A. Soil Conservation Service
Eric Conrad	Coastal Zone Management
William Johnson	Coastal Zone Management
Shamus Malone	Coastal Zone Management
Charles Mitchell	U.S.D.A. Soil Conservation Service
Lewis Steckler	U.S.D.A. Soil Conservation Service

Funded By

Pennsylvania Department of Environmental Resources
Coastal Zone Management Program
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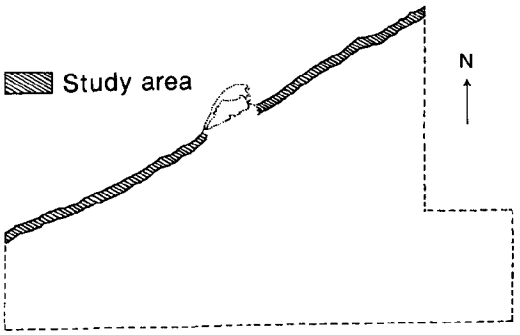
Lake Erie Shoreline



Erie County, Pennsylvania

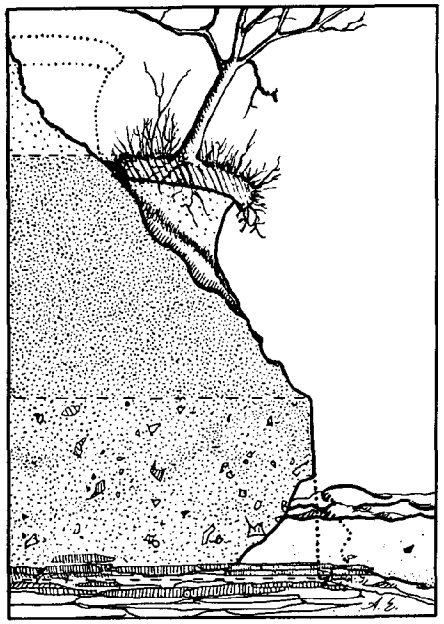
Contents

This brochure was prepared by the Erie County Conservation District (ECCD) and funded by the Department of Environmental Resources, Office of Resources Management, Bureau of Water Resources Management, Division of Coastal Zone Management (DCZM).

The species listed were identified as the result of extensive research conducted on the Lake Erie bluffs by the ECCD. The purpose of the research was to determine what species of plants, both native and introduced, would be best suited to help stabilize the lake bluffs.

The purpose of this brochure is to provide property owners receiving the Site Analysis Report (SAR) Service with pertinent information so recommendations made on vegetation can be properly carried out. The SAR Service provided by DCZM is **free** to bluff and shoreline property owners living along Pennsylvania's portion of Lake Erie and includes a site visit by the DCZM, usually in accompaniment with the ECCD to inspect the bluff property. After the site visit, a written subjective evaluation of the property is sent to the property owner. Included in the report is a summary of the physical setting of the property, an analysis of the causes and influences of bluff recession, and recommendations to the property owners concerning actions that can be taken to address bluff recession problems. Property owners are encouraged to review the growth characteristics and appearance of the various species included in this brochure to determine the ramifications of following the recommendations in SARs.

Preface



Bluff recession is a severe geologic problem occurring along the shoreline of Lake Erie. Layers of erodible clay, silts, sands and gravels make up the majority of bluff types along Pennsylvania's portion of Lake Erie.

The three (3) main causes of bluff recession are wave undercutting at the base of the bluff, groundwater seepage through the bluff face, and surface erosion. Surface erosion is possibly the most widely spread cause of bluff recession and may occur in the form of rain splash, wind, or surface water runoff.

Vegetation provides the primary protection against the effects of surface erosion. A good vegetation cover protects the bluff face from rain splash and wind, because the roughness along the soil surface caused by roots and stems slows the velocity of surface water runoff. A good root system not only holds the soil particles together, but through evapotranspiration, removes moisture from the bluff face and crest. Evapotranspiration decreases the weight of the bluff material, and, at the same time, increases the shear strength of the bluff material and its resistance to breaking and slumping.

Grasses, sedges, legumes and other herbaceous plants stabilize the surface of the bluff face and crest with their fibrous root systems. The colonization of a bluff invites a variety of deeper rooted plant life, i.e, shrubs and trees which have root systems that extend beyond the other plants, thereby securing deeper soil layers. Relative stability can usually be established when the bluff face and crest are extensively covered with a variety of species ranging from grasses and sedges to mature shrubs and trees.

Analysis of the field data collected by ECCD has yielded information about the type and frequency of plant species occurring under varying bluff conditions.

Vegetation growing on the bluffs was listed and evaluated as to its ability to stabilize and protect the bluffs under various conditions relating to bluff slope, canopy cover, insolation, pH, soil type and soil moisture.

A variety of grass, shrub, tree, and other plant species was found growing on the Lake Erie shoreline bluffs, fifty-eight (58) different species in all. The most frequently encountered species were Coltsfoot, goldenrods, horsetails, Yarrow, Flowering raspberry, willows, cottonwoods, Queen Anne's lace, Black locust, Redtop, Orchardgrass, Black alder, Canada bluegrass, and Staghorn sumac. These frequently encountered species were also the first to colonize a recently slumped bluff.

Unfortunately, six (6) of these species that showed this adaptation to the bluff environment were native and/or wild, with no commercial seed source. With nature as the only source, wild plants are difficult to recommend for bluff stabilization. Wilding transplants and cuttings of these species, which may be inconvenient in many cases, are usually the only methods of introducing certain wild species.

The species selected for this brochure perform well under various bluff conditions related to slope, soil pH, soil type, moisture and insolation (amount of sunlight). Some additional species that do not occur naturally on the bluff are listed in this brochure because they have commercial sources, have been observed growing under conditions similar to those on the bluff, and have demonstrated good soil-holding capabilities.

The goal in the vegetation of bluffs is to achieve a dense, well-suited (recommended species) growth of grasses, legumes, shrubs and trees. Grasses and legumes will hold the surface soils. Shrubs and trees will go deeper; they may encourage bluff stability by penetrating the slippage zone and thus preventing slippage between soil layers.

Determination of species listed

In the ECCD survey vegetation growing on the bluffs was listed and evaluated as to its ability to stabilize and protect the bluffs under various conditions. The following information pertains to these conditions.

All plants listed will grow on level surfaces (0 degrees). The maximum **slope** on which a plant can grow is also given.

Soil acidity is rated: neutral (7.0), slightly acid (5.6 - 6.9), acid (5.0 - 5.5), and very acid (3.5 - 5.0). Vegetative species will grow better where the soil is less acid than the maximum acidity indicated.

Soil types are rated: clayey, loamy, or sandy. These ratings indicate the kind of soil in which the plant can grow effectively.

The **moisture/drought** and **sun/shade** tolerances of each plant are rated poor, fair, or excellent as compared with all other plants within the section. The ratings help to determine the comparative advantages of selecting these plant species over others for a particular section of bluff. Moisture/drought tolerances indicate how the plant grows where only limited amounts of water are available and the soil is dry most of the year. If the plant does not tolerate full sun, that characteristic is also noted. Shade tolerance indicates how the plant grows in full shade.

A soil drainage class is also given under moisture/drought factors for each plant. This means that the plant will tolerate the drainage conditions indicated but will do better in better drained soils. Limited growth potential will be experienced in more poorly drained soils.

The soil drainage classes used are poorly drained, somewhat poorly drained, moderately well drained, and well drained. All the plants listed in this brochure grow in well-drained soil, and some **require** well-drained soil. Most of the plants tolerate soils that are not well drained. The minimum drainage classes tolerated by those plants are also given.

Other important growth characteristics relevant to the effective use and management of the vegetative species are indicated where appropriate.

For more information about the use and management of the plants for conservation uses, contact the Erie County Conservation District.

PLANTING INSTRUCTIONS FOR GRASS AND LEGUME SEEDS AND SHRUB AND TREE SEEDLINGS SHOULD BE OBTAINED FROM THE SEED SOURCE OR NURSERY AT WHICH SEEDS AND SEEDLINGS WERE PURCHASED.

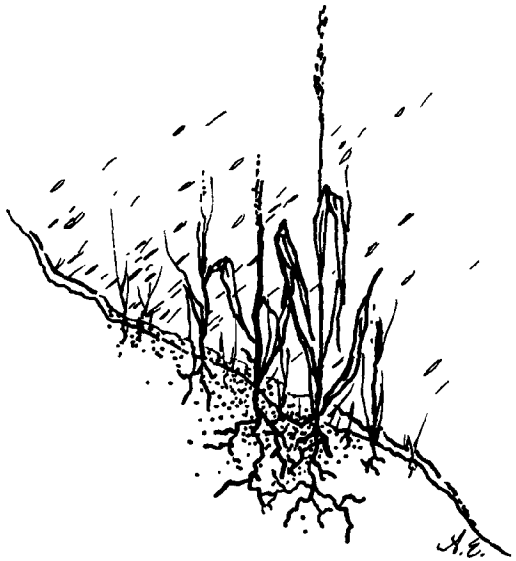
BECAUSE OF THE COMPLEXITIES OF THE PHENOMENON OF BLUFF RECESSION, WE RECOMMEND CONTACTING THE DIVISION OF COASTAL ZONE MANAGEMENT FOR TECHNICAL ADVICE, THROUGH THE SAR SERVICE, BEFORE UNDERTAKING ANY ACTIVITY ON THE BLUFF. THE SAR SERVICE CAN BE ACQUIRED FROM THE STATE DEPARTMENT OF ENVIRONMENTAL RESOURCES BY CONTACTING THE DIVISION OF COASTAL ZONE MANAGEMENT AT P.O. BOX 1467, HARRISBURG, PENNSYLVANIA 17120, TELEPHONE (717) 783-9500.

For the following reasons, property owners should consult the Division of Coastal Zone Management before undertaking any activity relating to vegetation on the bluff:

— As part of the overall evaluation of vegetative species to be included in this brochure, commercial availability was the overriding factor for final selection. With the exception of two (2) species (Yarrow and Queen Anne's lace), vegetative species that had good soil stabilization qualities are **not** included if they were **not** commercially obtainable. Therefore, until a qualified individual has seen the site, property owners should take care **not** to disturb naturally occurring vegetation that is **not** listed in this brochure as it may have good soil stabilization qualities.

— **It is important to note that vegetation is not the complete solution to bluff recession.** Other existing erosional phenomena such as wave undercutting and groundwater seepage have to be addressed before vegetation can be effectively used to address bluff recession problems. Vegetation, through proper applications, can lessen the effects of bluff recession and possibly add years of stability to an otherwise unstable bluff area.

— **Not all vegetative species in this brochure are well suited to every bluff situation.** It is important to note that each bluff site may have different problems and conditions that must be considered when selecting the appropriate specie or species mix for bluff stabilization.



Grasses and sedges help to stabilize the bluff against rapid surface runoff by holding the soil with their fibrous root systems. Their colonization invites a variety of deeper rooted plant life.

Orchardgrass (grass) perennial/ introduced
Dactylus glomerata

Slopes: 0 - 40 degrees.

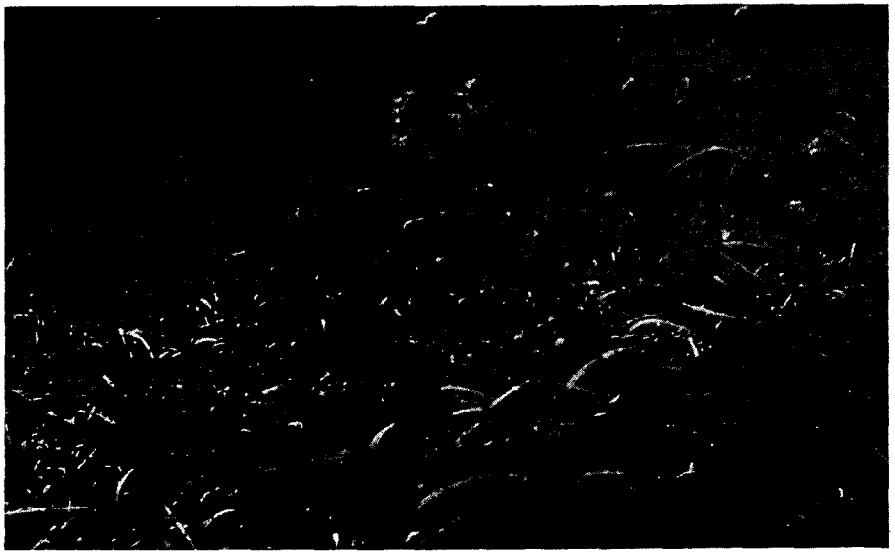
pH: All conditions. **Soil types:** All.

Moisture/Drought factors: Grows well under moist conditions.

Sun/Shade tolerance: Prefers sunlight; fair shade tolerance.

Physical characteristics: (1½ - 5 ft.) bunch grass which produces dense stands; excellent root system.

Sources: Commercial seed dealerships.



Redtop (grass) long-lived perennial
Agrostis alba

Slopes: 0 - 60 degrees.

pH: Tolerates low-fertility, very acid. **Soil types:** Clayey, loamy, and sandy.

Moisture/Drought factors: Tolerates poorly-drained soils; fair drought and cold tolerance.

Sun/Shade tolerance: Prefers sunlight; poor shade tolerance.

Physical characteristics: (10 in. - 4 ft.) sod-forming; fast starting; best used with other species.

Sources: Commercial seed dealerships.

Tall fescue (grass) perennial/ introduced
Festuca arundinacea

Slopes: 0 - 60 degrees.

pH: Low-fertility; acid. **Soil types:** Clayey, loamy, and sandy.

Moisture/Drought factors: Tolerates poorly-drained areas; fair drought tolerance.

Sun/Shade tolerance: Prefers sunlight; fair shade tolerance.

Physical characteristics: (1½ - 4 ft.) deep rooted, sod-forming.

Sources: Commercial seed dealerships.

Perennial ryegrass (grass) short-lived perennial/ introduced
Lolium perenne

Slopes: 0 - 40 degrees.

pH: Medium fertility, slightly acid. **Soil types:** Clayey, loamy.

Moisture/Drought factors: Tolerates poorly-drained areas.

Sun/Shade tolerance: Prefers sunlight; poor shade tolerance.

Physical characteristics: (1 - 2 ft.) bunch grass; shallow but fibrous root system; complete ground cover in a few months; use while other species take root.

Sources: Commercial seed dealerships.

Canada bluegrass (grass) perennial/ introduced
Poa compressa

Slopes: 0 - 40 degrees.

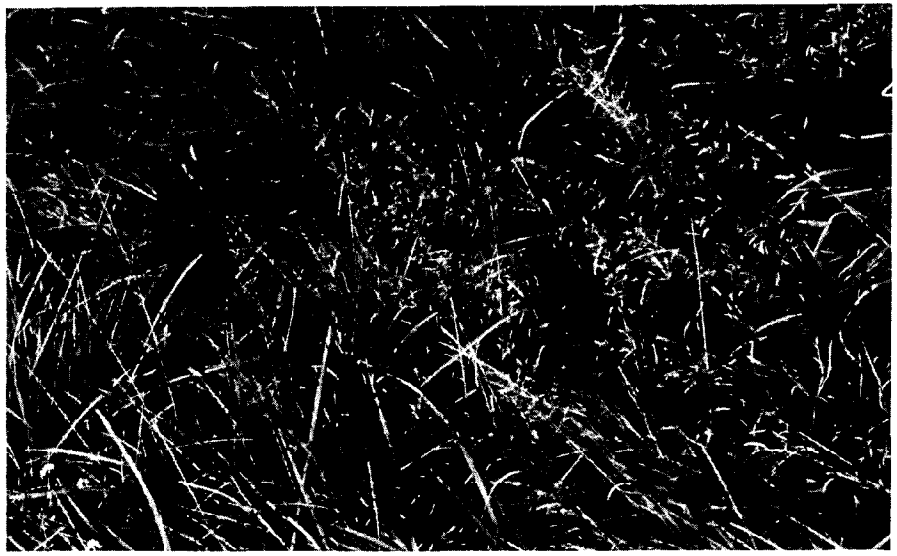
pH: Slightly acid to neutral. **Soil types:** Clayey, loamy, and sandy.

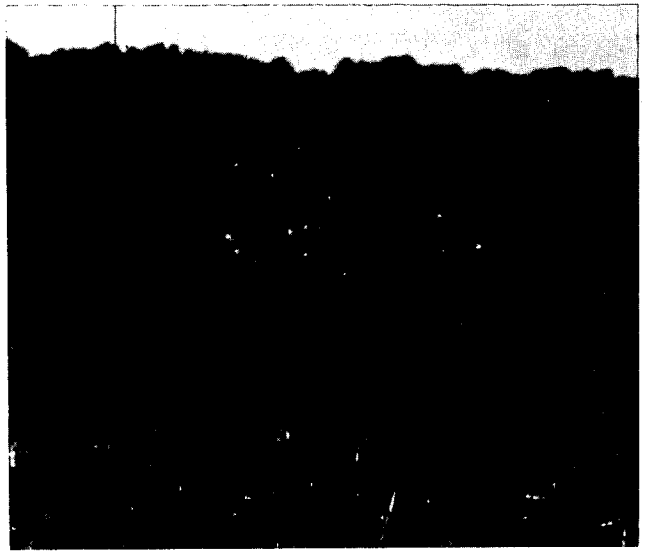
Moisture/Drought factors: Prefers moderately well-drained areas.

Sun/Shade tolerance: Prefers sunlight; poor shade tolerance.

Physical characteristics: (4 in. - 2½ ft.) grows in clumps and has a fair root system.

Sources: Commercial seed dealerships.





Timothy (grass) perennial/ introduced
Phleum pratense

Slopes: 0 - 45 degrees.

pH: Acid. **Soil types:** Loamy.

Moisture/Drought factors: Prefers well-drained to moderately well-drained areas.

Sun/Shade tolerance: Prefers full sunlight; poor shade tolerance.

Physical characteristics: (1 - 3½ ft.) bunch grass, relatively shallow fibrous root system.

Sources: Commercial seed dealerships.

Reed canarygrass (grass) perennial/ native
Phalaris arundinacea

Slopes: 0 - 45 degrees.

pH: Slightly acid. **Soil types:** Loamy.

Moisture/Drought factors: Prefers poorly-drained areas; tolerates well-drained areas.

Sun/Shade tolerance: Prefers sunlight; excellent to fair shade tolerance.

Physical characteristics: (4 - 7 ft.) sod-forming dense stands; excellent root system.

Sources: Most commercial seed dealerships.

Nutsedge (sedge) perennial/ native
Carex app.

Slopes: 0 - 60 degrees.

pH: Slightly acid to acid. **Soil types:** Loamy to sandy.

Moisture/Drought factors: Prefers moist areas.

Sun/Shade tolerance: Prefers full sunlight; poor shade tolerance.

Physical characteristics: (8 in. - 3 ft.) excellent fibrous root system.

Sources: Wilding transplants.

Legumes and other herbaceous plants help to slow raindrop impact on the soil. Their roots systems also slow surface runoff.

Yarrow/ (herbaceous plant) perennial/
Achillea millefolium introduced

Slopes: 0 - 35 degrees.

pH: All conditions. **Soil types:** Loamy to sandy.

Moisture/Drought factors: Prefers slightly moist areas.

Sun/Shade tolerance: Prefers sunlight.

Physical characteristics: (1 - 1½ ft.) fair root system.

Sources: Wilding transplants; not commercially available.

Legumes and other herbaceous plants

Crownvetch (legume) perennial/ introduced
Coronilla varia

Slopes: 0 - 90 degrees.

pH: Low-fertility; acid. **Soil types**: Clayey, loamy, and sandy.

Moisture/Drought factors: Requires well-drained soil; excellent drought tolerance.

Sun/Shade tolerance: Prefers sunlight; poor shade tolerance.

Physical characteristics: (1½ - 3 ft.) slow first year, second and third year growth produces a dense cover.

Sources: Commercial seed dealerships.

Queen Anne's lace (herbaceous plant) biennial/ introduced
Daucus carota

Slopes: 0 - 30 degrees.

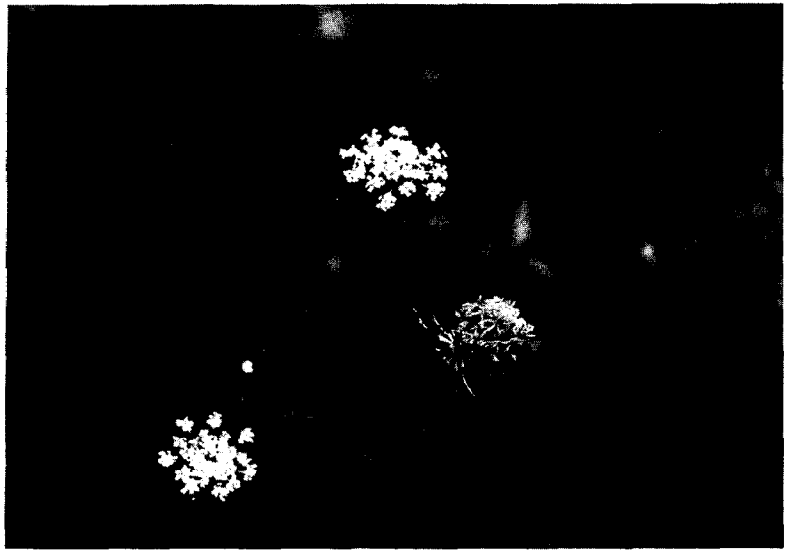
pH: Slightly acid. **Soil types**: Most conditions.

Moisture/Drought factors: Tolerates poorly drained areas.

Sun/Shade tolerance: Prefers sunlight; intolerant of shade.

Physical characteristics: (3 ft.) fair root system; produces good cover.

Sources: Wilding transplants; not commercially available.



Sweet white clover (legume) biennial/ native
Melilotus alba

Slopes: 0 - 35 degrees.

pH: Slightly acid. **Soil types:** Loamy to sandy.

Moisture/Drought factors: Prefers moist areas.

Sun/Shade tolerance: Prefers sunlight.

Physical characteristics: (2 - 5 ft.) moderately dense cover; fair root system.

Sources: Commercial seed dealerships.

Red clover (legume) perennial/ introduced
Trifolium pratense

Slopes: 0 - 60 degrees.

pH: Acid. **Soil types:** All.

Moisture/Drought factors: Tolerant of poorly-drained soils.

Sun/Shade tolerance: Intolerant of shade.

Physical characteristics: (6 - 16 in.) quick growing; gives complete cover; fair root system; may work well on steep sections.

Sources: Commercial seed dealerships.

Shrubs provide even better protection against storm impact. Their root systems extend beyond the grasses and legumes securing the deeper soils. Fallen leaves from deciduous shrubs and trees create humus, areate the soil and increase the soil fertility.

Silky/Graystem dogwood (shrub - deciduous) perennial/ native
Cornus amomun/racemosa

Slopes: 0 - 45 degrees.

pH: Medium-fertility; slightly acid.

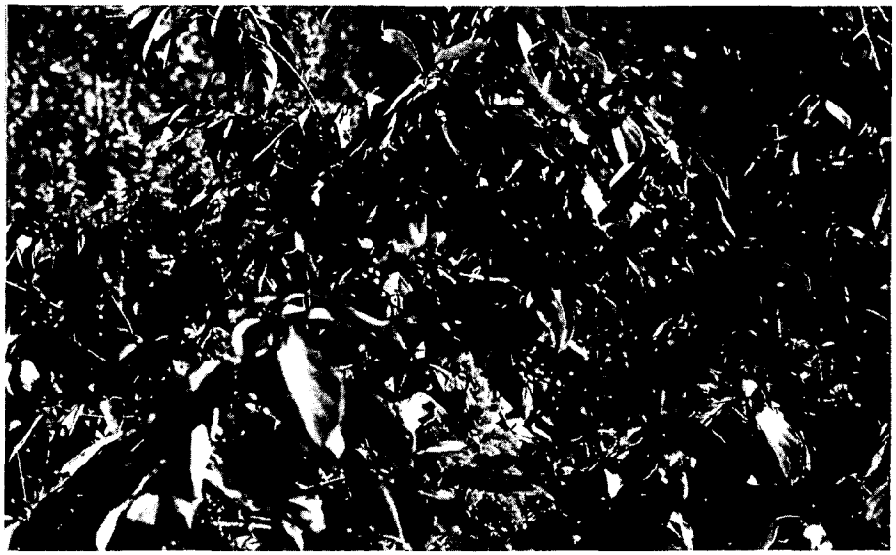
Soil types: Clayey, loamy, and sandy.

Moisture/Drought factors: Silky - tolerant of poorly-drained areas. Graystem - prefers well-drained areas. Both have fair drought tolerance.

Sun/Shade tolerance: Fair shade tolerance.

Physical characteristics: (8 - 12 ft.) excellent root system; use with a ground cover crop.

Sources: Commercial nurseries; cuttings.



Redosier dogwood (shrub - deciduous) perennial/ native
Cornus stolonifera

Slopes: 0 - 45 degrees.

pH: Medium-fertility; slightly acid. **Soil types:** Clayey, loamy, and sandy.

Moisture/Drought factors: Fair tolerance of poorly-drained areas; fair drought tolerance.

Sun/Shade tolerance: Fair shade tolerance.

Physical characteristics: (8 - 10 ft.) excellent root system; use with a ground cover crop.

Sources: Commercial nurseries; cuttings.

Halls Japanese honeysuckle (shrub - vine) perennial/ introduced
Lonicera japonica halliana

Slopes: 0 - 60 degrees.

pH: Low-fertility; acid. **Soil types:** Clayey, loamy, and sandy.

Moisture/Drought factors: Fair tolerance of poorly-drained areas; good drought tolerance.

Sun/Shade tolerance: Excellent shade tolerance.

Physical characteristics: (12 - 15 in.) excellent root system for cover of large areas; aggressive semi-evergreen vine.

Sources: Commercial nurseries; wilding transplants.

'Rem Red' Amur honeysuckle (shrub - deciduous) perennial/ introduced
Lonicera maackii

Slopes: 0 - 30 degrees.

pH: Medium-fertility; slightly acid.

Soil types: Clayey, loamy, and sandy.

Moisture/Drought factors: Fair tolerance of poorly-drained areas; fair drought tolerance.

Sun/Shade tolerance: Fair shade tolerance.

Physical characteristics: (8 - 12 ft.) fair root system; use with ground cover crop.

Sources: Commercial nurseries.

Purpleosier willow (shrub - deciduous) perennial/ introduced
salix pururea

Slopes: 0 - 40 degrees.

pH: Medium-fertility; slightly acid.

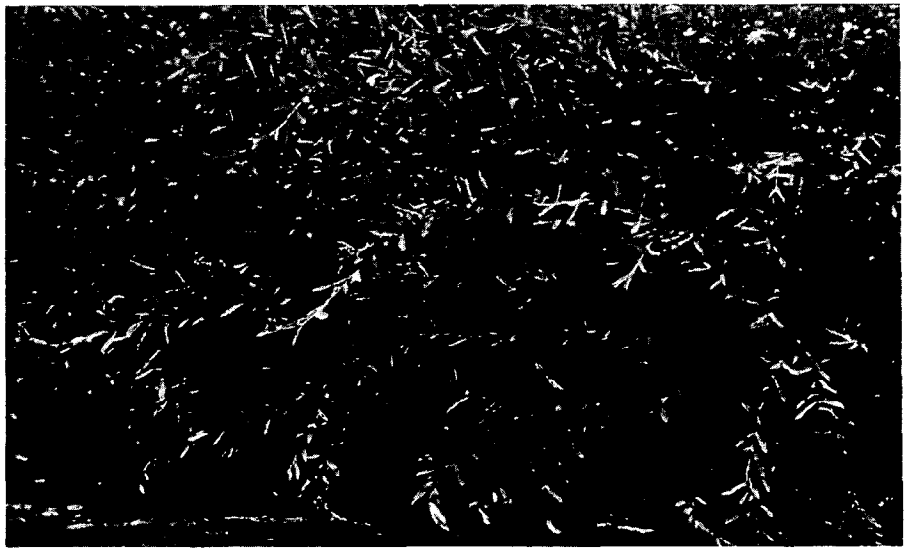
Soil types: Clayey, loamy, and sandy.

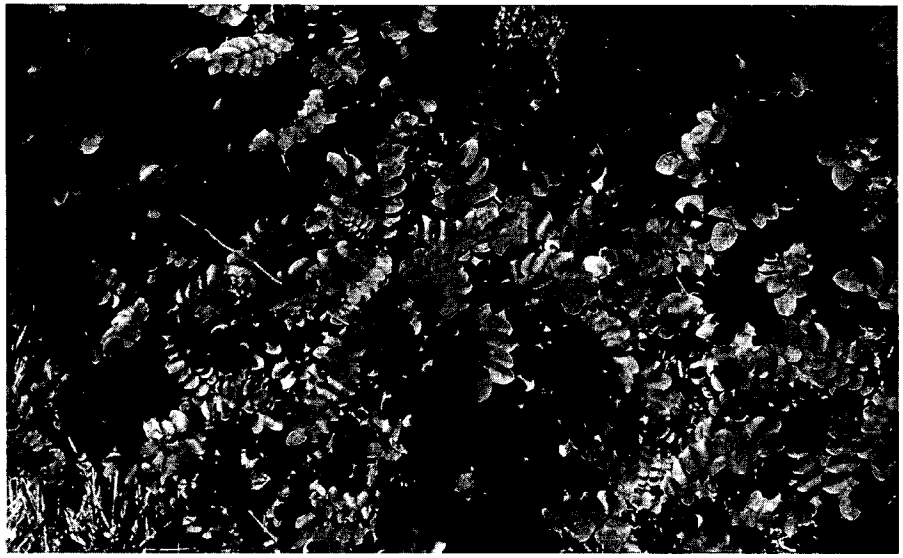
Moisture/Drought factors: Excellent tolerance of poorly-drained areas; poor drought tolerance.

Sun/Shade tolerance: Fair shade tolerance.

Physical characteristics: (20 ft.) excellent root system; use with ground cover crop.

Sources: Seedling, saplings, cuttings; available at commercial nurseries.





'Arnot' bristly locust (shrub - deciduous) perennial/ introduced
Robinia fertilis

Slopes: 0 - 75 degrees.

pH: Low-fertility; very acid. **Soil types**: Loamy and sandy.

Moisture/Drought factors: Requires well-drained areas; excellent drought tolerance.

Sun/Shade tolerance: Poor shade tolerance.

Physical characteristics: (4 - 6 ft.) forms a thicket by root suckers.

Sources: Commercial nurseries

Staghorn sumac (shrub - deciduous) perennial/ native
Rhus typhina

Slopes: 0 - 60 degrees.

pH: Medium-fertility; slightly acid. **Soil types**: Loamy.

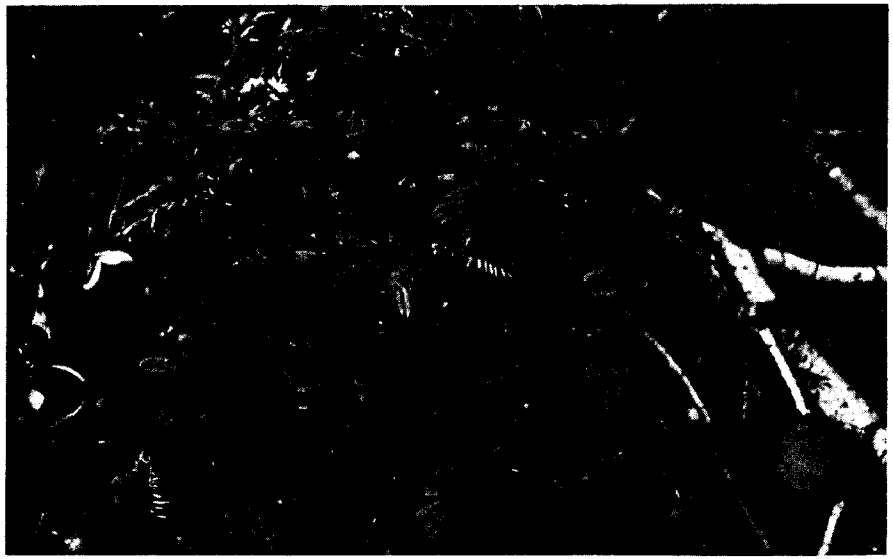
Moisture/Drought factors: Tolerates moderately well-drained areas; fair drought tolerance.

Sun/Shade tolerance: Intolerant of shade.

Physical characteristics: (10 - 15 ft.) fair root system; use with a ground cover crop.

Sources: Commercial nurseries.

Trees have roots which may grow deep into the soil layers to secure and reinforce the bluff. Through evapotranspiration the trees and shrubs remove excess soil moisture. Direct storm impact is also reduced by trees.



Black locust (tree - deciduous) perennial/ native
Robinia pseudo-acacia

Slopes: 0 40 degrees and bluff crests.

pH: Slighily acid. **Soil types**: Loamy, sandy.

Moisture/Drought factors: Tolerates dry to moderately well-drained soils.

Sun/Shade tolerance: Shade tolerant.

Physical characteristics: (70 - 80 ft.) extensive root system; plant with ground cover crop.

Sources: Commercial nurseries.

Hybrid poplar (tree - deciduous) perennial/ introduced
Populus spp.

Slopes: All conditions.

pH: All conditions. **Soil types**: All conditions

Moisture/Drought factors: Tolerant of poorly drained areas.

Sun/Shade tolerance: Prefers sunlight.

Physical characteristics: Excellent root system; use with a ground cover crop.

Sources: Seedling and saplings, available at all commercial nurseries.

Black alder (tree - deciduous) perennial/ introduced
Alnus glutinosa

Slopes: 0 - 30 degrees.

pH: Low-fertility, acid. **Soil types:** Loamy, sandy.

Moisture/Drought factors: Prefers moderately well-drained areas.

Sun/Shade tolerance: Prefers sunlight; poor shade tolerance.

Physical characteristics: (50 ft.; 15 ft. on bluffs) excellent root system; use with ground cover crop.

Sources: Commercial nurseries.

White ash (tree - deciduous) perennial/ native
Fraxinus americana

Slopes: 0 - 40 degrees.

pH: Slightly acid. **Soil types:** Clayey, loamy, and sandy.

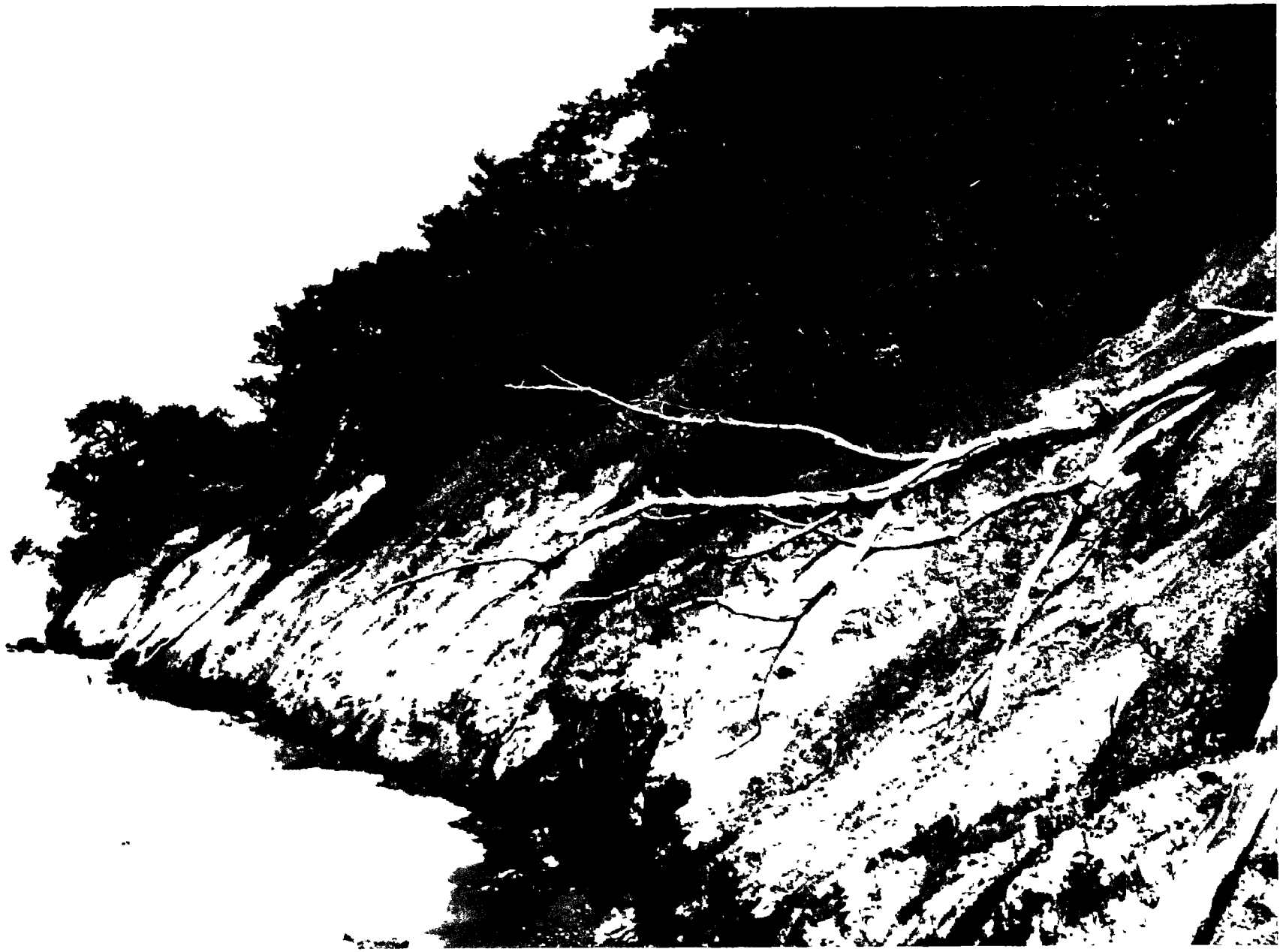
Moisture/Drought factors: Tolerates poorly drained areas.

Sun/Shade tolerance: Prefers sunlight; fair shade tolerance.

Physical characteristics: (70 - 80 ft.) excellent root system; use with ground cover crop.

Sources: Commercial nurseries.

Index to plants



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References

Erie County Conservation District

R.D. 5 • ROUTE 19 • WATERFORD, PA. 16441 PHONE (814) 796-4203

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Issued 1986