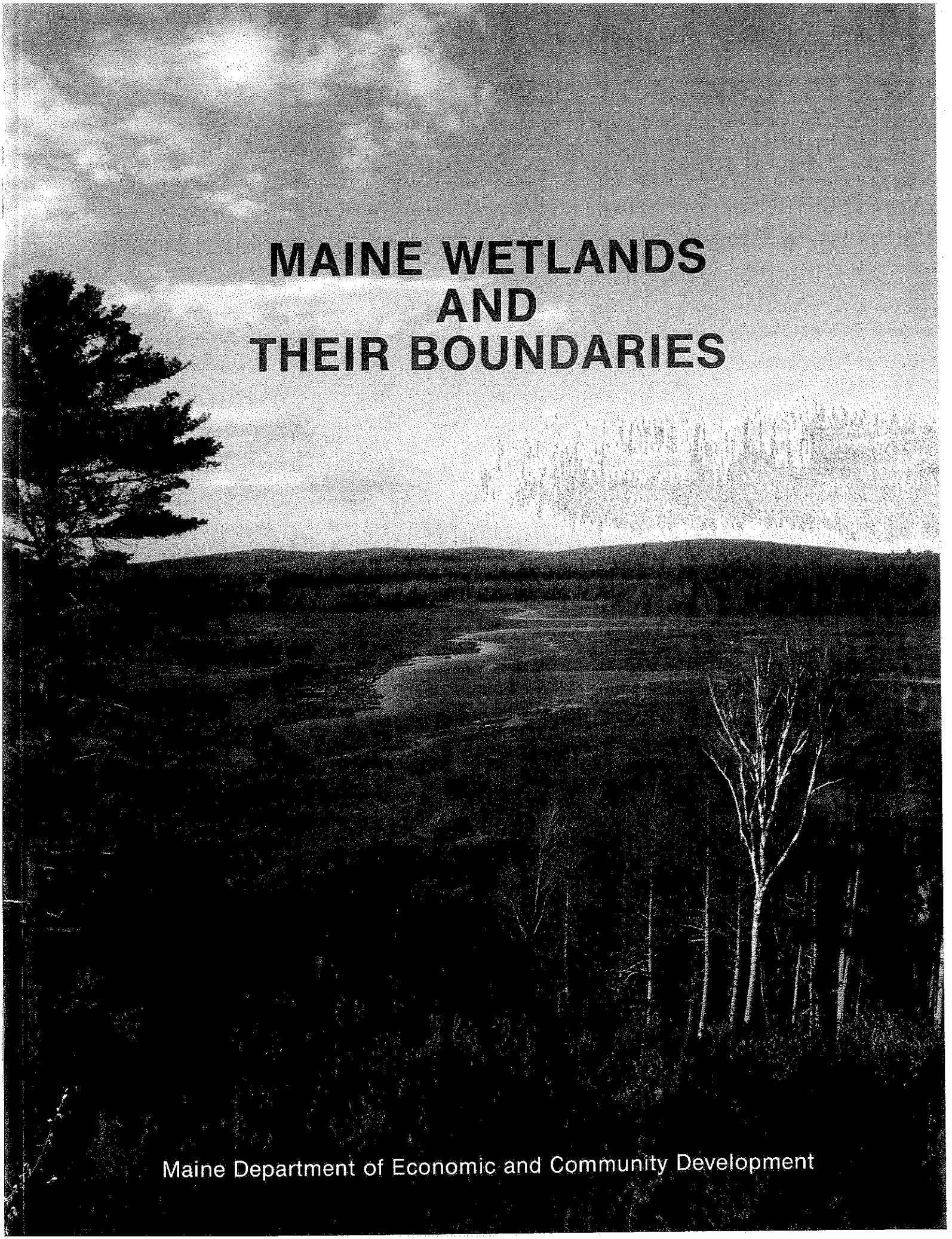

MAINE WETLANDS AND THEIR BOUNDARIES

Maine Department of Economic and Community Development

MAINE WETLANDS AND THEIR BOUNDARIES: A GUIDE FOR CODE ENFORCEMENT OFFICERS

by

Ralph W. Tiner

Prepared for the
STATE OF MAINE
Department of Economic and Community Development
Office of Community Development
Augusta, Maine

June 1994
Revised Edition

Prepared by
Institute for Wetland & Environmental
Education & Research
Sherborn, Massachusetts

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Note: Color plates of hydrology indicators, wetland communities, and soils are located between pages 8 and 9.

ACKNOWLEDGMENTS

The Office of Community Development's Code Enforcement Training Program has recognized the need to train local officials to administer the Mandatory Shoreland Zoning Act and to be adequately informed about other State and Federal wetland protection regulations. The development of this guidebook represents a major part of this training effort to make the laws more understandable and to specifically provide code enforcement officers with a basic tool to help them identify and delineate Maine wetlands subject to these laws and regulations.

Many individuals contributed to the successful completion of this guidebook. Linda J. Butler (Office of Community Development) conceived the need for this type of field guide, directed the project, and coordinated reviews of the draft manuscript to insure that it would meet the needs of code enforcement officers and others with similar interests. Susan Gawler (Maine Natural Heritage Program) provided the benefit of her botanical expertise and recommended the inclusion of numerous plants under similar species to insure the book's utility in the field for plant identification. Lauren Stockwell also provided comments for expanding the plant identification section for this revised edition. David Rocque (Maine Soil and Water Conservation Commission) reviewed the guidebook for its content and coverage of Maine's hydric soils. He also provided additional input for this revised edition, especially on Folists and current criteria for recognizing hydric soils and drainage classes in Maine. Norm Kalloch and Kenny LaFlamme (U.S.D.A. Soil Conservation Service) also reviewed the hydric soils section. John DelVecchio provided his insight into the needs for the book. Rick Rogers and David Kalloch (code enforcement officers) also helped in assessing the level of training needed to make field determinations of wetlands. Abigail Rorer prepared the line drawings of the plants. Barbara Tiner typed the manuscript and coordinated production of the guidebook. I gratefully acknowledge the assistance of these people.

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A Field Guide to Coastal Wetland Plants of the Northeastern United States by Ralph W. Tiner, Jr., drawings by Abigail Rorer (University of Massachusetts Press, Amherst 1987), copyright (c) 1987 by , Ralph W Tiner, Jr. - Figures 2, 6, and 7; Illustrations for Species 1-6,8-15, 25, 30, 31, 42a, 56, 90, and 97a.

Hydric Soils of New England by Ralph W. Tiner, Jr. and Peter L M. Veneman, drawings by Elizabeth Scott (University of Massachusetts Cooperative Extension, Amherst 1987) Figure 8.

Photo credits are given beneath the photos. I wish to thank the photographers for the use of their photos and offer special thanks to Macbeth Division of Kollmorgen Instruments Corporation for permission to print copies of two of their soil color charts.

INTRODUCTION

Wetlands are important natural resources that yield many benefits for the citizens of Maine. These wet environments are vital habitats for many fish and wildlife species that provide food, hunting and fishing opportunities, other outdoor recreation, and economic benefits to Maine residents, and also provide a basis for local tourism. Wetlands serve as nursery and spawning grounds for coastal fishes and shellfish and freshwater fishes, feeding and resting areas for migratory shorebirds, nesting grounds for waterfowl and other waterbirds (such as herons and bitterns), homes for muskrat, beaver and otter, feeding areas for black bear, winter yards for deer and moose, and critical habitats for many rare or endangered plants and animals, for example. Wetlands produce fuelwood and timber, products important to Maine's economy. In addition, wetlands provide other valuable functions that help protect private property from flood damages or help preserve the quality of Maine waters. Wetlands temporarily store flood water and slowly release it downstream, thereby reducing flood flows and peaks. Wetland soils and vegetation help remove impurities from water, reduce sediment and nutrient loads, and bind soil to help prevent erosion. The position of wetlands between uplands and waterbodies greatly facilitates their flood protection and water quality maintenance functions. These and other functions make wetlands valuable resources. Maine is blessed with an abundance of wetlands, with perhaps as much as 25 to 30 percent of the State covered by these wet habitats.

To help maintain their current values and protect wetlands for future generations, the Federal government and the State of Maine have established laws to restrict certain uses of wetlands, mainly regulating the filling or dredging of wetlands, that destroy or severely diminish wetland values. These laws define wetlands by certain hydrologic (wetness) conditions.

Definition of Wetlands

The State of Maine has adopted the following wetland definitions:

- ***Freshwater Wetlands.*** Freshwater swamps, marshes, bogs, and similar areas which are:

  A. Of 10 or more contiguous acres, or of less than 10 contiguous acres and adjacent to a surface water body, excluding any river, stream or brook, such that in a natural state, the combined surface area is in excess of 10 acres; and

  B. Inundated or saturated by surface or ground water at a frequency and for a duration sufficient to support, and which under normal circumstances do support, a prevalence of wetland vegetation typically adapted for life in saturated soils.
- ***Coastal Wetlands.*** All tidal and subtidal lands, including all below any identifiable debris line left by tidal action; all areas with vegetation present that is tolerant of salt water and occurs primarily in a salt water or estuarine habitat; and any swamp, marsh, bog, beach, flat or other contiguous lowland which is subject to tidal action during the maximum spring tide level as identified in tide tables published by the National Ocean Service. Coastal wetlands may include portions of coastal sand dunes (38 M.R.S.A. Sec. 480-B(2)).

These definitions require that wetlands must be wet enough to support vegetation adapted for life in saturated soils or must be periodically flooded by tidal waters. Wetland identification generally involves being able to identify three features: (1) hydrophytic vegetation, (2) hydric soils, and (3) signs of wetland hydrology. The Federal government has developed a technical manual for wetland identification and delineation, *Federal Manual for Identifying and Delineating Jurisdictional Wetlands.* The State of Maine has adopted the delineation procedures described in this manual for implementing its wetland protection program under the Natural Resources Protection Act.

Purpose and Organization of this Guide

The Office of Community Development, within the Department of Economic and Community Development, is responsibile for providing training to code enforcement officers within the State of Maine. These officials are responsible for, among other things, the enforcement of State Mandatory Shoreland Zoning and should know about other wetland protection rules and ordinances. The ability to recognize wetlands and generally delineate their boundaries is necessary to ensure adequate enforcement of these laws. This guidebook was written as a training aid and reference source for local enforcement officials to help them meet the demands placed upon them. It in-

cludes discussions of both tidal and nontidal wetlands covering their major plants, soils, and signs of hydrology. A key to identifying common wetland plants selected for this guidebook is included along with brief descriptions and illustrations of these species. In addition, a discussion of wetland identification and boundary delineation is presented along with a stepwise procedure for conducting field inspections. This guide is not highly technical nor comprehensive in its coverage of plants, soils, hydrology, or wetland delineation methods. It does, however, provide practical guidance for identifying and delineating wetlands in Maine. It can be used by local code enforcement officers to make preliminary field decisions and serves to aid office review of project plans.

This guidebook is divided into five sections: (1) Wetland Hydrology, (2) Wetland Plants, (3) Hydric Soils, (4) Wetland Identification and Delineation, and (5) Other Sources of Information. Color plates of some examples of Maine's wetlands, signs of hydrology, and hydric and nonhydric soils are included.

WETLAND HYDROLOGY

Wetlands form in areas subject to periodic tidal flooding or other areas where water is present for extended periods (usually for seven or more consecutive days) during the growing season (Figure I) and for longer periods during the nongrowing season. Water usually comes from rainfall, snowmelt, a rising water table, groundwater seepage, or incoming tides. Water may be present on the surface of wetlands for varying periods, as in flooded or ponded wetlands, or it may simply keep the underlying soils saturated near the surface with no surface water present. Prolonged saturation in the root zone of plants creates an environment that limits the growth of most plants and favors hydrophytes.

Wetland Hydrology Definition

To be designated as wetland, an area must be wet at or near the surface for a significant period in most years. **"Wetland hydrology" may be generally defined as:**

- **inundation (flooding or ponding) for one week or more during the growing season in most years; or**
- **saturation at or near the surface for more than two weeks during the growing season in most years; or**
- **periodic flooding by the tides in most years.**

These conditions promote the formation of hydric soils and the establishment of wetland (hydrophytic) vegetation. An accurate assessment of hydrology requires extensive knowledge of fluctuations in water levels or the water table. This can only be gained through intensive and long-term studies. Hydrologic records from tide or stream gauging stations may be available for many areas from the U.S. Geological Survey, U.S. Army Corps of Engineers, and various state and local agencies. There are, however, several reliable ways to recognize differences in hydrology in the field. At certain times of the year, such as during spring runoff or at high tide along the coast, wetland hydrology is obvious as rivers overflow adjacent floodplains or as tides flood coastal marshes. At other times or in other wetlands, such stark evidence is often lacking, but other indicators may be detected. The following discussion contains a brief overview of wetland hydrology in tidal and nontidal areas and presents helpful hints on how to recognize signs of wetland hydrology in the absence of standing water or soggy ground.

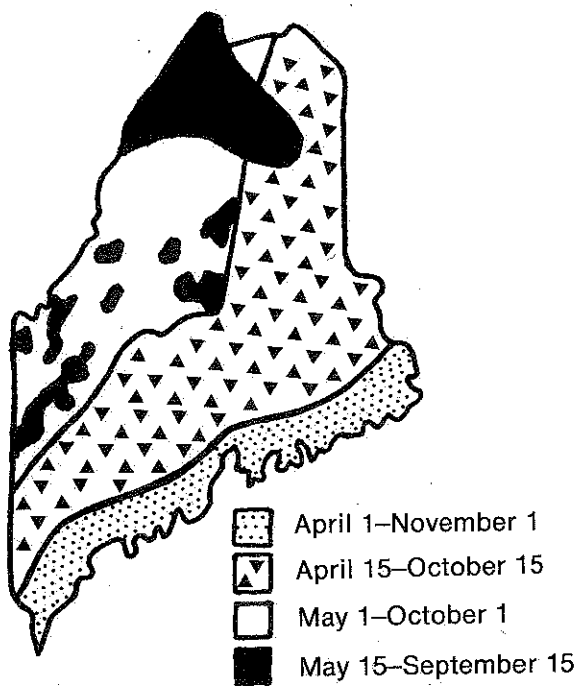


Figure 1. Generalized growing season map of Maine. (Data derived from U.S.D.A. Soil Conservation Service)

Tidal Wetland Hydrology

In coastal areas, ocean-driven tides are the dominant hydrologic feature of wetlands. Along the Atlantic coast, tides are semidiurnal and symmetrical with a period of 12 hours and 25 minutes. In other words, there are roughly two high tides and two low tides each day. Since the tides are largely controlled by the position of the moon relative to the sun, the highest and lowest astronomic tides (i.e., "spring tides") usually occur during full and new moons. Coastal storms (e.g., "Northeasters") cause the most extreme high and low tides and may even on occasion inundate adjacent nonwetlands (uplands). Tides in Maine are quite high relative to the rest of the eastern United States. The mean tidal range is 20 feet in the St. Croix River at Calais and 10.5 feet in Frenchman Bay at Bar Harbor.

Differences in tidal flooding create two readily identifiable zones in coastal wetlands (Figure 2):

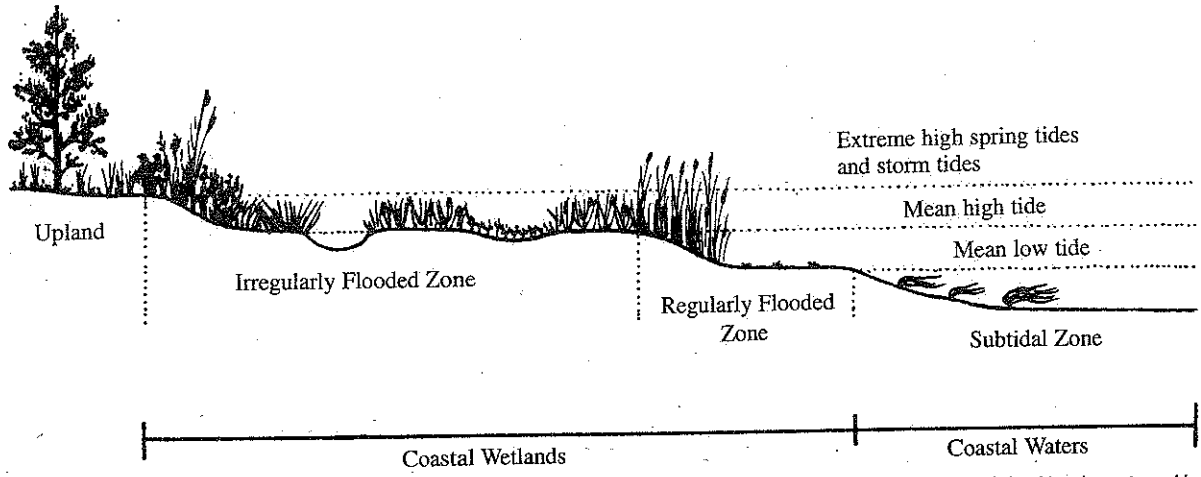


Figure 2. Hydrology of coastal or tidal wetlands. (Source: *A Field Guide to Coastal Wetland Plants of the Northeastern United States*, Tiner 1987)

(1) ***regularly flooded zone*** - alternately flooded and exposed at least once daily by the tides, includes both the "low marsh" and intertidal mud, sand, or cobble-gravel flats;

(2) ***irregularly flooded zone*** - above the regularly flooded zone, the "high marsh" is less frequently flooded by the tides (less than once a day), and is exposed to the air for variable periods, and usually flooded only for brief periods, but may be saturated near the surface during each high tide; most of the high marsh is flooded during spring tides; the upper margins of the high marsh may be flooded only during storm tides which are more frequent in winter.

Estuarine plants have adapted to these differences in hydrology and certain plants are good indicators of the two zones. The tall form of smooth cordgrass (about 4 to 6 feet high) has been shown to be a reliable indicator of the regularly flooded zone, whereas other salt marsh plants characterize the irregularly flooded zone.

Nontidal Wetland Hydrology

Nontidal wetlands, by definition, lie above the reach of ocean-driven tides, and they are virtually all freshwater wetlands in Maine. They receive their water mainly from surface water runoff, groundwater discharge, and direct precipitation (Figure 3). Surface water runoff from the land either collects in isolated depressions surrounded by upland, or overflows from rivers and lakes after snowmelt and heavy rainfall periods. By contrast, ground water discharges into many depressional wetlands or into sloping wetlands in "spring" or "seepage" areas. In other cases, water may be perched above a confining layer in the soil, saturating the soil above it, and sometimes causing rainwater to pond on the surface for extended periods. Thus, hydrologic conditions vary from one wetland to another. Some wetlands receive only surface water runoff, while others are groundwater-fed. Most wetlands, however, receive water from both sources.

Freshwater rivers and streams in Maine usually discharge the greatest volumes in winter and spring. During April and May, flooding is heaviest despite relatively uniform rainfall throughout the year. Such flooding is associated with snowmelt and spring rains. In summer, less water is available for runoff due to high evaporation, active uptake by plants, and interception of rainfall by plant leaves.

Water table fluctuations follow a similar pattern (Figure 4). From winter to spring or early summer, the water table is usually at or near the surface in most Maine wetlands. During this time, water may be present on the wetland surface for variable periods. In May or June, the water table usually begins to drop, typically reaching its low point in September or October. Most of the daily (short-term) fluctuation in the water table relates to rainfall patterns, while longer days, increasing air temperatures, increasing evaporation and water utilization by plants, and other factors are responsible for the consistent lowering of the water table from spring through summer.

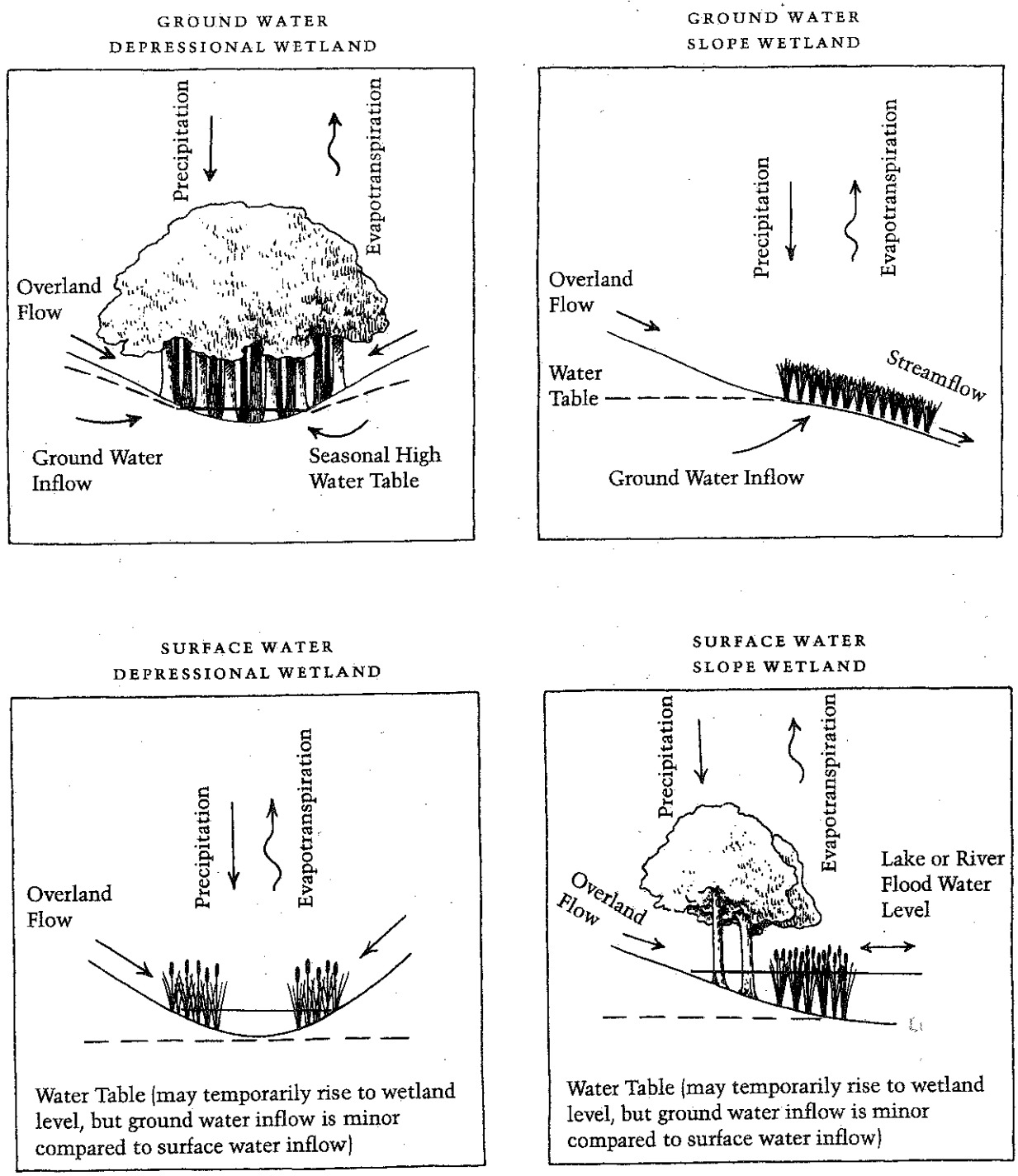


Figure 3. Hydrology of surface water and ground water wetlands. (Source: Adapted from *Hydrology of Wisconsin Wetlands*, Novitski 1982)

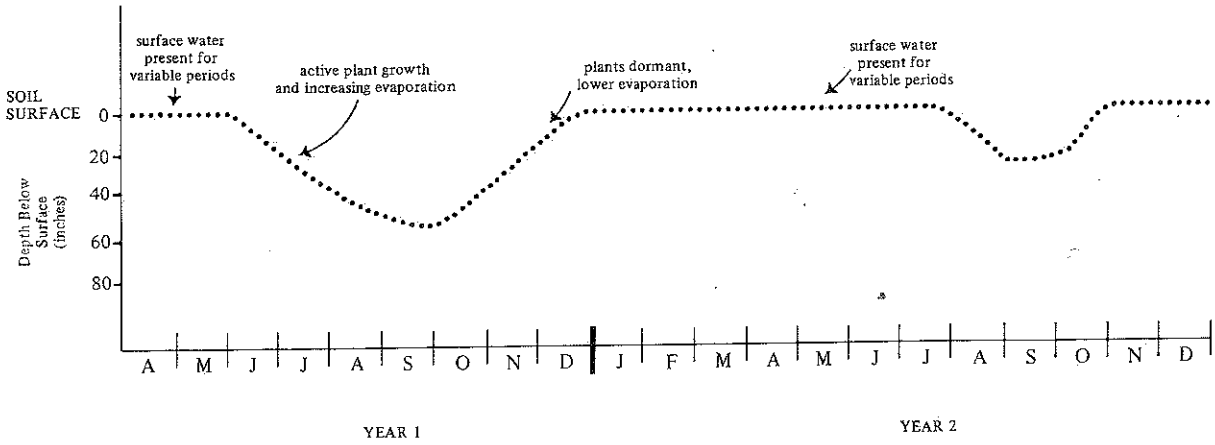


Figure 4. Water table fluctuations in a hypothetical seasonally flooded nontidal wetland. In general, the water table is at or near the surface through the winter and spring, then drops markedly in summer and begins to rise in the fall after plants become dormant. The water table fluctuates constantly - daily, seasonally, and annually. (Source: Adapted from *Water Table Fluctuations in Periodically Wet Soils of Central New England*, Lyford 1964)

Flooded Wetland Types

Standing water may be present in depressional, streamside, or lakefront wetlands for variable periods during the growing season, late fall, and winter (as ice). Four types of flooded wetlands are characterized by differences in the duration of standing surface water:

(1) ***temporarily flooded wetlands*** - surface water is present for brief periods (usually less than two consecutive weeks) during the growing season and during the summer the water table may be three feet or more below the surface; these wetlands are common along floodplains of major rivers;

(2) ***seasonally flooded wetlands*** - surface water is present for longer periods (usually more than two weeks) during the growing season and by summer, surface water is usually absent; if the water table remains at or very near the surface in summer, the wetland's water regime is considered *seasonally flooded/saturated*;

(3) ***semipermanently flooded wetlands*** - surface water is present throughout the growing season in most years; only during droughts or other extended dry period is surface water absent, yet the water table usually remains at or very near the surface at these times;

(4) ***permanently flooded wetlands*** - surface water is present throughout the growing season and nongrowing season in all years except those of the most extreme droughts; these wetlands are the wettest and include open shallow water zones (less than 6.6 feet at low water) of lakes, ponds, rivers, and streams.

Saturated Wetland Types

Other nontidal wetlands rarely have surface water present, yet their soils or substrates are saturated for much of the growing season. Three types of saturated wetlands may occur in Maine:

(1) ***floating wetlands*** - bog vegetation may extend as floating mats into deep waters of lakes and great ponds; the vegetation mat is never flooded, but rises and falls with fluctuating water levels, yet its peaty substrate remains saturated throughout the year;

(2) ***seepage wetlands*** - in sloping areas where ground water discharges to the land surface, the soil remains saturated for prolonged periods of the growing season ("seasonal seeps") or for the entire season ("permanent seeps"), yet water flows continuously downslope and does not collect on the ground surface;

(3) ***perched water table wetlands*** - in relative flat areas with a subsurface confining layer in the soil, a seasonal water table may be "perched" on top of the confining layer (hardpan, clay layer, or dense basal till); the high water table occurs from mid- to late fall into late spring or early summer, and by mid-summer, water cannot usually be observed; these are among the most difficult wetlands to identify.

How to Recognize Wetland Hydrology

Direct Evidence of Water

Obvious signs of wetland hydrology are usually found in the spring in nontidal areas, since this is the wettest part of the growing season. For tidal areas, wetland hydrology is most apparent at high tides and spring tides, yet saturated soils may usually be observed at other times. Obvious signs of hydrology include:

(1) ***the presence of water on the land surface***;

(2) ***soggy soils saturated to the surface***;

(3) ***water near the surface*** - within 12 inches of the soil surface in nonsandy soils or within 6 inches in sandy soils.

When flooded or saturated to the surface, wetland hydrology is easily recognized. In other cases, you must dig a hole and look for free water standing in the hole or for water seeping in from some point above the bottom of the hole. Sometimes water can only be squeezed or shaken from a soil sample taken near the surface. Not all areas of observed flooding or soil saturation are wetlands. For example, an extreme flooding event, such as a 50- or 100-year flood, may pose a problem in identifying wetlands, since low-lying uplands within the 50- or 100-year floodplain will be underwater at these times. Wetland determinations should not be made during these times for obvious reasons. Also, areas that are only saturated near the surface during winter and/or for short periods (less than one week or two) during the growing season are usually not wetlands.

Field work is usually performed in spring, summer, and fall, although winter work also occurs, especially in the occasional absence of snow cover in certain areas. When out in the field, keep in mind the normal fluctuations of the water table throughout the year, as shown in Figure 4. Depending on the time of year, the water table will be high, low, falling, or rising. Various signs of hydrology are discussed below.

Indirect Evidence of Water

Water is absent from many wetlands during the growing season; therefore, other signs of wetland hydrology must be found. Prolonged inundation or saturation leaves "markers" in the soil or vegetation or on the ground, including:

(1) ***signs left on the ground or above ground***:

- water-stained or silt-covered leaves and stems (e.g., trunks of trees and shrubs);
- water-carried branches and twigs collected as "drift lines" around the bases of trees and other vegetation;
- water-carried dead plant stems deposited as "tidal wrack" in coastal marshes;
- other water-carried debris deposited in branches of trees or shrubs well above the ground;
- recent water-borne deposits of sand or silt on the ground surface;
- natural drainage channels (evidence of intermittent streams) through the area;
- water level marks on the bridge abutments.

(2) ***vegetative indicators of wetland hydrology***:

- obligate wetland plants;
- plant adaptations or responses to significant inundation and/or saturation (Table 1).

(3) ***signs of significant saturation in the soil***:

- mucky or peaty soils;
- orangish stains along the channels of living roots (oxidized rhizospheres) in soils with a gleyed (grayish) subsoil - a response or adaptation of many plants living in anaerobic (oxygen-deficient) soils;
- sulfidic odor (smell of rotten eggs).

Some examples of these hydrology indicators are illustrated in Plates 1-8.

Table 1. Structural adaptations or responses of plants to growing in periodically flooded and/or saturated soils.

Adaptation/Response	Examples of Plants Possessing Feature
Multiple Trunks	Red Maple, Silver Maple, and Speckled Alder
Adventitious Roots (arising from stem above ground)	Black Willow and Green Ash
Shallow Roots* (often exposed at ground surface)	Red Maple, Yellow Birch, White Pine, Black Spruce, and Eastern Hemlock
Aerenchyma (air-filled "spongy" tissue) in Roots and Stems	Giant Bur-reed, Cattails, Soft Rush, Soft-stemmed Bulrush, and Smooth Cordgrass

**Note: Root systems of trees may also be exposed in rocky nonwetland areas and along trails through the woods where soil erosion is significant.*

Certain species of plants are reliable indicators of various water regimes, while many plants (e.g., red maple and soft rush) are wide-ranging and capable of growing under a variety of hydrologic

conditions. Table 2 lists several examples of useful indicator plant species for predicting the hydrology of different nontidal wetlands.

Table 2. Examples of plant indicators of nontidal water regimes in Maine. These plants are generally reliable indicators, but exceptions will occur. When using plants to determine water regime, be careful not to confuse those listed with similar species resembling them.

Water Regime	Indicator Plants
Permanently Flooded	White Water Lily, Pondweeds, and Water Shield
Semipermanently Flooded	Giant Burreed, Pickerelweed, and Hard-stemmed Bulrush
Seasonally Flooded	Marsh Fern, Bluejoint, False Hellebore, Marsh Marigold, Blue Flag, Skunk Cabbage, Tussock Sedge, Swamp Rose, Speckled Alder, and Common Winterberry
Permanently Saturated	Leatherleaf, Bog Laurel, Bog Rosemary, Labrador Tea, Pitcher-plant, Sundews, Black Spruce, and Larch
Temporarily Flooded	Silver Maple and Ostrich Fern

Evidence of soil saturation can be detected even during low water periods by examining properties of the underlying soil provided the area's hydrology has not been significantly altered. Certain soil properties that are the direct result of wetland hydrology can, therefore, be used as indicators of wetland hydrology (see section on hydric soils).

In summary, wetland hydrology can be documented by:

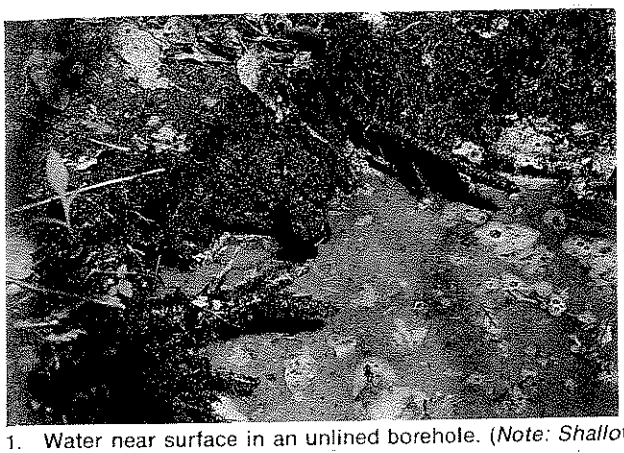
(1) *consultation of available hydrologic records*;

(2) *observation of surface water, soil saturated at or near the surface, water or silt marks, water-stained leaves, water-deposited debris, and oxidized rhizospheres*;

(3) *the presence of plants that are highly adapted to wetlands and/or possess specific structural adaptations or responses to wetland hydrology*; or

(4) *certain soil properties caused by excess wetness.*

A wetland does not have to have standing water or saturated soils visible at all times, but usually other signs of wetland hydrology are present to provide indirect evidence of inundation and/or saturation for sufficient frequency and duration.



R.Tiner

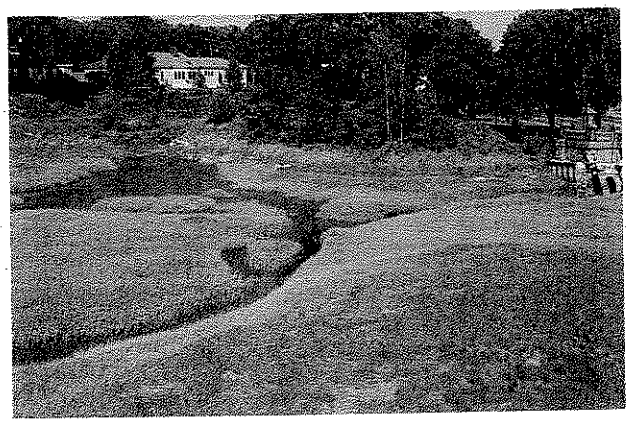
1. Water near surface in an unlined borehole. (*Note: Shallow roots.*)

R.Tiner

2. Oxidized rhizospheres around root - a response by plants living in anaerobic soils.

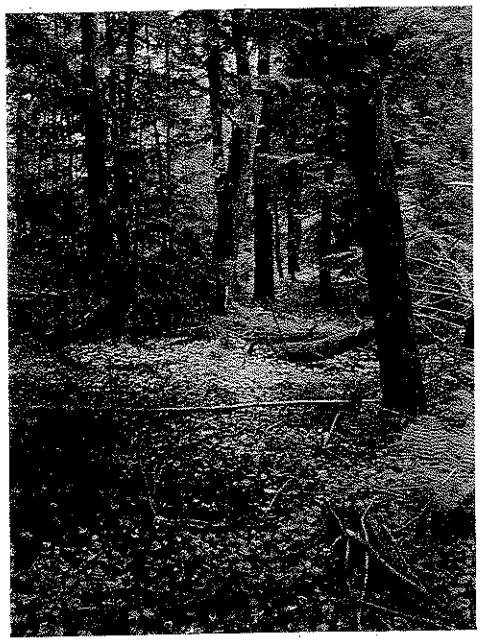
R.Tiner

5. Silt line on trees indicates recent flood level.



R.Tiner

7. Silt-covered salt marsh vegetation indicates recent tidal flooding. (*Note: Tidal wrack in foreground.*)



R.Tiner

3. Pit and mound landscape with wet depressions.

R.Tiner

4. Close-up of water-stained leaves.

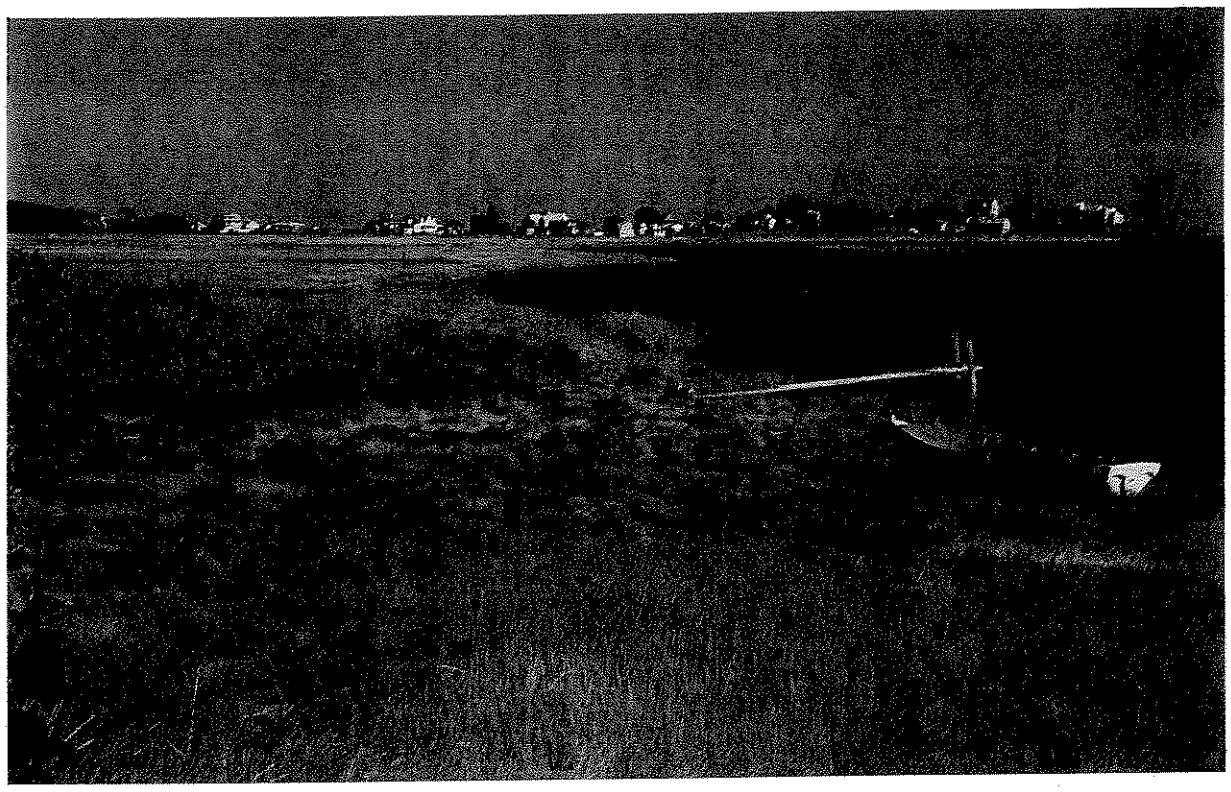
R.Tiner

6. Close-up of drift line (water-deposited debris).

R.Tiner

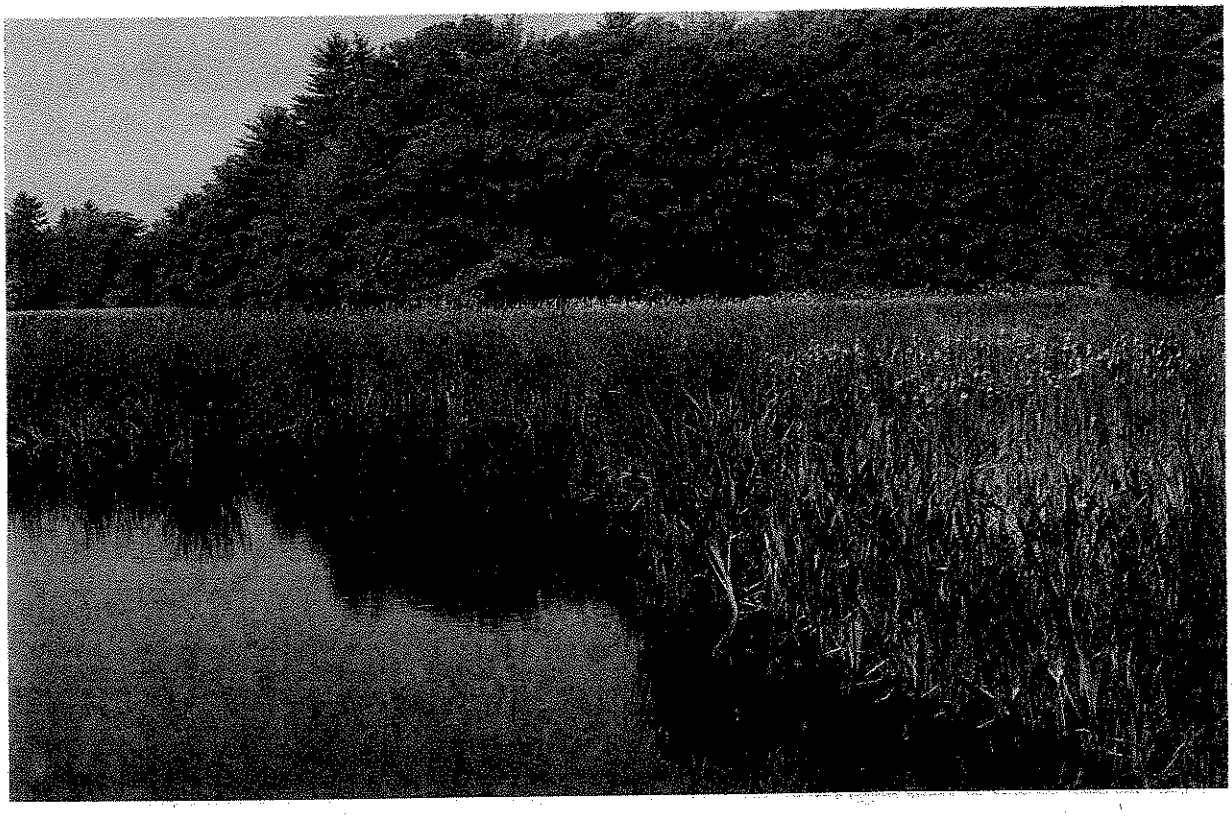
8. Close-up of tidal wrack - vegetative debris left by a recent high tide.

WETLAND HYDROLOGY INDICATORS (Plates 1–8)



R.Tiner

9. Salt Marsh.



R.Tiner

10. Cattail Marsh.

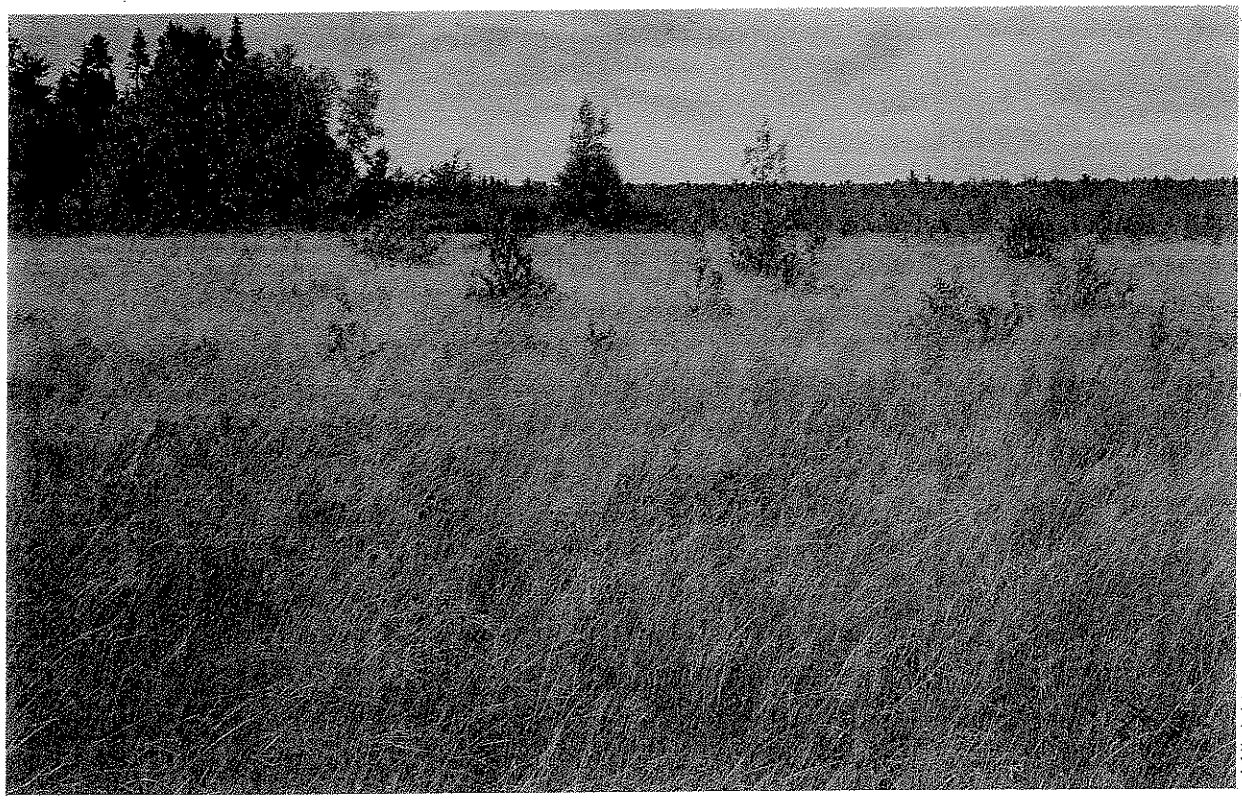
WETLAND PLANT COMMUNITIES (Plates 9–19)

R.Tiner

11. Inland Marsh.

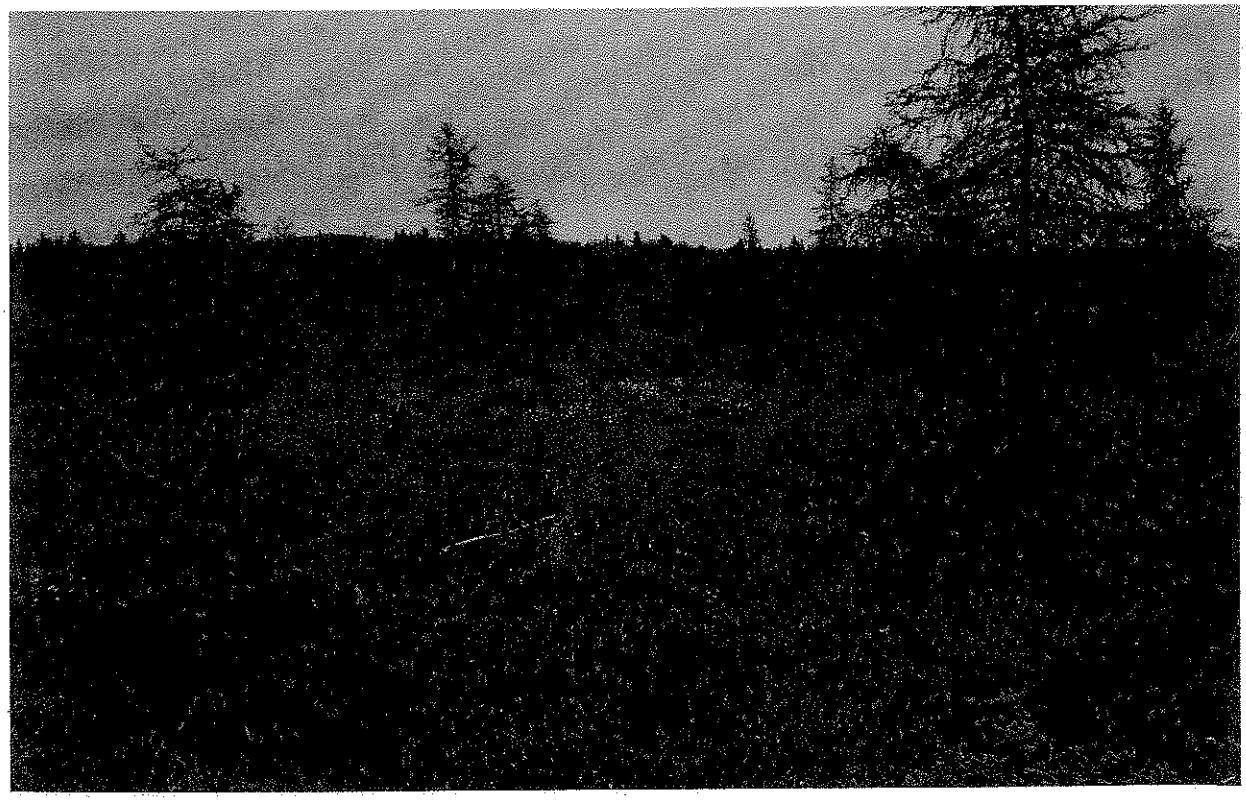
R.Tiner

12. Sedge Meadow.



J.Albright

13. Calcareous Fen.



R.Tiner

14. Shrub Bog.

R.Tiner

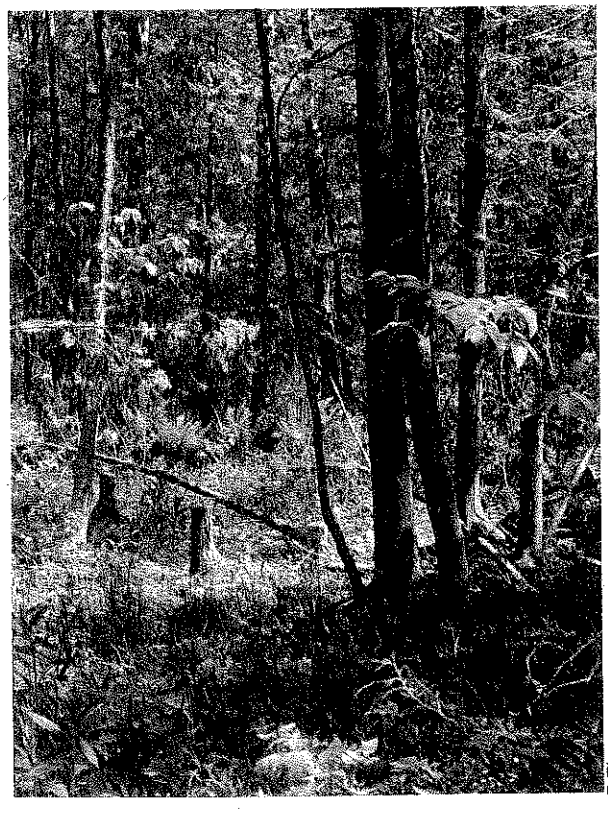
15. Buttonbush Shrub Swamp.

J.Albright

16. Deciduous Forested Swamp.

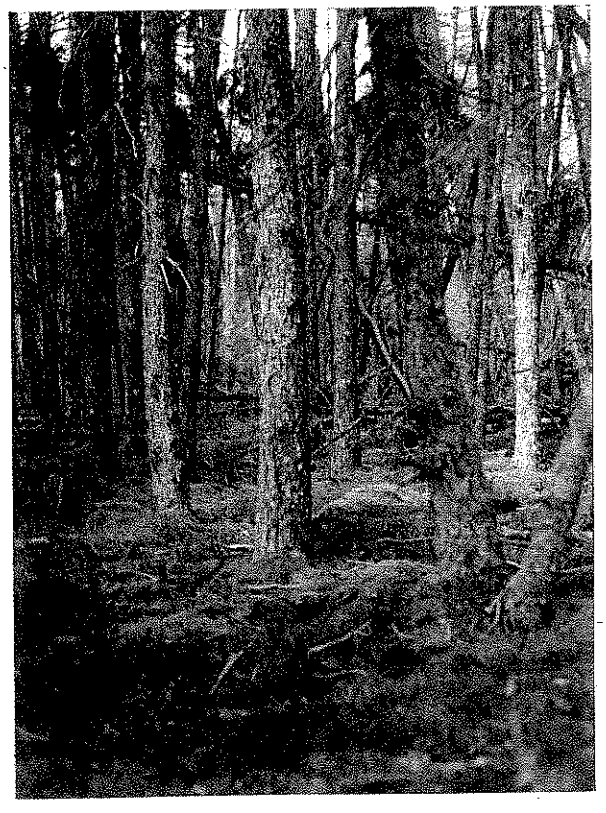
G.Smith

17. Black Spruce Bog (background) and Sedge Meadow.



R.Tiner

18. Northern White Cedar Swamp.

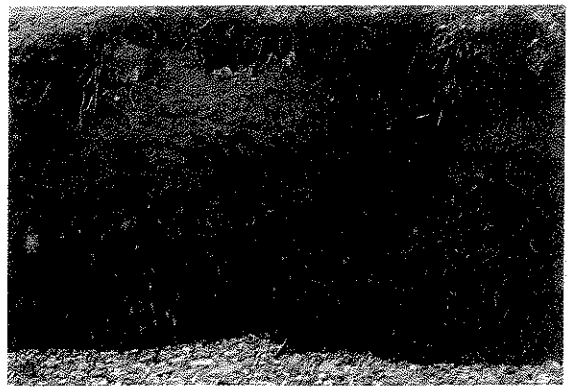


J.McMahon

19. Larch Swamp.

R.Tiner

20. Organic soil - muck. (*Carlisle series.*)



G.Smith

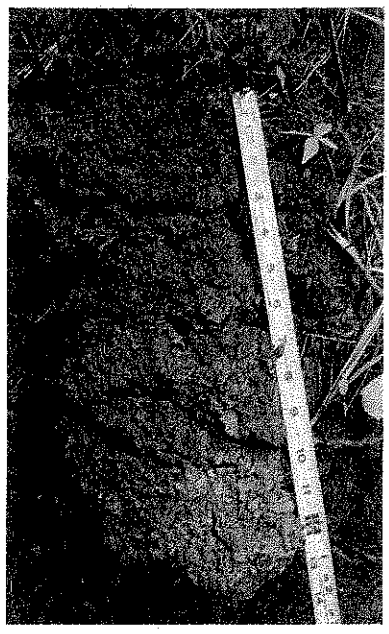
21. Organic soil - peat.

R.Tiner

22. Hydric mineral soil with gleyed subsoil. (*Biddeford series - taxadjunct.*)

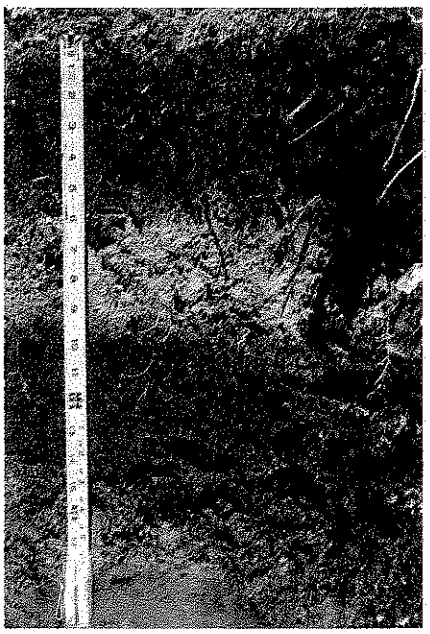
R.Tiner

23. Low chroma matrix with bright mottles.



R.Tiner

24. Poorly drained hydric soil with low chroma matrix at 12 inches. (*Scantic series.*)



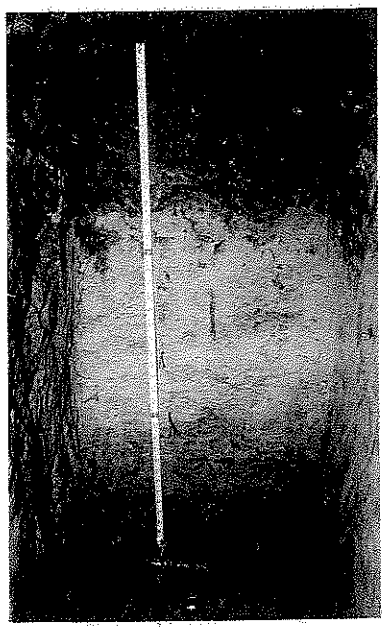
R.Tiner

25. Poorly drained hydric Spodosol. (*Naskeag series.*)

R.Tiner

26. Moderately well-drained nonhydric Spodosol. (Chesuncook series.)

HYDRIC AND NONHYDRIC SOILS (Plates 20–30)

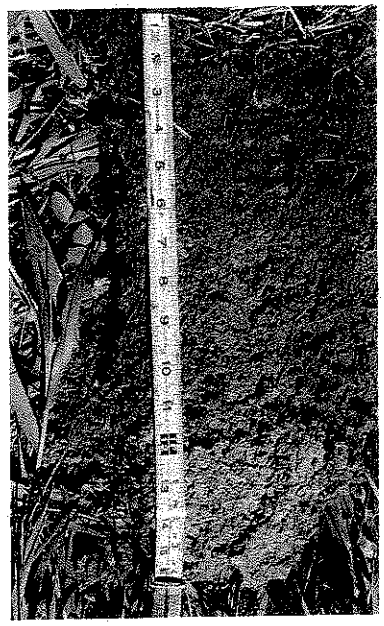


P. Veneman

27. Poorly drained hydric soil. (*Ridgebury series.*) Low chroma (gray) subsoil below the surface layer. Compare with Plate 28.

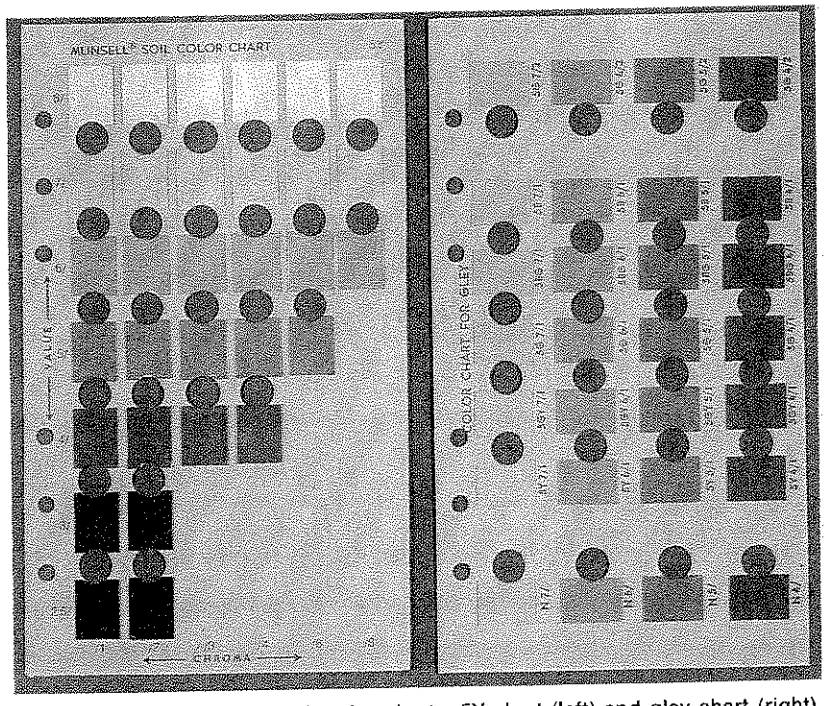
R.Tiner

28. Somewhat poorly drained nonhydric soil. (*Ridgebury series.*) Bright-colored subsoil directly below the surface layer.



R.Tiner

29. Somewhat poorly drained nonhydric soil. (*Lamoine series.*) Low chroma mottles do not come within 7 inches.



R.Newton

30. Examples of Munsell soil color charts: 5Y chart (left) and gley chart (right). Left two columns of 5Y chart are low chroma colors associated with hydric soils. Gley chart represents only hydric soil colors due to wetness.

WETLAND PLANTS

One of the easiest ways to recognize many wetlands is to become familiar with characteristic wetland plants or "hydrophytic vegetation." Many plants are easily recognized by the nonbotanist, since leaf shapes, leaf margins, flower types, and flower characteristics are quite different among plant species. Grasses and grasslike plants (sedges and rushes) are difficult to identify to species; these are best left to experts to identify. Traditionally, vegetation has been used as the most common means to identify the presence of wetland.

Through the years, botanists and ecologists have observed and recorded many species of plants growing in wetlands. Many of these plants grow only in wetlands, yet a large number of plants are more wide-ranging, found in both wetlands and uplands to varying degrees. Only recently has the available scientific information on plant ecology been thoroughly reviewed to compile a list of virtually all the plants that occur (more than rarely) in wetlands.

Hydrophyte Definition and Concept

Wetland plants, technically called "hydrophytes," are defined as plants growing in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content. Thus, hydrophytes are not restricted to true aquatic plants growing in water (e.g., ponds, lakes, rivers, and estuaries), but also include plants morphologically and/or physiologically adapted to periodic flooding or saturated soil conditions typical of marshes, swamps, and bogs. The concept of hydrophyte applies to individual plants and not to species of plants, although certain species may be represented entirely by hydrophytes, such as smooth cordgrass and broad-leaved cattail. For example, certain individuals of white pine and hemlock can be considered hydrophytes when they grow in undrained hydric soils, while those growing on uplands are not hydrophytes. To survive in wet habitats, these evergreens have developed shallow root systems. Wetland ecotypes of many plant species undoubtedly exist, since all plants growing in wetlands have adapted in one way or another for life in periodically flooded or saturated, anaerobic soils. Consequently, these individuals are considered hydrophytes. For more information, read "The Concept of a Hydrophyte for Wetland Identification" in the April 1991 issue of *BioScience*, available at most academic (college) libraries and science centers throughout Maine and libraries of the major cities.

Wetland Plant Lists

The U.S. Fish and Wildlife Service, in cooperation with other Federal agencies, has developed a list of plants that grow in the nation's wetlands. The list was compiled by an exhaustive review of botanical manuals, with subsequent technical review by wetland experts. Regional wetland plant lists were prepared in producing the national list. The 1988 list, *National List of Plant Species that Occur in Wetlands: Northeast Region*, contains over 2500 species of vascular plants found in wetlands from Maine through Virginia and west to Ohio and Kentucky. From this regional list, a state list for Maine was compiled: *Wetland Plants of the State of Maine 1988.* This list represents the best list of plants occurring in Maine's wetlands (to order, see "Other Sources of Information" at the end of this guide). Each plant is listed by scientific name according to the U.S.D.A. Soil Conservation Service's *National List of Scientific Plant Names* and by common names where known. In addition, the national and regional wetland indicator status of each plant is given, along with information on plant habit and general distribution.

The ***wetland indicator status*** represents a plant species' frequency of occurrence in wetlands. Four major categories are recognized:

(1) ***obligate wetland*** (OBL) - greater than 99% occurrence in wetlands and found almost exclusively in wetlands;

(2) ***facultative wetland*** (FACW) - 67-99% occurrence in wetlands, usually found in wetlands, but may be found in nonwetlands (uplands);

(3) ***facultative*** (FAC) - 34-66% occurrence wetlands, nearly equally abundant in wetlands and nonwetlands;

(4) ***facultative upland*** (FACU) - 1-33% occurrence in wetlands, usually found in nonwetlands.

(*Note: Plant species not listed are strictly upland plants.*)

Obligate wetland plants (OBL) and facultative wetland (FACW) plants are the best vegetative indicators of wetland, whereas the facultative upland (FACU) plants are the least indicative of wetland, generally being better indicators of upland.

Interestingly enough, there are many wetlands where facultative (FAC) plants (e.g., red maple and yellow birch) and occasionally FACU plants (e.g., white pine and hemlock) predominate. By themselves, these plants may reveal very little about an area's "wetlandness," but by considering the presence, abundance, and distribution of all of the plants within an area (i.e., the plant community), a better assessment can be made. In refining the wetland plant list, the regional wetland plant review panel assigned a positive sign (+) or a negative sign (-) to the three facultative categories to indicate whether a plant was on the "wetter" side or "drier" side of the category's range, respectively. For example, a FACW+ plant has a higher frequency of occurrence in wetlands (84-99%) than a FACW- plant (67-83%).

The wetland indicator status of plant species is important for determining the likely presence of hydrophytic vegetation. The association of different plants in an area of similar landscape, soils, and hydrology form what may be called a "plant community." When more than 50 percent of the dominant species of a plant community (considering all strata - tree, sapling, shrub, herb, and woody vine) consists of OBL, FACW, and FAC species, the plant community has a high probability of being wetland and meets the hydrophytic vegetation criterion for wetland identification. The more OBL and FACW species, the greater the likelihood of wetland. The most obvious wetlands are dominated by OBL species. So by knowing the indicator status of dominant plants, you can get a sense of whether the area is likely to be wetland or not. Some wetlands, however, are dominated by FACU species (e.g., hemlock and white pine). The presence of hydric soils and signs of wetland hydrology together with considering landscape position helps identify these communities as hydrophytic vegetation and wetlands.

Wetland Plant Communities

Maine's wetlands generally fall into nine major categories or types: (1) coastal marshes, (2) inland marshes, (3) wet meadows, (4) fens, (5) bogs, (6) shrub swamps, (7) deciduous forested swamps, (8) floodplain forested wetlands, and (9) evergreen forested swamps. Recognize, however, that many types intergrade between one another (e.g., marshes and wet meadows, fens and bogs, and bogs and forested wetlands). Thus these types may not always be distinctive, yet they are useful for discussion purposes. Examples of Maine's wetlands are shown in Plates 9 through 19. To learn more about Maine's wetland plant communities, read "Natural Landscapes of Maine: A Classification of Ecosystems and Natural Communities" published by and available from the Maine Natural Heritage Program.

Coastal marshes are "grasslands" periodically flooded by the tides, primarily salt or brackish tidal water. These marshes are flooded by the tides at various intervals, ranging from once daily to a few times a year. When not flooded, however, the soils remain saturated near the surface at least during the high tide stage. The salinity due to ocean-derived salts creates a salt-stressed aquatic environment that prevents the establishment of most wetland plants. Plants adapted for life in salt water are called "halophytes." Most halophytes actually grow best in fresh water, but are outcompeted by other plants there and forced to live in salt and brackish environments. In more saline areas, coastal marshes called *salt marsh* are represented by grasses and grasslike plants: smooth cordgrass, salt hay cordgrass, salt grass, salt marsh bulrush, glasswort, black grass, baltic rush, salt marsh sedge, and seaside arrow-grass. Further landward or upstream, *brackish marshes* dominated by narrow-leaved cattail are found. Seaside goldenrod, prairie cordgrass, and common reed also occur in these situations and along the upper borders of salt marshes. The most upstream coastal marshes are *freshwater tidal marshes*. They are strictly freshwater wetlands whose water levels fluctuate due to tidal action. Wild rice, cattails, and other freshwater species dominate these tidal marshes, such as found in Merrymeeting Bay.

Inland marshes are nontidal wetlands usually dominated by grasses or grasslike plants. They are seasonally flooded and usually saturated at or near the surface when not flooded. Dominant plants include broad-leaved cattail, tussock sedge, wool grass, bluejoint, reed canary grass, manna grasses, rice cutgrass, three-way sedge, soft-stemmed bulrush, hard-stemmed bulrush, common three-square, pickerelweed, big-leaved arrowhead, giant bur-reed, wild rice, white water lily, horsetails, and beggars-ticks.

Wet meadows are herb-dominated areas saturated for long periods during the growing season, but are seldom flooded. Some sedge meadows may have standing surface water and look more marsh-like in appearance. Wet meadows are often associated with agricultural lands, especially pastures. They may be characterized by tussock sedge and other sedges, bluejoint, reed canary grass, soft rush, green bulrush, wool grass, and various flowering herbs. Shrubs may be present including steeplebush, broad-leaved meadowsweet, willows, and speckled alder.

Fens are mineral-rich peatlands developed in

areas of groundwater discharge and along rivers and streams. The availability of minerals creates opportunities for many wetland plants to grow. Larch and northern white cedar dominate *wooded fens* with red maple, black spruce, black chokeberry, sweet gale, blue flag, skunk cabbage, and rarely bog birch also present. *Herbaceous fens* are dominated by sedges, cotton-grasses, white beak-rush, peat mosses, and liverworts.

Bogs are permanently saturated nutrient-poor peatlands dominated by heath or ericaceous shrubs (*shrub bogs*) and/or evergreen trees (*forested bogs*) growing in peat moss. They may on rare occasions be inundated. They are found in isolated depressions (kettles) and sometimes extend up adjacent slopes. They also occur behind narrow fens along rivers, streams, and lakes. Characteristic shrub bog species include leatherleaf, sheep laurel, bog laurel, bog rosemary, labrador tea, sweet gale, mountain holly, rhodora, black huckleberry, dwarf huckleberry, cranberries, and black chokeberry. Along the coast in Downeast Maine, black crowberry and baked appleberry may be locally dominant with tufted bulrush. Bog herbs include pitcher-plant, grass pink, rose pogonia, dragon's mouth, white-fringed orchid, sundews, cotton-grasses, white beak-rush, and bog goldenrod. Forested bogs may have black spruce, balsam fir, and larch as dominants. Associated species include sheep laurel, labrador tea, rhodora, and creeping snowberry. Edges of bogs where minerals are more abundant and water forms a type of moat are called "laggs." They are colonized by speckled alder and the trees listed above plus northern white cedar, northern wild raisin, blue flag, wild calla, and cinnamon fern.

Shrub swamps are dominated by woody vegetation less than 20 feet tall. They are seasonally flooded and often saturated near the surface when not flooded. Common species include buttonbush, broad-leaved meadowsweet, steeplebush, speckled alder, sweet gale, mountain holly, northern arrowwood, maleberry, red osier dogwood, silky dogwood, highbush blueberry, willows, and common winterberry. Herbs include skunk cabbage, false hellebore, flat-topped aster, New York aster, marsh fern, cinnamon fern, and sensitive fern. Some shrub swamps are dominated by saplings of trees such as red maple, black gum, and larch.

Deciduous forested swamps are characterized by deciduous trees (20 feet or taller). They are mostly seasonally flooded wetlands along rivers and streams or in isolated depressions. Dominant swamp trees include red maple, larch, black ash, yellow birch, gray birch, green ash, and American elm. White pine may also occur in varying abundance. Black willow and, rarely, black gum may be dominant in southern Maine. Associated shrubs include highbush blueberry, sheep laurel, maleberry, black chokeberry, mountain holly, common elderberry, common winterberry, and silky dogwood. Herbs include skunk cabbage, Jack-in-the-pulpit, Canada mayflower, royal fern, cinnamon fern, sensitive fern, and marsh fern.

Floodplain forested wetlands are temporarily flooded forested wetlands found along major rivers and streams. They are often dominated by silver maple, green ash, and American elm. Bur Oak is locally common in central Maine. Ostrich fern is usually the characteristic herb, along with sensitive fern, jewelweed, and false nettle.

Evergreen forested swamps are dominated by needle-leaved or scale-leaved evergreens growing on hydric mineral soils or shallow peats. Northern white cedar is one dominant type which may be mixed with red maple, hemlock, balsam fir, larch, and black spruce. Understory species include rhodora, royal fern, sensitive fern, goldthread, northern arrowwood, Canada mayflower, and jewelweed. Black spruce and larch are often co-dominants in forested bogs. Associated species are ericaceous shrubs, cotton-grasses, cranberries, bunchberry, speckled alder, and various sedges. Peat mosses form the ground cover and three-seeded sedge may also be common. In southern Maine, Atlantic white cedar may predominate along with other bog shrubs. Hemlock is another dominant evergreen forested wetland type. Associated plants may include red maple, white pine, yellow birch, Canada mayflower, and goldthread. White pine also may dominate some evergreen forested wetlands.

How to Recognize Common Wetland Plants

The following section deals with plant identification and includes brief plant descriptions and line drawings to help identify some of Maine's more common wetland plants. A set of simple keys is also included as an aid to their identification.

Wetland vegetation can be generally separated into five major life-form groups:

(1) ***aquatic herbs*** - free-floating species, floating-leaved rooted vascular plants, and submergent plants growing beneath the water's surface (*Note: Because their habitats are obviously wetland or deepwater habitat, they are not included in this guidebook*);

(2) ***emergent herbs*** - nonwoody plants whose stems and leaves normally extend above the water's surface or grow erect in periodically flooded or saturated soils; they can be subdivided into three general subtypes: ferns, grasses and grasslike plants (e.g., sedges and rushes), and broad-leaved herbs;

(3) ***shrubs*** - woody plants shorter than 20 feet, including young trees (saplings) as well as true shrubs with multiple woody stems;

(4) ***trees*** - woody plants 20 feet or taller and typically having a single main stem or trunk;

(5) ***woody vines*** - other woody plants climbing other plants or trailing along on the ground surface.

Three figures are provided as a general review of important plant characteristics. Figure 5 shows diagnostic characteristics of grasses, sedges, and rushes, to allow quick separation of grasses from grasslike plants. Leaf and flower characteristics are illustrated in Figures 6 and 7, respectively. These figures should be reviewed before using the keys.

How to Use the Plant Identification Keys

The keys to common wetland plants of Maine are provided to facilitate identification of the plants included in this field guide. Four specific keys are provided:

(1) Key A - Common Salt and Brackish Marsh Plants,

(2) Key B - Common Freshwater Wetland Herbs,

(3) Key C - Common Freshwater Wetland Shrubs and Woody Vines, and

(4) Key D - Common Freshwater Wetland Trees.

The keys are based on vegetative characteristics so that plants may be identified at most times during the growing season and not only when flowers are present. Each key is composed of a couplet of contrasting statements, for example, 1-1, 2-2, 3-3, and so on. Start at couplet 1 of the appropriate key and begin matching couplet statements with the plant in hand. Read both parts of the couplet and choose the one that best fits your plant. Next to that choice, you will see either a species reference number (e.g., Species 1) or a number which refers to the next numbered couplet to read. You will eventually find a couplet where species numbers are referenced along with the page or pages where they are illustrated. Review the appropriate drawings and locate the plant illustration that best resembles the subject plant and then read the applicable description. Be sure to read about similar species which resemble or are related to the illustrated species. If the plant is not illustrated or covered under "*Similar species,*" consult other field guides (see "Other Sources of Information") or send the plant to a botanist for identification. You should be reasonably sure of your identification, especially for dominant species, before going further in identifying wetlands.

Keys To Selected Common Wetland Plants of Maine

1. Plants growing in salt or brackish marshes ..... Key A
1. Plants growing in freshwater wetlands 2
   2. Herbaceous (nonwoody) plants ..... Key B
   2. Woody plants 3
      3. Shrubs, usually less than 20 feet tall at maturity and multi-stemmed, and woody vines ..... Key C
      3. Trees, usually 20 feet or taller at maturity and single-stemmed (main trunk) ..... Key D

Key A - Common Salt and Brackish Marsh Plants

1. Fleshy leaves and/or stems ..... Species I to 4 (page 28)
1. Parts not fleshy 2
   2. Grass or grasslike plants (see Figure 5) 3
      3. Grass ..... Species 6 to 10 (page 29)
      3. Grasslike 4
         4. Sedge ..... Species 11 and 12 (page 30)
         4. Not sedge 5
            5. Rush ..... Species 13 and 14 (page 30)
            5. Other grasslike plant ..... Species 15 (page 30)
   2. Not grasslike, but broad-leaved herb ..... Species 5 (page 28)

Key B - Common Freshwater Wetland Herbs

1. Fern ..... Species 16 to 20 (page 31)
1. Not fern 2
   2. Grass or grasslike plants (see Figure 5) 3
      3. Grass ..... Species 21 to 25 (page 32)
         Species 10 (page 29)
      3. Grasslike 4
         4. Sedge ..... Species 26 to 32 (pages 33 - 35)
         4. Not sedge 5
            5. Rush ..... Species 33 and 34 (page 36)
            5. Other grasslike plant ..... Species 35 to 37 (page 36)
   2. Not grasslike, but broad-leaved herb 6
      6. Basal leaves only ..... Species 38 to 47 (pages 37 - 38)
      6. Leaves arranged along a stem 7
         7. Simple leaves 8
            8. Alternately arranged 9
               9. With entire margins ..... Species 48 to 52 (page 39)
               9. With toothed margins ..... Species 53 to 55 (page 40)
            8. Oppositely arranged or whorled 10
               10. With toothed margins ..... Species 56 to 58 (page 40)
               10. With entire margins ..... Species 59 and 60 (page 41)
         7. Compound leaves 11
            11. Oppositely arranged ..... Species 61 (page 42)
            11. Alternately arranged ..... Species 62 and 63 (page 42)

Key C - Common Freshwater Wetland Shrubs and Woody Vines

1. Thorns or prickles present 2
   2. Shrub ..... Species 64 and 65 (page 43)
   2. Woody vine ..... Species 89 (page 48)
1. Thorns absent 3
   3. Shrub 4
      4. Evergreen shrub 5
         5. Toothed leaves ..... Species 66 (page 43)
         5. Entire leaves 6
            6. Oppositely arranged ..... Species 67 and 68 (page 43)
            6. Alternately arranged ..... Spacies 69 and 70 (page 43)
      4. Deciduous shrub 7
         7. Compound leaves ..... Species 71 and 72 (page 44)
         7. Simple leaves 8
            8. Oppositely arranged or whorled 9
               9. Toothed margins ..... Species 73 and 74 (page 44)
               9. Entire margins ..... Species 75 to 77 (page 45)
            8. Alternately arranged 10
               10. Toothed margins ..... Species 78 to 84 (pages 45 - 46)
               10. Entire margins ..... Species 84 to 88 (page 47)
   3. Woody vine ..... Species 90 and 91 (page 48)

Key D - Common Freshwater Wetland Trees

1. Evergreen tree ..... Species 92 to 95 (page 49)
1. Deciduous tree 2
   2. Needle-leaved ..... Species 96 (page 50)
   2. Broad-leaved 3
      3. Oppositely arranged leaves 4
         4. Compound leaves ..... Species 97 (page 50)
         4. Simple leaves ..... Species 98 (page 50)
      3. Alternately arranged leaves 5
         5. Toothed margins ..... Species 99 to 102 (page 51)
         5. Entire or lobed margins ..... Species 103 to 104 (page 52)

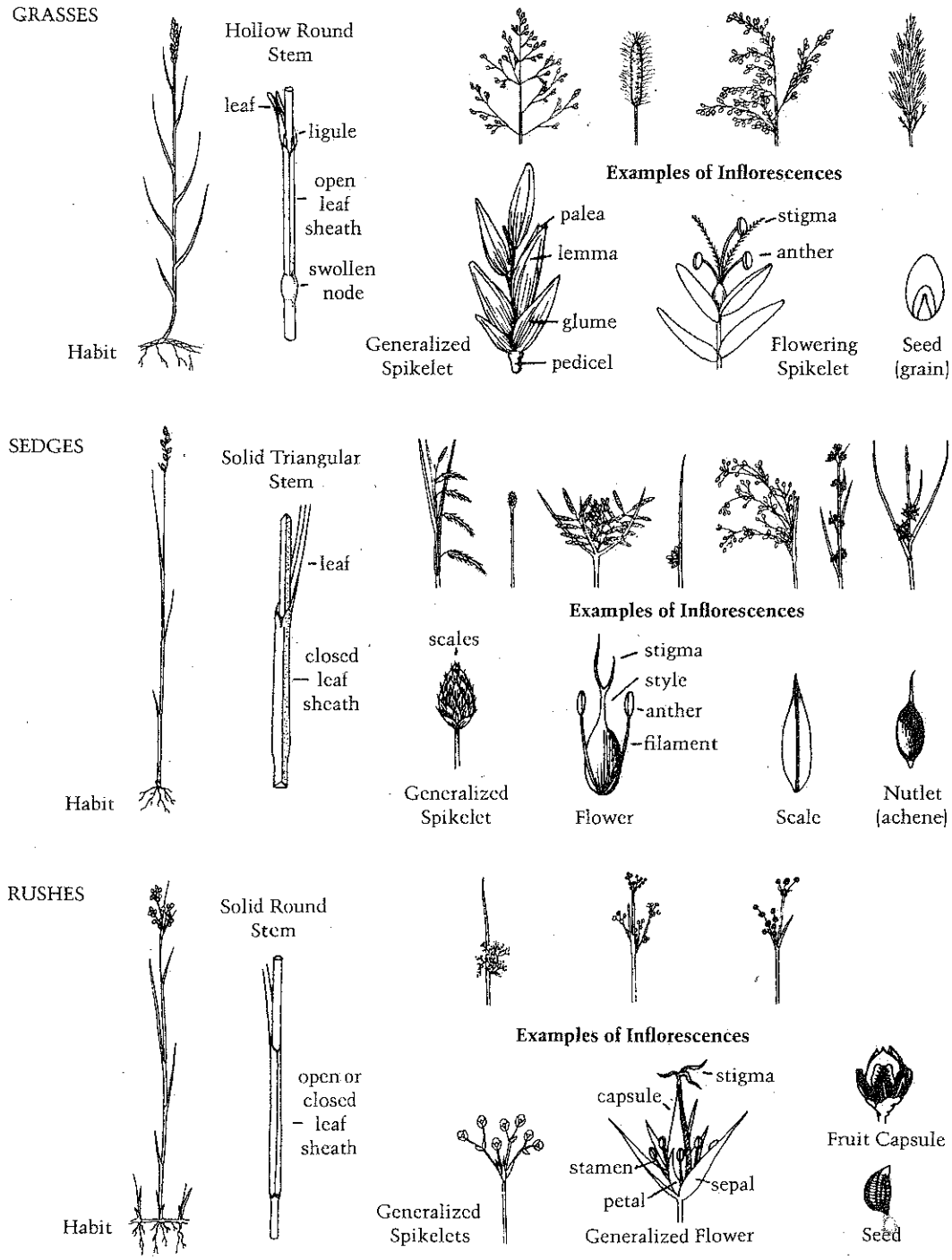


Figure 5. Distinguishing characteristics of grasses, sedges, and rushes. Grasses have hollow round stems with distinct nodes, sedges usually have solid triangular stems, and rushes have solid round stems, distinctive flowers, and fruit capsules bearing many tiny seeds. (Source: *Field Guide to Nontidal Wetland Identification*, Tiner 1988)

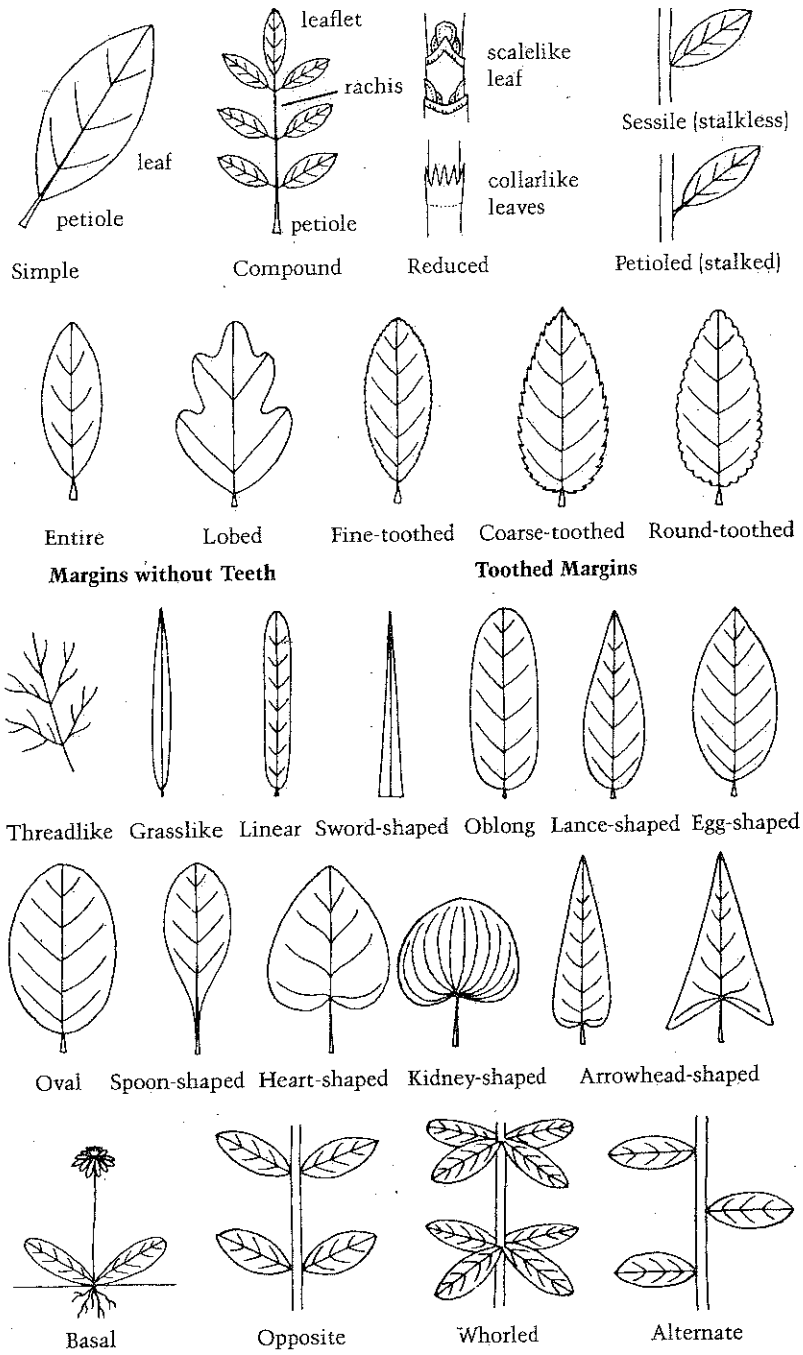


Figure 6. Leaf types and arrangements (Source: *A Field Guide to Coastal Wetland Plants of the Northeastern United States*, Tiner 1987)

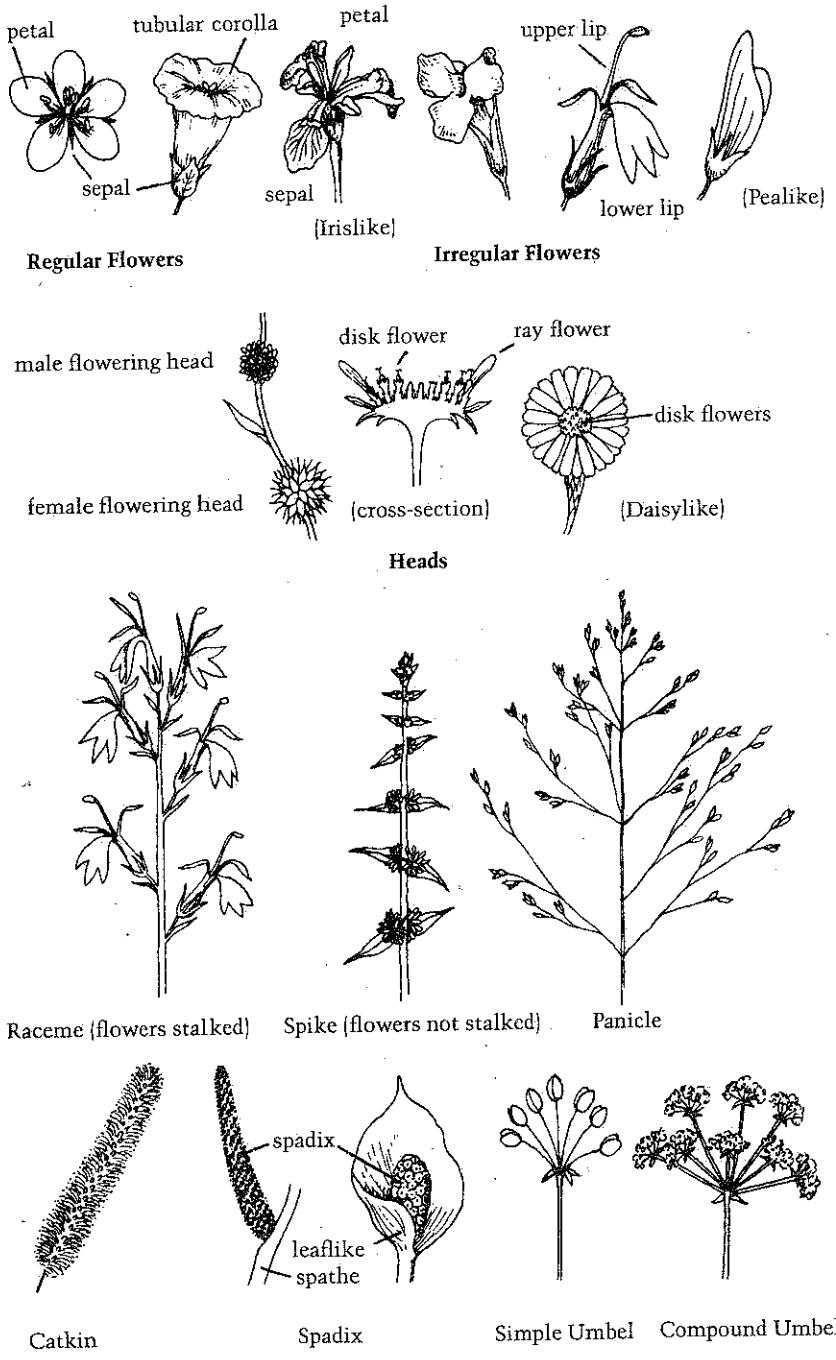


Figure 7. Flower types and arrangements. (Source: *A Field Guide to Coastal Wetland Plants of the Northeastern United States*, Tiner 1987)

Wetland Plant Descriptions and Illustrations

Selected common wetland plants are generally described and illustrated by line drawings in the following section. When these plants represent more than 50 percent of a plant community's dominant species, the area should usually meet the hydrophytic vegetation criterion for purposes of wetland identification. Each described species has been assigned a unique number that can be used to easily cross-reference an illustration with its corresponding description. The descriptions include the common name of the plant, its scientific name, a brief overview of major features, flowering period (in the Northeast), habitats, and wetland indicator status. Related species or plants that may be confused with the described plant (including upland species) are listed under *"Similar species."* Some similar species are also illustrated; they can be located in the text by following the numbering code for the principal species, e.g., black ash (Illustration 97b) can be located under the description of green ash (Species No. 97). More detailed descriptions can be found in various taxonomic manuals or field guides listed under "Other Sources of Information." These books should prove useful for identifying plants not included in this guidebook. *Remember that this field guide is not comprehensive and that many plants are not included. Over 100 common wetland plants, however, are covered and should be identifiable.*

COASTAL MARSH PLANTS

Fleshy Herbs

1. **Marsh Orach or Spearscale** *(Atriplex patula):* Medium-height fleshy annual herb up to 3 1/2 feet tall or long with grooved stems, light green arrowhead-or triangle-shaped leaves (up to 3 inches long) mostly alternately (sometimes oppositely) arranged, and many very small green flowers in ball-shaped clusters; July to November; irregularly flooded salt marshes; FACW. *Similar species:* Coast-blite Goosefoot *(Chenopodium rubrum)* has somewhat triangle-shaped leaves , but its margins are coarse-toothed to lobed; FACW.
2. **Common Glasswort** *(Salicornia europaea):* Low growing erect fleshy annual herb up to 20 inches tall with fleshy jointed much-branched stems and no apparent leaves; August to October; irregularly flooded salt marshes; OBL.
3. **Seaside Arrow-grass** *(Triglochin maritima)*: Low to medium-height erect fleshy perennial herb up to 2 1/2 feet tall with long erect linear fleshybasal leaves (up to 20 inches long) having conspicuous sheaths, and many small greenish flowers on separate terminal spike; May through August; irregularly flooded salt marshes; OBL. *Similar species:* Seaside Plantain *(Plantago maritima)* grows up to 1 foot and has fleshy linear leaves (up to 6 inches) lacking basal sheaths; FACW.
4. **Seaside Goldenrod** *(Solidago sempervirens):* Medium-height fleshy perennial herb usually about 3 feet tall with entire thick fleshy lance-shaped leaves (up to 16 inches long) alternately arranged and reduced in size toward top of stem, and many small yellow flowers borne in heads on one-sided branches forming a terminal inflorescence; August into October; irregularly flooded salt and brackish marshes, sand dunes, and coastal beaches; FACW. *Note: Other goldenrods may look similar with their yellow-flowered inflorescences, but they do not have fleshy leaves nor occur in salt marshes.*

Flowering Herbs

5. **Sea Lavender** *(Limonium nashii):* Low to medium-height perennial herb up to 2 feet tall with cluster of spoon-shaped to lance-shaped basal leaves (up to 6 inches long) and many small light purplish (lavender) tubular flowers borne on a separate, erect many-branched terminal inflorescence; July through September; irregularly flooded salt marshes; OBL.

Also see: Seaside Goldenrod (Species No. 4) and Slender Blue Flag under Blue Flag (Species No. 44).

Grasses

6. **Salt Grass** *(Distichlis spicata):* Low-growing perennial grass up to 16 inches tall, often forming dense mats, with conspicuously two-ranked leaves (up to 4 inches long), overlapping leaf sheaths, and dense terminal inflorescence (up to 2 1/2 inches long); August into October; irregularly flooded salt and brackish marshes (generally southwest of Penobscot Bay); FACW+.
7. **Common Reed** *(Phragmites australis):* Tall perennial grass up to 14 feet high often forming dense stands, with long tapered conspicuously two-ranked leaves (up to 24 inches long and 2 inches wide), and dense much-branched purplish to brownish terminal inflorescence (8 to 16 inches long); July through September; salt and brackish marshes and freshwater tidal and nontidal marshes; FACW.
8. **Smooth Cordgrass** *(Spartina alterniflora):* Low to tall perennial grass up to 6 feet high with soft base of stem, elongate smooth tapered leaves (up to 16 inches long and 1/2 inch wide), and narrow terminal inflorescence (up to 12 inches long) composed alternately arranged and appressed spikes; July through September; salt and brackish marshes; OBL. *(Note: The tall form typically grows along tidal creeks and ranges from about 4 to 6 feet in height.)*
9. **Salt-hay Grass** *(Spartina patens):* Low to medium-height perennial grass up to 3 feet tall, often forming cow-licked mats, with slender stems, narrow linear leaves (up to 1 1/2 feet long and 1/5 inch wide) having margins rolled inwardly, and open terminal inflorescence (up to 8 inches long) composed of usually three to six spikes; late June into October; irregularly flooded salt marshes and brackish marshes; FACW+.

10. **Prairie Cordgrass** (*Spartina pectinata*): Medium-height to tall perennial grass up to 6 1/2 feet high with very long leaves (up to 4 feet long) having threadlike tips and margins rolled inwardly, and open terminal inflorescence (up to 16 inches long) composed of ten to twenty alternately arranged, ascending spikes; July into September; irregularly flooded salt marshes (especially marsh-upland border), brackish marshes, and freshwater marshes; OBL.

Sedges

11. **Salt Marsh Sedge** (*Carex paleacea*): Medium-height perennial grasslike herb up to 3 feet tall with slightly drooping linear leaves arranged in three-ranks and inconspicuous flowers borne on drooping spikes; June through August; upper edges of salt marshes and irregularly flooded brackish marshes; OBL.
12. **Salt Marsh Bulrush** (*Scirpus robustus*): Medium-height perennial grasslike herb up to 3 1/2 feet tall with stout triangular stems, several elongate linear grasslike leaves, and three or more flowering budlike spikelets borne near top of plant and surrounded by leaflike bracts; July to October; irregularly flooded salt and brackish marshes; OBL. *Similar species*: Common Three-square (*Scirpus pungens*) occurs along the upper edges of salt marshes and in brackish and tidal fresh marshes and has leafless stems bearing cluster of budlike spikelets near top of stem; FACW+. (Species No. 33)

Rushes

13. **Baltic Rush** (*Juncus balticus*): Medium-height perennial grasslike herb up to 3 feet tall with unbranched round stems sheathed at base, no apparent leaves, minute flowers borne in clusters near top of stem, and roundish fruit capsules; May to September; irregularly flooded salt and brackish marshes; FACW+.
14. **Black Grass** (*Juncus gerardii*): Low to medium-height perennial grasslike herb up to 2 feet tall, with one or two elongate leaves (up to 8 inches long and round in cross-section), flowers borne in clusters near top of stem, and roundish fruit capsules; June into September; irregularly flooded salt and brackish marshes; FACW+.

Other Grasslike Plants

15. **Narrow-leaved Cattail** (*Typha angustifolia*): Tall grasslike perennial herb up to 10 feet high with narrow leaves (to 1/2 inch wide) and inconspicuous flowers borne in terminal spike (persistent through winter) composed of two separate parts (male flowers above and female flowers below); May into July; coastal marshes mostly in brackish waters, but also along edges of salt marshes, and inland marshes; OBL. *Similar species*: Broad-leaved Cattail (*Typha latifolia*) has wider leaves (up to one inch wide) and a continuous terminal spike (not separated into two distinct parts); it is the typical freshwater species (Species No. 39).

FRESHWATER WETLAND HERBS

Ferns

16. **Ostrich Fern** (*Matteuccia struthiopteris*): Tall fern up to 5 feet tall with plumelike sterile fronds tapering greatly toward base and widest near top and surrounding separate fertile feather-shaped fronds (about 1-2 feet tall) composed of dark brown (when mature) podlike sporangia; summer; floodplain forested wetlands and other wet to moist woodlands; FACW.
17. **Sensitive Fern** (*Onoclea sensibilis*): Medium-height fern up to 3 1/2 feet tall with light green shallow-lobed leaflets of sterile frond and a separate fertile frond bearing beadlike fertile leaflets; June to October; inland marshes and meadows, shrubs swamps, and forested wetlands; FACW.
18. **Cinnamon Fern** (*Osmunda cinnamomea*): Medium-height to tall fern up to 5 feet tall with cinnamon-colored woolly stalks and a separate fertile frond bearing cinnamon-colored sporangia; May and June; forested wetlands, shrub swamps, and margins of bogs; FACW. *Similar species*: Interrupted Fern (*Osmunda claytoniana*) has similiar sterile leaflets, but they lack woolly hairs at their bases and the fertile leaflets are located between sterile leaflets; FAC. Virginia Chain Fern (*Woodwardia virginica*) has shiny dark purplish-brown stalks and lacks the separate fertile frond (sporangia are borne on leaflike fronds); OBL.
19. **Royal Fern** (*Osmunda regalis*): Medium-height to tall fern up to 6 feet high with leaves (fronds) twice divided into many separate leaflets and fertile leaflets at end of frond; spring and early summer; inland marshes and forested wetlands; OBL.
20. **Marsh Fern** (*Thelypteris thelypteroides*): Medium-height fern up to 2 feet tall with black rhizomes and light green to yellowish green fronds that taper toward both ends; June into October; inland marshes, shrub swamps, forested wetlands and upper edge of salt marshes; FACW+.

Note: Many other ferns than those listed above occur in a wide variety of habitats in Maine; consult other field guides for their identification (see Other Sources of Information).

Grasses

21. **Bluejoint** (*Calamagrostis canadensis*): Medium-height to tall perennial grass up to 5 feet high with slender leaves and an open, somewhat drooping terminal inflorescence (up to 8 inches long); June through August; inland marshes, shrub swamps and tidal fresh marshes; FACW+.
22. **Manna Grass** (*Glyceria canadensis*): Medium-height perennial grass up to 3 1/2 feet tall with rough-margined leaves and an open, loose terminal inflorescence (up to 12 inches long) with drooping branches of overlapping 2-ranked

spikelets (spikelets about 1/5 inch wide); marshes, wet meadows, forested wetlands, and bogs; OBL. *Similar species:* Nerved or Fowl Manna Grass *(Glyceria striata)* is quite similar but its spikelets are smaller (less than 1/10 inch wide); OBL. Manna Grass *(Glyceria obtusa)* has a dense, compact oblong-shaped inflorescence (up to 7 inches long) with ascending branches; OBL.

23. **Rice Cutgrass** *(Leersia oryzoides):* Medium-height to tall perennial grass up to 5 feet high with rough stems and leaves, yellowish green leaves, and an open terminal inflorescence (up to 8 inches long); June into October; inland marshes and wet meadows; OBL.
24. **Reed Canary Grass** *(Phalaris arundinacea):* Medium-height to tall grass up to 5 feet high with terminal inflorescence (up to 7 inches long) compressed early in the season, but sometimes with open, spreading branches later; June through August; inland marshes, wet meadows, and tidal fresh marshes; FACW+.
25. **Wild Rice** *(Zizania aquatica):* Tall annual grass up to 10 feet high with large, flat soft leaves having rough margins and an open terminal inflorescence divided into two parts (ascending appressed branches with female flowers above, open, spreading branches with male flowers); June into October; inland marshes, shallow waters, and tidal fresh marshes; OBL.

Also see: Prairie Cordgrass (Species No. 10).

Sedges

26. **Carex Sedges** *(Carex* spp.*):* Many sedges grow in Maine's wetlands. They are especially common in wet meadows, fens, and bogs. They have triangular stems; bear male and female "flowers" on the same stem, but in different places; and usually produce clusters (spikes) of hardseeds (each enclosed by a sac). These sedges are highly varied and most are too difficult for positive identification with this guide book. Some common sedges are presented. Fringed Sedge *(Carex crinita):* to 4 1/2'; OBL; Tussock Sedge *(C. stricta):* to 3 1/2' usually forming large clumps called tussocks; OBL. Three-seeded Sedge *(C. trisperma):* to 2 1/4'; common in evergreen forested wetlands and bogs; OBL. Lurid Sedge *(C. lurida):* to 3', usually about 1 1/2', common in wet meadows; OBL. Hop Sedge *(C. lupulina):* to 4', in wet meadows and forested wetlands; OBL. Bladder Sedge *(C. intumescens):* to 3', in forested wetlands; FACW+. Beaked Sedge *(C. rostrata):* to 4', in shallow water and wet meadows; OBL. Long's Sedge *(C. lonchocarpa):* to 4'; OBL. Few-seeded Sedge *(C. oligosperma):* to 3', in bogs, fens, and shallow water; OBL. Poor Sedge *(C. paupercula):* to 3', in bogs, and wet meadows; OBL. Coast Sedge *(C. exilis):* to 2 1/2', with single spike at the top of the stem, in bogs; OBL. Little Prickly Sedge *(C. echinata):* to 1 1/2', in wet meadows and fens; OBL. Yellow Sedge *(C. flava):* to 2 1/2', in wet meadows and fens; OBL. Wooly-fruited Sedge *(C. lasiocarpa):* to 4' with long wire-like leaves, in bogs, fens, and shallow water; OBL. Hoary Sedge *(C. canescens):* to 3', in bogs and fens; OBL. Bristlebract Sedge *(C. tribuloides):* to 4'; FACW+. Fox Sedge *(C. vulpinoidea):* to 3 1/2'; OBL.
27. **Three-way Sedge** *(Dulichium arundinaceum):* Low to medium-height perennial grasslike plant up to 3 1/2 feet tall with somewhat rounded hollow stems, many leaves arranged in three distinct ranks (easily seen from above), and flowering spikelets borne from leaf axils; July to October; inland marshes, bogs, and swamps; OBL.
28. **Cotton-grasses** *(Eriophorum* spp.*):* Medium height perennial grasslike plants up to 4 feet tall with inconspicuous flowers borne in whitish cottonlike terminal cluster subtended by leafy bracts; April to October, depending on species; bogs and fens; OBL. *Similar species:* Tufted Bulrush *(Scirpus cespitosus)* is similar to Alpine Cotton-grass *(Eriophorum alpinum, formerly Scirpus hudsonianus),* but has smooth round stems versus rough triangular stems; both are bog species and OBL. Tufted Bulrush is particularly common in coastal peatlands of Downeast Maine.
29. **White Beak-Rush** *(Rhynchospora alba):* Low to medium-height perennial grasslike plant up to 2 1/4 feet tall, often forming dense clumps, with very slender stems and clusters of spikelets (whitish then turning whitish brown) borne on short stalks at the end of elongate stalks arising from leaf axils and terminally; early summer; bogs and wet sand; OBL.
30. **Wool Grass** *(Scirpus cyperinus):* Medium-height to tall perennial grasslike plant commonly 4 to 5 feet high with roundish to weakly triangular stems, rough-margined leaves, and terminal inflorescence of dense, round, woolly reddish brown clusters on mostly drooping branches subtended by leafy bracts; August through September; inland marshes, wet meadows, shrub swamps, bogs, forested wetlands and tidal fresh marshes; FACW+. *Similar species:* Other bulrushes with woolly but not reddish brown-colored spikelets are Stalked Bulrush *(Scirpus pedicellatus)* and Black-girdled Bulrush *(Scirpus atrocinctus);* both OBL. The latter has small blackish minor bracts subtending its spikelets and a black band at the top of the stem below its primary leafy bracts. Green Bulrush *(Scirpus atrovirens)* has more distinctly triangular stems with few leaves usually on lower stems and a terminal inflorescence of dark green round clusters, not woolly, on mostly ascending branches; OBL. Red-tinged or Small-fruit Bulrush *(Scirpus microcarpus, formerly S. rubrotinctus)* has red tinged leaf sheaths at its base; OBL.
31. **Common Three-square** *(Scirpus pungens):* Medium-height perennial grasslike plant up to 4 feet tall with stout triangular stems, leaves mostly reduced to basal leaf sheaths, and several brown budlike flowering clusters located near top of stem; June into September; inland marshes, shallow waters, shores, and coastal marshes; FACW+.
32. **Soft-stemmed Bulrush** *(Scirpus validus):* Tall perennial grasslike plant up to 10 feet high with soft, round, grayish-green stems, no apparent leaves, and an open inflorescence of many stalked budlike flowering clusters borne on drooping branches near top of stem; June into September; inland marshes, shallow waters, shores, slightly brackish coastal marshes, and tidal fresh marshes, OBL. *Similar species:* Hard-stemmed Bulrush *(Scirpus acutus)* has hard, round, dark green stems; OBL.

Rushes

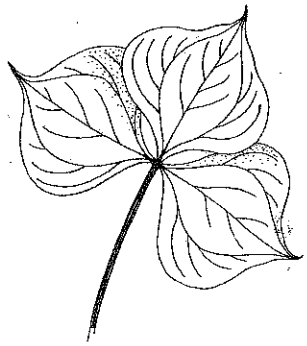
33. **Canada Rush** (*Juncus canadensis*): Medium-height perennial grasslike plant up to 3 1/4 feet tall growing in clumps, with few elongate round (in cross-section) leaves, small flowers borne in dense heads, and fruit capsules; July into October; inland marshes and edges of salt marshes; OBL.
34. **Soft Rush** (*Juncus effusus*): Medium-height perennial grasslike plant up to 3 1/2 feet tall forming dense clumps with round stems, no apparent leaves, small greenish brown flowers borne in branched clusters near middle of stem, and later bearing roundish fruit capsules containing many small seeds; July into September; inland marshes, wet meadows, shrub swamps, wet pastures, and tidal fresh marshes; FACW+. *Similar species*: Bayonet Rush (*Juncus militaris*) grows in shallow water and has a single, hollow leaf (divided by distinct cell walls) arising from middle of stem; OBL.

Other Grasslike Plants

35. **Rough Horsetail** (*Equisetum hyemale*): Medium-height to tall perennial grasslike plant up to 5 feet high or more with mostly unbranched, erect evergreen rough ridged hollow stems, no apparent leaves, black-toothed collars and bands around stem, and single terminal cone; summer; inland marshes, sandy shores, embankments, and roadsides; FACW. *Similar species*: Other common horsetails found in marshes are annuals that have the terminal cone borne on a stalk and often have whorls of branches from nodes. Common Horsetail (*Equisetum arvense*) is common along roadsides and railroad embankments and has many-branched rough sterile stems and unbranched fertile stems; FAC. Water Horsetail (*Equisetum fluviatile*) is a wetland species that has smooth, hollow many-branched to no branched stems and reddish roots; OBL.
36. **Eastern Bur-reed** (*Sparganium americanum*): Medium-height perennial grasslike plant up to 3 1/2 feet tall with simple entire linear leaves (triangular in cross-section) alternately arranged and clasping stem at base, greenish to whitish flowers in ball-shaped heads, and ball-like fruit clusters of nutlets; May through August; inland marshes and shallow waters; OBL. *Similar species*: Giant Bur-reed (*Sparganium eurycarpum*) has stiff erect triangular linear leaves up to 7 feet tall; OBL.
37. **Broad-leaved Cattail** (*Typha latifolia*): Tall perennial grasslike herb up to 10 feet high with elongate, somewhat flattened, erect basal leaves (up to 1 inch wide) sheathing base of stem and inconspicuous flowers borne on terminal spike composed of two contiguous parts (male part above green changing to brown female part); May into July; inland marshes, ponds, and tidal fresh marshes; OBL. *Similar species*: Narrow-leaved Cattail (*Typha angustifolia*) has narrower leaves (to 1/2 inch wide) and a terminal spike separated into two parts by a space; OBL (Species No. 15).

Broad-leaved Herbs With Basal Leaves

38. **Pitcher-plant** (*Sarracenia purpurea*): Low-growing insectivorous perennial herb with unique, thick, erect yellowish to greenish or reddish-purple pitcher-shaped basal leaves (up to 8 inches tall) often having red veins, and large purplish five-petaled flowers (up to 2 1/2 inches wide) on a separate stalk (up to 1 1/2 feet tall); June into August; bogs and forested wetlands with peat moss; OBL.
39. **Northern Water Plantain** (*Alisma plantago-aquatica*): Low to medium-height perennial herb up to 3 1/2 feet tall with simple entire egg-shaped leaves (up to 6 inches long) having somewhat heart-shaped bases, many small three-petaled white flowers (up to 3/5 inch wide) borne on separate stalk exceeding leaves; June into September; inland marshes, shallow waters, and ditches; OBL.
40. **Big-leaved Arrowhead** (*Sagittaria latifolia*): Medium-height perennial herb up to 4 feet tall with broad to narrow arrowhead-shaped basal leaves, three-petaled white flowers (up to 1 1/2 inch wide) with yellow centers arranged in whorls on separate flowering stalk, and ball-shaped fruit clusters of green nutlets; July through September; inland marshes, shallow waters, and tidal fresh marshes; OBL. *Similar species*: Arrow Arum (*Peltandra virginica*) has somewhat leathery arrowhead-shaped leaves, but its flowers are not conspicuous being enclosed in a leafy sheath; OBL.
41. **Jack-in-the-pulpit** (*Arisaema triphyllum*): Low to medium-height perennial herb up to 3 feet tall with underground bulb, compound leaves divided into three (sometimes five) leaflets, inconspicuous flowers borne on a fleshy spike enclosed within a leafy tubular hood, and clusters of red berries; late April into June; forested wetlands and rich moist woods; FACW-. *Similar species*: Purple Trillium or Wake-robin (*Trillium erectum*) is a moist upland woods species that has a single whorl of three leaves that are widest near middle and bears a distinctive three-petaled purplish flower; FACU-.



Purple Trillium

42. **Skunk Cabbage** (*Symplocarpus foetidus*): Medium-height perennial herb up to 2 feet tall with large, oval to heart-shaped leaves that are foul-

smelling (skunklike odor when crushed), and inconspicuous flowers borne on a somewhat oval-shaped to roundish fleshy spike enclosed within a thick, fleshy purple and green striped hood; April into May (before leaves emerge); deciduous forested wetlands, shrub swamps, and inland marshes; OBL. *Similar species*: False Hellebore (*Veratrum viride*) also has large leaves but they are not foul-smelling and are deeply ridged (many folds) and alternately arranged in a three-ranked fashion, also it has greenish flowers borne on a branched terminal inflorescence; FACW+.

43. **Round-leaved Sundew** (*Drosera rotundifolia*): Low-growing insectivorous perennial herb usually less than 6 inches tall with cluster of roundish basal leaves covered with sticky hairs and small five-petaled white to purplish flowers borne on one side of separate flowering stalks; July through August; bogs; OBL. *Similar species:* Spatulate-leaved Sundew (*Drosera intermedia*) has spoon-shaped leaves; OBL.
44. **Blue Flag** (*Iris versicolor*): Medium-height perennial herb up to 4 feet tall with somewhat fleshy sword-shaped leaves (1/2 to 1 inch wide) in basal clumps and bluish or violet iris flowers with the three larger "petals" having yellow, green, white or purple veins; June through July; inland marshes, wet meadows, bogs, deciduous forested wetlands, and tidal fresh marshes; OBL. *Similar species*: Slender Blue Flag (*Iris prismatica*) has narrower, grasslike leaves (less than 1/4 inch wide) and occurs along margins of salt marshes; OBL; *it is a rare plant, so report any findings to the Maine Natural Heritage Program.* Sweet Flag (*Acorus calamus*) has sword-shaped basal leaves (up to 4 feet tall) that are aromatic (when crushed); OBL.
45. **Wild Calla** (*Calla palustris*): Low to medium-height perennial herb up to 2 feet tall with thick heart-shaped leaves (up to 8 inches long), small flowers borne on thick cylinder-shaped fleshy spike surrounded by whitish leaf, and red berries; June to August; margins of bogs and shallow water; OBL.
46. **Marsh Marigold** (*Caltha palustris*): Low to medium-height perennial herb up to 2 feet tall with fleshy stem, large kidney-shaped, shallow-toothed mostly basal leaves (up to 7 inches wide), and conspicuous shiny bright yellow five- to nine-petaled flowers (up to 1 inch wide); April into June; along streams in forested wetlands, streamside fens, and shrub swamps; OBL.
47. **Goldthread** (*Coptis trifolia*): Low perennial herb up to 6 inches tall with yellow-orange roots, compound leaves composed of three shiny evergreen cloverlike toothed leaflets, and small white three- to five-petaled flowers (about 1/2 inch wide) borne on long separate stalks; May through July; evergreen forested wetlands and cool evergreen upland woods; FACW. *Similar species*: Wild Strawberry (*Fragaria virginiana*) is an upland field species that has similar-shaped leaves that are deciduous, wider flowers (1/2 to 1 inch wide), and bears a strawberry fruit; FACU.

Herbs With Simple Entire Alternate Leaves

48. **Canada Mayflower** (*Maianthemum canadense*): Low perennial herb up to 8 inches tall with two or three leaves (about 1 1/2 inches wide) having heart-shaped bases, small four-petaled white fragrant flowers borne on a terminal spikelike inflorescence, and red berries; May through June; forested wetlands and acidic woods; FAC-. *Similar species*: Three-leaved False Solomon's-seal (*Smilacina trifolia*) is a bog species with usually three leaves clasping the stem and small six-petaled white flowers borne on long stalks in a terminal inflorescence; OBL. Sessile-leaved Bellflower (*Uvularia sessilifolia*) is an upland woodland species that has narrower leaves (less than 1/2 inch wide), one or two yellowish six-petaled drooping flowers, and a triangular fruit pod; FACU-.
49. **White-fringed Orchid** (*Platanthera blephariglottis*, formerly *Habenaria blephariglottis*): Medium-height perennial herb up to 2 1/2 feet tall with leaves sheathing stem and numerous showy white irregular flowers with long curved spurs and fringed lips borne in a terminal spike (up to 7 inches long); July into August; bogs and forested wetlands; OBL.
50. **Rose Pogonia** (*Pogonia ophioglossoides*): Low to medium-height perennial herb up to 20 inches tall with one to three leaves and one or two fragrant pink to purplish flowers (up to 1 1/4 inches wide) with a bearded lower tip borne at top of stem; May into August; bogs; OBL. *Similar species:* Other pinkish-flowered bog herbs include Dragon's Mouth (*Arethusa bulbosa*) and Grass-pink (*Calopogon tuberosus*). The former has a single flower with a bearded lower lip and the other petals ascending over it; OBL. The latter bears two or more flowers with a bearded uppermost petal (lip) and other petals wide spreading; FACW+.
51. **Pickerelweed** (*Pontederia cordata*): Medium-height fleshy perennial herb up to 3 1/2 feet tall with narrow heart-shaped leaves on long stalks and numerous small purplish tubular flowers on a spikelike terminal inflorescence; July to October; inland marshes and shallow waters, and tidal fresh marshes; OBL. *Similar species:* Spatterdock (*Nuphar luteum*) has wider heart-shaped leaves and a single five- to six-petaled yellow flower borne on a long stalk; OBL.
52. **Flat-topped White Aster** (*Aster umbellatus*): Medium-height to tall perennial herb up to 6 1/2 feet high or more with rough upper leaf surfaces and many white daisylike flowers (up to 3/4 inch wide) borne on leafy branches often forming a somewhat flat-topped terminal inflorescence; July to September; forested wetlands, shrub swamps, dry thickets, and borders of woods and fields; FACW. *Similar species*: Bog Aster (*Aster nemoralis*) is a bog species that grows up to 2 feet tall, often less than 1 foot, and has rough hairy stems and one or more pink to light purple daisylike flowers; FACW+.

Herbs With Simple Toothed Alternate Leaves

53. **Jewelweed** *(Impatiens capensis):* Medium-height to tall annual herb up to 5 feet high with smooth somewhat succulent stems, soft coarse-toothed egg-shaped leaves, three-petaled orange to orangish-yellow, reddish brown-spotted, tubular flowers (up to 1 1/4 inches long) borne on long drooping stalks from leaf axils, and elongate fruit capsules that open explosively when touched; July through September; deciduous forested wetlands, inland marshes, shrub swamps, stream banks, and moist woods; FACW.
54. **New York Aster** *(Aster novi-belgii):* Medium-height to tall perennial herb up to 5 feet high with simple entire or weak-toothed narrowly lance-shaped leaves (up to 6 3/4 inches long) slightly clasping stem and violet to bluish daisylike flowers (to 1 1/4 inches wide); late July into October; inland marshes, shrub swamps, shores, edges of swamps, and tidal fresh marshes; FACW+. *Similar species:* Swamp Aster *(Aster puniceus)* has distinctly toothed leaves with rough upper surfaces and definitely clasping stem at base, hairy purplish (sometimes green) stems and bluish daisylike flowers; OBL. *Note: Many asters occur in uplands, so check other field guides.*
55. **Bog Goldenrod** *(Solidago uliginosa)* Medium-height to tall perennial herb up to 5 feet high with very long basal leaves (up to 16 inches long), upper leaves reduced in size, and numerous small yellow flowers in heads borne terminally on one-sided branches from upper leaf axils; August to early September; bogs, forested wetlands, and wet meadows; OBL. *Note: Many goldenrods occur in upland fields, so check other guides.*

Herbs With Simple Toothed Opposite or Whorled Leaves

56. **Boneset** *(Eupatorium perfoliatum):* Medium-height to tall perennial herb up to 5 feet high with hairy stems, pairs of triangle-shaped leaves joined at bases, and many small white flowers in heads borne on a somewhat flat-topped inflorescence; late August through September; inland marshes, wet meadows, shrub swamps, forested wetlands, and tidal fresh marshes; FACW+. *Similar species:* White Snakeroot *(Ageratina altissima, formerly Eupatorium rugosum)* is an upland woodland species that has opposite leaves borne on stalks; FACU-. Spotted Joe-Pye-weed *(Eupatoriadelphus maculatus, formerly Eupatorium maculatum)* is a wetland species that has separate leaves arranged in whorls of four or five along the stem, pinkish to purplish flowers borne in a flat-topped inflorescence, and a purple or purple-spotted stem; FACW.
57. **False Nettle** *(Boehmeria cylindrica):* Medium-height perennial herb up to 3 feet tall with coarse toothed, distinctly pointed lance-shaped leaves and inconspicuous greenish flowers in roundish heads borne on erect elongate spikes from leaf axils; July through September; deciduous forested wetlands, shrub swamps, floodplain wetlands, inland marshes and meadows, and moist woods; FACW+. *Similar species:* Clearweed *(Pilea pumila)* has translucent stems and flowers in drooping clusters from leaf axils; FACW. Stinging Nettle *(Urtica dioica)* has stinging hairs on stems and/or leaves and flowers borne on somewhat drooping branches from leaf axils; FACU.
58. **American Bugleweed** *(Lycopus americanus):* Medium-height perennial herb up to 3 feet tall with square stems, deeply lobed lower leaves (up to 3 1/4 inches long), toothed upper leaves and many small white tubular flowers (less than 1/4 inch long) borne in dense clusters in leaf axils; late June into September; forested wetlands, inland marshes, wet meadows, and shrub swamps; OBL. *Similar species:* Northern Bugleweed *(Lycopus uniflorus)* has light green coarse-toothed leaves (not deeply divided); OBL. Wild Mint *(Mentha arvensis)* has purplish flowers and a strong minty odor when crushed; FACW.

Also see: Nodding Beggar-ticks listed under Devil's Beggar-ticks (Species No. 61).

Herbs With Simple Entire Opposite or Whorled Leaves

59. **Purple Loosestrife** *(Lythrum salicaria):* Medium-height to tall perennial herb up to 6 feet high with angled almost woody stems, entire lance-shaped leaves often having heart-shaped bases, sometimes in whorls of threes, and many pink to purplish five- to six-petaled flowers (up to 3/4 inch wide) borne in leafy spikelike inflorescence (up to 16 inches long); July through September; inland marshes, wet meadows, shrub swamps, tidal fresh marshes, and upper edges of coastal marshes; FACW+. *Similar species:* Swamp Loosestrife *(Decodon verticillatus)* grows in shallow water and has opposite or whorled leaves (in threes or fours), five-petaled bell-shaped pinkish-purplish flowers borne in dense clusters in leaf axils, and long whiplike arching stems that often root at tips; OBL. Swamp Candles *(Lysimachia terrestris)* has five-petaled yellow flowers (with reddish centers) borne singly on long stalks along a terminal spike; OBL. Fringed Loosestrife *(Lysimachia ciliata)* has fringed leaf stalks and five-petaled pale yellow flowers (with petals ending in an abrupt toothlike point) borne on long drooping stalks from leaf axils; FACW.
60. **Dye Bedstraw** *(Galium tinctorium):* low to medium-height weakly erect herb up to 2 feet tall with prickly, angled stems, leaves mostly in whorls of fives and sixes, and many very small whitish three-lobed flowers borne in clusters of three on short stalks; June through September; marshes and swamps; OBL.

Herbs With Compound Opposite Leaves

61. **Devil's Beggar-ticks** *(Bidens frondosa):* Medium-height to tall annual herb up to 4 feet tall with leaves divided into three to five lance-shaped toothed leaflets, yellow to orangish flowers borne in dense heads (up to 1/2 inch wide) from leafy branches, and two-barbed seeds ("stickers"); July into October; marshes, wet meadows, forested wetlands, shrub swamps,

ditches, floodplain forests, and waste places; FACW. Similar species: Nodding Beggar-ticks *(Bidens cernua)* has simple coarse-toothed lance-shaped leaves and six- to eight-petaled yellow daisylike flowers (up to 2 1/4 inches wide) and four-barbed seeds; OBL.

Herbs With Compound Alternate Leaves

62. **Tall Meadow-rue** *(Thalictrum pubescens):* tall perennial herb up to 6 feet, with leaves divided into many round toothed leaflets and bearing many small white flowers in dense clusters terminally; June and July; marshes, wet meadows and swamps; FACW+.
63. **Water Parsnip** *(Sium suave):* Tall perennial herb up to 7 feet high with grooved or angled stems, leaves divided into seven to seventeen separate linear to lance-shaped toothed leaflets, and minute white flowers borne in terminal clusters (umbels, up to 5 inches wide); July through September; marshes, shrub swamps, and deciduous forested wetlands;OBL. Similar species: Water Hemlock *(Cicuta maculata)* has some three-lobed leaflets and its stems may be purple-mottled; OBL. Hemlock Parsley *(Conioselium chinense)* has parsley-like compound leaves and rough-margined leaf sheaths; FACW.

FRESHWATER WETLAND SHRUBS

Thorny Shrubs

64. **Swamp Rose** *(Rosa palustris):* Broad-leaved deciduous shrub up to 7 feet tall with stems bearing pairs of recurved thorns, compound leaves divided into seven fine-toothed, narrow egg-shaped leaflets, large five-petaled pink flowers (up to 2 1/2 inches wide), and fleshy hairy reddish rosehip fruits; June to October; marshes, shrub swamps and forested wetlands; OBL. Similar species: Shining Rose *(Rosa nitida)* has shiny dark green leaflets and very bristly stems; FACW+. Common Red Raspberry *(Rubus idaeus)* has prickly or bristly stems, three-parted leaflets, and red raspberry fruits; FAC-. Currants or Gooseberries *(Ribes* spp.*)* have three- to seven-lobed (simple) leaves and thorny or bristly stems.
65. **Bristly Black Currant** *(Ribes lacustre):* Broad-leaved deciduous shrub up to about 5 feet tall with bristly stems and branches and longer spines at nodes, simple toothed deeply three- to five-lobed leaves (up to 4 inches long) alternately arranged, foul-smelling branches when broken, small green, pinkish, or purple five-petaled flowers borne on bristly stalks in arching or drooping clusters, and purplish black bristly berries; May to August; forested wetlands, moist woods, and thickets; FACW. Similar species: Smooth Gooseberry *(Ribes hirtellum)* has smooth or prickly stems with peeling bark, flowers borne on smooth stalks (usually), and bluish black berries (lacking bristles); FAC.

Evergreen Shrubs With Minutely Toothed Leaves

66. **Leatherleaf** (*Chamaedaphne calyculata*): Medium-height ericaceous (heath) shrub up to 5 feet tall with simple entire to minutely toothed leathery leaves (up to 2 inches long), small five-lobed bell-shaped white flowers drooping from short stalks at ends of branches, and five-celled fruit capsules; late April through June; shrub bogs and lake margins; OBL. Similar species: Blueberries (*Vaccinium* spp.) have deciduous leaves.

Evergreen Shrubs With Simple Entire Opposite Leaves

67. **Sheep Laurel** (*Kalmia angustifolia*): Medium-height ericaceous (heath) shrub up to 3 1/2 feet tall with round branchlets, soft leaves (up to 2 1/2 inches long) green above and pale green below, small five-lobed pinkish flowers (about 1/2 inch wide) borne in clusters along branches from leaf axils just below top of leafy stem, and small round five-valved fruit capsules; May to August; shrub bogs, forested wetlands, and acidic upland woods; FAC.
68. **Bog or Pale Laurel** (*Kalmia polifolia*): Low to medium-height ericaceous (heath) shrub up to 2 feet tall with two-sided branchlets having nodes, thick leathery leaves (up to 1 2/3" long) dark green, smooth above and whitish hairy below having inwardly rolled margins, small five-lobed pale pinkish flowers (1/2 - 3/5 inch wide) borne at end of twigs, and small five-valved round fruit capsules; June to July; shrub bogs; OBL.

Evergreen Shrubs With Simple Entire Alternate Leaves

69. **Bog Rosemary** (*Andromeda glaucophylla*): Low to medium-height ericaceous (heath) shrub up to 2 1/2 feet tall with round branchlets, thick leathery linear leaves (up to 2 1/4 inches long) bluish green above and whitish hairy below having inwardly rolled margins, small white to pinkish urn-shaped flowers (about 1/4 inch long) borne in drooping clusters, and small five-valved round fruit capsules; June to July; shrub bogs; OBL.
70. **Labrador Tea** (*Ledum groenlandicum*): Medium-height ericaceous (heath) shrub up to 3 feet tall with thick leathery oblong leaves (up to 2 inches long) dark green above, rusty hairy below having inwardly rolled margins, and aromatic when crushed, white five-petaled flowers (about 1/3 inch wide) borne in terminal clusters, and cylinder-shaped five-parted fruit capsules; June through July; shrub bogs and adjacent forested wetlands; OBL.

Also see: Leatherleaf (Species No. 65).

Deciduous Shrubs With Compound Leaves

71. **Poison Sumac** (*Toxicodendron vernix*): Poisonous shrub or low tree up to 20 feet tall with milky sap, alternately arranged leaves divided into

seven to thirteen leaflets (up to 3 1/2 inches long) on red stalks, small greenish yellow flowers in dense clusters borne on long stalks from leaf axils, and small whitish berries; June through July; forested wetlands, shrub swamps, and edges of inland marshes in southern Maine; OBL. **WARNING - DO NOT TOUCH - POISONOUS.** *Similar species*: Poison Ivy (*Toxicodendron radicans*) is a trailing, climbing vine or erect shrub with leaves divided into three leaflets; FAC (Species No. 90). Staghorn Sumac (*Rhus typhina*) is a related nonpoisonous upland shrub with fuzzy twigs and somewhat pyramid-shaped terminal clusters of hairy red berries; UPL.

72. **Common Elderberry** (*Sambucus canadensis*): Shrub up to 12 feet tall with narrow light brown stems (about 1 inch wide) having many raised warts (lenticels), soft white pith, opposite leaves with usually seven (five to eleven) fine-toothed lance-shaped leaflets, many small white five-lobed tubular flowers borne in somewhat flat-topped clusters at end of twigs, and dark purplish berries; June through July; forested wetlands, shrub swamps, inland marshes, wet meadows, moist woods, and old fields; FACW-. *Similar species*: Red-berried Elderberry (*Sambucus racemosa*, formerly *S. pubens*) is an upland relative that has a brown pith, creamy white to yellowish flowers borne in a pyramid-shaped (panicle-like) inflorescence, and bright red berries; FACU.

Deciduous Shrubs With Simple Toothed Opposite Leaves

73. **Northern Wild Raisin** (*Viburnum cassinoides*): Shrub up to 12 feet tall with entire, blunt-toothed, or wavy-margined thick somewhat leathery oval leaves (up to 6 inches long), small five-lobed white flowers borne in somewhat flat-topped terminal clusters (up to 4 inches wide), and bluish-black berries; May through July; forested wetlands and shrub swamps; FACW. *Similar species*: Northern Bush-honeysuckle (*Diervilla lonicera*) is a low-growing upland shrub (up to 4 feet tall) with somewhat similar leaves, but has hairy ridged twigs, leaves with somewhat heart-shaped bases, and funnel-shaped yellow flowers usually borne in groups of two or three; UPL.
74. **Northern Arrowwood** (*Viburnum recognitum*): Shrub up to 15 feet tall with somewhat angled (up to 6-angled) brown twigs, coarse-toothed egg-shaped leaves (to 3 3/4 inches long), many small five-lobed white flowers in flat-topped or rounded inflorescences, and dark blue berries; May through July; forested wetlands, shrub swamps, inland marshes, wet meadows, and moist woods; FACW-.

Deciduous Shrubs With Simple Entire Opposite or Whorled Leaves

75. **Red Osier Dogwood** (*Cornus stolonifera*): Shrub up to 10 feet tall with a white pith, reddish twigs and main stems, somewhat egg-shaped leaves (up to 6 inches long) dark green above and sometimes hairy below having somewhat rounded bases and pointed tips, many small four-petaled white flowers borne in flat-topped to rounded clusters (about 2 1/2 inches wide) at end of branches, and white (sometimes blue-tinged) berries; May to August; shrub swamps, inland marshes and wet meadows; FACW+. *Similar species*: Silky Dogwood (*Cornus amomum*) has a light brown pith, reddish purplish twigs, grayish main stems with purplish stripes, and blue to bluish-white berries; FACW. Roundleaf Dogwood (*Cornus rugosa*) is an upland relative that has greenish twigs marked with purple, a white pith, and light bluish berries; UPL. Bunchberry (*Cornus canadensis*) is a low-growing relative (less than 12 inches tall) that grows in forested wetlands and uplands; it has a whorl-like cluster of four to six simple entire lance-shaped leaves borne at the top of the stem, a single flower cluster with four white "petals" (bracts), and red berries; FAC-.
76. **Buttonbush** (*Cephalanthus occidentalis*): Shrub up to 10 feet or taller with flaky grayish brown older bark, grayish brown to purplish twigs marked by light-colored elongate dots, egg-shaped leaves (up to 6 inches long) sometimes in whorls of threes or fours, red leafstalks, many small white tubular flowers in dense ball-shaped heads, and ball-like fruit clusters bearing nutlets; June through August; shrub swamps, margins of waterbodies, and inland marshes; OBL.
77. **Swamp Fly-honeysuckle** (*Lonicera oblongifolia*): Shrub up to 6 feet tall with solid pith, oblong leaves (up to 3 1/2 inches long) soft hairy below, yellowish two-lipped flowers borne on long stalks from leaf axils, and orange or red berries; May and June; forested wetlands and bogs; OBL. *Similar species*: Mountain Fly-honeysuckle (*Lonicera caerulea* var. *villosa*, formerly *L. villosa*) is shorter (to 3 1/2 feet tall) with hairy twigs and leaves, yellowish five-lobed tubular flowers, and blue berries; FACW+.

Deciduous Shrubs With Simple Toothed Alternate Leaves

78. **Sweet Gale** (*Myrica gale*): Low to medium-height shrub usually less than 3 feet tall with entire or few-coarse-toothed aromatic (bayberry-scented) leaves (up to 2 1/2 inches long) having wedged-shapped bases, and inconspicuous flowers borne in dense budlike clusters at top of last year's twigs; May into June; shrub bogs, inland marshes, fens, margins of lakes and ponds, and upper edges of salt marshes; OBL. *Similar species*: Sweet Fern (*Comptonia peregrina*) is a related upland species with aromatic parts, but has narrow round-toothed leaves resembling those of a fern; UPL.
79. **Common Winterberry** (*Ilex verticillata*): Shrub up to 16 feet tall with coarse-toothed leaves (up to 4 inches long) with a prominent tip, tapering leaf base, small four- to six-lobed white flowers (about 1/4 inch wide) borne singly or in clusters

from leaf axils, and bright red berries on female plants (persist into winter); May through August; shrub swamps and deciduous forested wetlands; FACW+. *Similar species*: Black Chokeberry (*Aronia melanocarpa*) has larger five-petaled white flowers (about 1/2 inch wide) borne in clusters at end of branches, fine-toothed leaves with midveins bearing small black glands, and black berries; FAC. Leaves of cherries (*Prunus* spp.) are somewhat similar, but have a pair of raised glands on the leaf stem and twigs that have an offensive odor when broken; FACU or UPL.

80. **Speckled Alder** (*Alnus rugosa*): Shrub or small tree up to 25 feet tall, usually growing in clumps (much branched from base), with white-speckled bark, coarse and fine toothed leaves (up to 6 inches long), minute flowers borne on elongate spikes, and small pinelike cones; March to May; shrub swamps, inland marshes, and hillside seeps; FACW+. *Similar species*: Green Alder (*Alnus crispa*) has finely sharp-toothed leaves and sticky young leaves and twigs; FAC.
81. **Maleberry** (*Lyonia ligustrina*): Shrub up to 13 feet tall with fine-toothed leaves (up to 3 inches long) usually fine-pointed, small five-lobed bell-shaped white flowers borne in clusters (up to 6 inches long) at ends of branches or from leaf axils, and persistent five-celled round fruit capsules; May through July; forested wetlands and shrub swamps; FACW.
82. **Broad-leaved Meadowsweet** (*Spiraea latifolia*): Shrub up to 4 1/2 feet tall with purplish brown to reddish brown twigs, fine-toothed leaves, small five-petaled white flowers (about 1/4 inch wide) borne in dense clusters in upper branches and top of stem, and persistent five-parted fruit capsules; June into September; shrub swamps, wet meadows, and inland marshes; FAC+.
83. **Steeplebush** (*Spiraea tomentosa*): Shrub up to 3 1/2 feet tall with coarse-toothed leaves that are white- or rusty-woolly below, small five-petaled pinkish flowers in dense steeplelike terminal inflorescence (up to 6 inches long); July into September; wet meadows, inland marshes, and shrub swamps; FACW.
84. **Willows** (*Salix* spp.): Shrubs with mostly fine-toothed (some species with entire), narrow leaves (up to 5 inches long) and flowers borne on catkins which develop before leaves; April to June; shrub swamps, wet meadows, and marshes; mostly OBL and FACW. *Note: Many willows occur in Maine and they are often difficult to identify.*

Deciduous Shrubs With Simple Entire Alternate Leaves

85. **Mountain Holly** (*Nemopanthus mucronata*): Shrub up to 10 feet tall with entire (sometimes weakly toothed) somewhat egg-shaped leaves (up to 1 inch long) with a distinct bristle tip, small four- to five-petaled white to yellowish flowers borne on long slender stalks singly or in clusters from leaf axils, purplish twigs, and dull reddish berries; May into June; shrub swamps, forested wetlands, and shrub bogs; OBL.
86. **Rhodora** (*Rhododendron canadense*): Ericaceous (heath) shrub up to 3 feet tall with stiff ascending branches, somewhat egg-shaped leaves (to about 2 1/2 inches long) dark green above and paler somewhat hairy below having short-pointed tips and wedge- shaped bases, showy pinkish to purplish two-lipped flowers (about 1 1/4 inches wide), and persistent elongate five-parted fruit capsules; April to June (before leaves fully emerge); shrub bogs and rocky slopes; FACW.
87. **Highbush Blueberry** (*Vaccinium corymbosum*): Ericaceous (heath) shrub up to 13 feet tall, usually growing in clumps, with entire or toothed leaves (up to 3 1/4 inches long), small whitish urn-shaped flowers (up to 1/2 inch long) borne in dense terminal and lateral clusters; blueberry fruits (up to 1/2 inch wide); May through July (before leaves emerge); forested wetlands, shrub swamps, bogs, and upland woods; FACW-. *Similar species*: Black Huckleberry (*Gaylussacia baccata*) has leaves with yellow resin dots on both surfaces and blackish seedy berries; FACU. Dwarf Huckleberry (*Gaylussacia dumosa*) has thicker shiny dark green bristle-tipped leaves and yellow resin dots below; FAC.
88. **Velvet-leaf Blueberry** (*Vaccinium myrtilloides*): Low ericaceous (heath) shrub less than 2 feet tall with hairy margined velvety entire leaves (at least on undersides), velvety warty stems, greenish white to creamy (pink- or purple-tinged) bell-shaped flowers borne in clusters at the end of branches, and blueberry fruits (up to 1/3 inch wide); May and June; bogs, swamps, and dry or moist sandy or rocky areas; FAC. *Similar species*: Lowbush Blueberry (*Vaccinium angustifolium*) is also low-growing, but has fine-toothed leaves and lacks velvety stems and leaves; FACU-.

Also see: Willows (Species 84).

FRESHWATER WETLAND WOODY VINES

Woody Vines With Compound Leaves

89. **Swamp Dewberry** (*Rubus hispidus*): Low trailing woody vine up to 8 feet long with bristly stems, leaves divided into three (sometimes five) glossy semi-evergreen toothed leaflets (up to 3 inches long), small five-petaled white flowers (to 3/4 inch wide) borne on stalked clusters, and blackberry-like fruits (*Note*: Leaves turn reddish in winter); July into September; inland marshes, shrub swamps, bogs, forested wetlands, and moist uplands; FACW. *Similar species*: Baked Appleberry or Cloudberry (*Rubus chamaemorus*) has simple deciduous, thick leathery, five- to seven-round-lobed toothed leaves, five-petaled white flowers (4/5 to 1 1/4 inches wide), and reddish to orange or yellow blackberry-like fruits; it is generally restricted to bogs in Downeast Maine; FACW.
90. **Poison Ivy** (*Toxicodendron radicans*): Broad-leaved deciduous woody vine or shrub with climbing stems covered by dense fibers, alternately arranged compound leaves composed of

three weak-toothed leaflets, milky sap, small yellowish five-petaled flowers borne on lateral clusters, and small grayish white fruit balls; May through July; forested wetlands, upland woods, edge of salt marshes, and dry thickets; FAC. **WARNING - DO NOT TOUCH - POISONOUS.** *Similar species:* Virginia Creeper (*Parthenocissus quinquefolia*) has compound leaves divided into five to seven sharp-toothed leaflets and dark blue to blackish berries; FACU.

Woody Vines With Simple Leaves

91. **Large Cranberry** (*Vaccinium macrocarpon*): Low trailing ericaceous shrub up to 8 inches tall with smooth branchlets, narrow leathery leaves (3/8 to 5/8 inch long) shiny dark green above (reddish in winter), small nodding white to pinkish flowers with four recurved petals, and red cranberries (1/2 to 7/8 inch wide); July through August; shrub bogs and acidic marshes; OBL. *Similar species:* Small Cranberry (*Vaccinium oxycoccus*) has smaller leaves (less than 3/8 inch long) and smaller berries (1/4 inch wide); OBL. Black Crowberry (*Empetrum nigrum*) has hairy or glandular branchlets, needlelike leaves arranged singly or in whorls, minute pink to purplish flowers, and purplish to blackish berries; FACW. Creeping Snowberry (*Gaultheria hispidula*) has wintergreen-scented leaves (when crushed) and small white berries; FACW.

FRESHWATER WETLAND TREES

Evergreen Trees

92. **Balsam Fir** (*Abies balsamea*): Tree up to 60 feet tall with aromatic short flat needles (up to 1 1/3 inches long) whitish below, and elongate somewhat cylinder-shaped cones (up to 3 1/2 inches long); forested bogs, evergreen forested wetlands, and upland woods; FAC. *Similar species:* Eastern Hemlock (*Tsuga canadensis*) has dark green shiny flattened needles (up to 5/8 inch long) with two whitish lines below and attached to twigs by slender stalks, and small somewhat egg-shaped cones (up to 1 inch long); FACU. Spruces (*Picea* spp.) have needles that are square in cross section, not flattened.
93. **Black Spruce** (*Picea mariana*): Tree up to about 100 feet tall (but usually much shorter) with hairy branches, pale bluish green short blunt needles (up to 7/16 inch long) and small grayish brown somewhat roundish cones (5/8 to 1 1/4 inches long) that remain on tree at maturity; bogs and evergreen forested wetlands; FACW-. *Similar species:* Red Spruce (*Picea rubens*) looks very similar, but has dark green to yellowish green four-angled sharp-pointed needles (1/2 to 5/8 inch long) often curved upward, and reddish brown cylinder-shaped cones (1 1/4 to 1 1/2 inches long) that fall off when mature; FACU. White Spruce (*Picea glauca*) has smooth branches; FACU.
94. **White Pine** (*Pinus strobus*): Tree up to 160 feet tall with long pine needles in bundles of five and elongate cylinder-shaped cones (up to 10 inches long); forested wetlands, bogs, and upland forests; FACU. *Similar species:* Pitch Pine (*Pinus rigida*) has needles in bundles of three and somewhat oval-shaped spiny cones; FACU. Jack Pine (*Pinus banksiana*) has needles in bundles of two; FACU. Both of these pines may occur in bogs.
95. **Northern White Cedar** (*Thuja occidentalis*): Tree up to 65 feet tall with yellowish-green flattened scale-like leaves (to about 3/4 inch long) and small reddish brown oblong cones (about 1/2 inch long); forested wetlands, wooded fens, and old fields and rocky areas in limestone regions; FACW. *Similar species:* Atlantic White Cedar (*Chamaecyparis thyoides*) has bluish green to pale green scale-like leaves and small globe-shaped cones (1/4 to 3/8 inch wide) with short-pointed scales; bogs in southern Maine only; OBL.

Needle-leaved Deciduous Trees

96. **Larch or Tamarack** (*Larix laricina*): Tree up to 90 feet tall with light bluish green soft leaves (up to 1 inch long) borne in clusters on raised twig spurs and small scaly egg-shaped to rounded cones (1/2 to 3/4 inch long); forested wetlands, shrub bogs, and upland soils; FACW. *Similar species:* European Larch (*Larix decidua*) has larger and hairy cones (1 to 1 1/4 inches long); UPL.

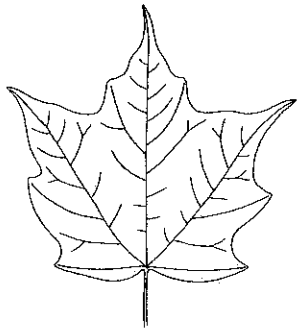
Deciduous Trees With Compound Opposite Leaves

97. **Green Ash** (*Fraxinus pennsylvanica*): Tree up to 80 feet tall with leaves divided into five to nine (usually seven) shallow-toothed lance-shaped leaflets (up to 6 inches long) attached to main leaf stalk by mostly winged stalks, flattened winged fruits, and shallow-notched leaf scars; May to June (as leaves emerge); forested wetlands and floodplains; FACW. *Similar species:* White Ash (*Fraxinus americana*) has whitish, hairy undersides of leaves, mostly wingless leaflet stalks, and deeply notched leaf scars; FACU. Black Ash (*Fraxinus nigra*) has stalkless leaflets and is common in forested swamps; FACW.

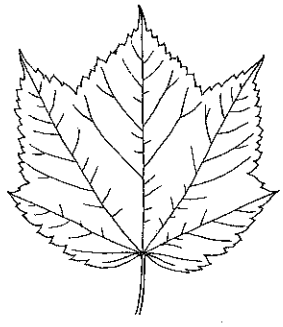
Deciduous Trees With Simple Toothed Opposite Leaves

98. **Red Maple** (*Acer rubrum*): Tree up to 120 feet tall with smooth gray bark, reddish twigs, shallowly three- to five-lobed coarse-toothed leaves (up to 8 inches long) often silvery below, and reddish winged fruits; April through May (before leaves emerge); deciduous forested wetlands, edges of bogs, inland marshes, tidal fresh marshes, floodplains, and moist uplands; FAC. *Similar species:* Silver Maple (*Acer saccharinum*) has foul-smell-

ing twigs when crushed, and deeply five-lobed coarse-toothed leaves (up to 10 inches long) bright green above and silvery below; temporarily flooded forested wetlands along floodplains, alluvial woods, and river banks; FACW. Two common upland maples are Sugar Maple (*Acer saccharum*; FACU-) and Mountain Maple (*Acer spicatum*; FACU-); their leaves are distinctive.



Sugar Maple



Mountain Maple

Deciduous Trees With Simple Toothed Alternate Leaves

99. **Yellow Birch** (*Betula alleghaniensis*): Tree up to 100 feet tall with shiny golden yellow to silvery gray peeling older bark (young bark not peeling), aromatic (wintergreen-scented) twigs, coarse-toothed egg-shaped leaves (up to 5 inches long), and inconspicuous flowers borne on elongate cylinder-shaped spikes; April and May; forested wetlands and moist upland woods; FAC. *Similar species*: Gray Birch (*Betula populifolia*) has dull whitish bark that does not peel and triangle-shaped leaves; FAC. Paper Birch (*Betula papyrifera*) has white peeling bark; FACU. Ironwood (*Carpinus caroliniana*) has smooth gray, ridged, muscle-like bark; FAC. Hop-horn beam (*Ostrya virginiana*) has grayish-brown shredding bark; FACU-. Young cherries (*Prunus* spp.) may have similar looking young bark, but their twigs have an offensive odor when broken; FACU or UPL.
100. **Balsam Poplar** (*Populus balsamifera*): Tree up to 80 feet tall with smooth or shallow furrowed grayish bark, sticky buds, somewhat triangle-shaped leaves (up to 8 inches long) with heart-shaped round bases, round leafstalks, fragrant (balsam-like) leaves and buds when crushed, small flowers borne on drooping clusters, and small egg-shaped fruit capsules; early spring; river banks, forested wetlands, floodplains, sandbars, and shores; FACW. *Similar species*: Other trees with similar leaves are not aromatic. Quaking Aspen (*Populus tremula*, formerly *P. tremuloides*) has flat leafstalks and more roundish leaves; FACU. American Basswood (*Tilia americana*) has more heart-shaped leaves often with a prominent toothed tip and somewhat uneven bases, and clusters of small flowers borne on long stalks with main stalk growing out of a leaf-like bract; FACU.
101. **Black Willow** (*Salix nigra*): Tree up to 70 feet or more with deeply grooved brownish bark, fine-toothed narrow lance-shaped leaves (up to 5 inches long and to 4/5 inch wide) on hairy stalks, somewhat heart-shaped leaflike structures (stipules, to 1/2 inch long) at leaf bases, inconspicuous flowers borne on long spikes at end of leafy stalks, and somewhat pear-shaped fruit capsules; April to June; floodplain forested wetlands, wet meadows, and tidal fresh marshes and swamps in the southern half of Maine; FACW+.
102. **American Elm** (*Ulmus americana*): Tree up to 125 feet tall with scaly ridged gray bark, coarse-toothed leaves (up to 6 inches long) having uneven leaf bases and rough surfaces, inconspicuous purplish brown flowers borne in clusters on long drooping stalks, and flattened egg-shaped winged fruits (about 1/2 inch long); late April (before leaves emerge); floodplain forested wetlands and rich upland woods; FACW-. *Similar species*: American Beech (*Fagus grandifolia*) has thick, toothed leaves with even bases and smooth surfaces and smooth light gray bark; FACU.

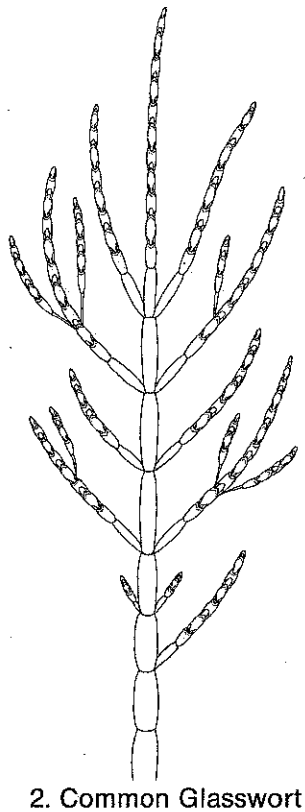
Deciduous Trees With Simple Entire Alternate Leaves

103. **Black Gum** (*Nyssa sylvatica*): Tree up to 125 feet tall with deeply furrowed brown or gray bark, chambered pith (visible cell walls in center of twigs), entire (rarely few-toothed) somewhat thick leaves (up to 6 inches long) shiny green above, small greenish flowers, bluish black berries; April and May; forested wetlands in southern Maine and moist or dry upland woods; FAC.

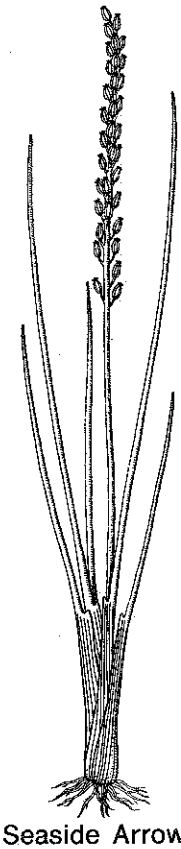
Deciduous Trees With Simple Lobed Alternate Leaves

104. **Bur or Mossy-cup Oak** (*Quercus macrocarpa*): Tree up to 80 feet tall with flaky bark, orange-tinged hairy new twigs, irregular deep to shallow blunt-lobed leaves (up to 12 inches long) shiny green above and gray-white below, and large acorns mostly covered by their caps; May and June (as leaves emerge); temporarily flooded forested wetlands and other bottomlands along floodplains in central Maine; FAC-. *Similar species*: Swamp White Oak (*Quercus bicolor*) has shallow-lobed leaves and occurs in swamps in southern Maine; FACW+; *it is a rare plant, so report any findings to the Maine Natural Heritage Program.* White Oak (*Quercus alba*) has deep-lobed leaves and occurs mostly in dry upland woods from central Maine south. FACU-. Other oaks common in Maine's uplands have sharp-toothed lobed leaves.

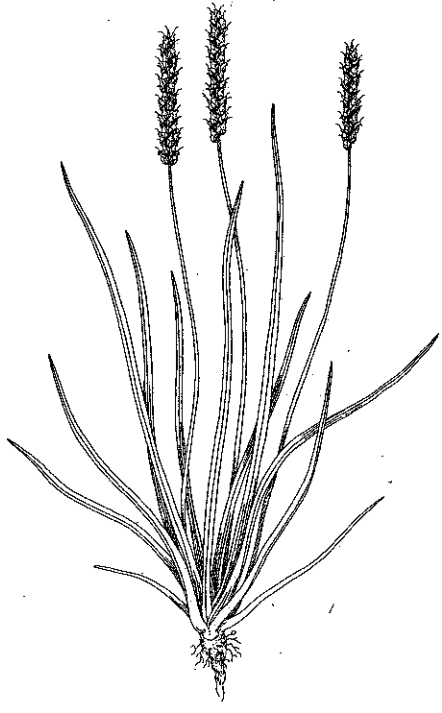
1. Marsh Orach



2. Common Glasswort

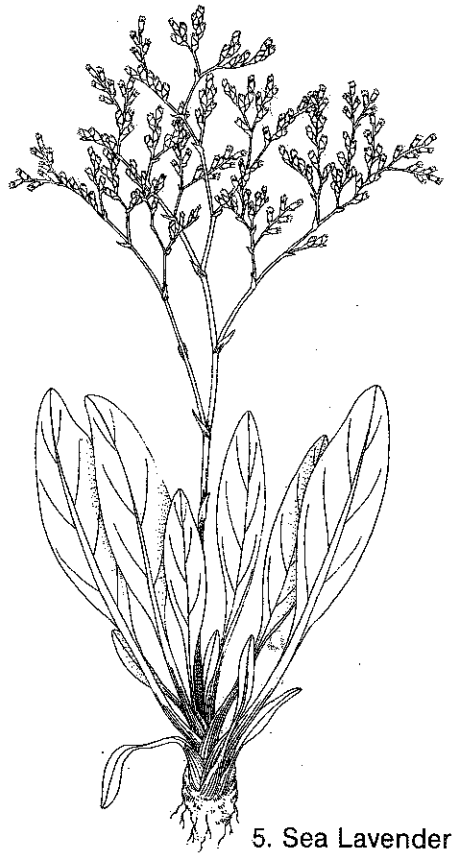


3a. Seaside Arrow-grass



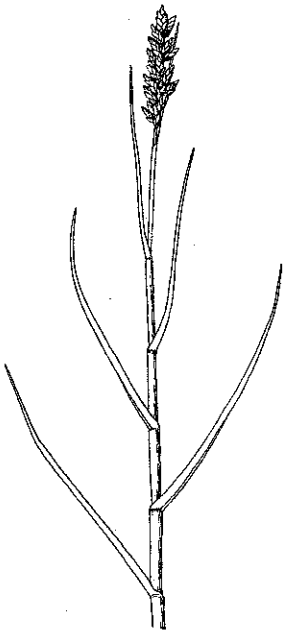
3b. Seaside Plantain

4. Seaside Goldenrod

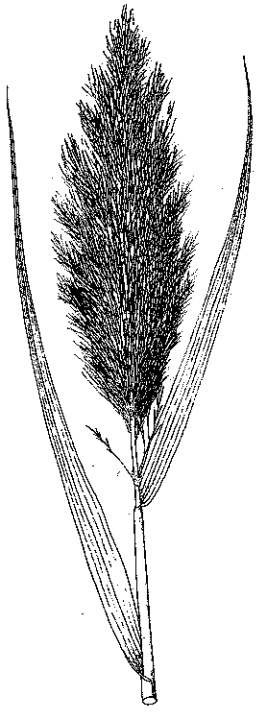


5. Sea Lavender

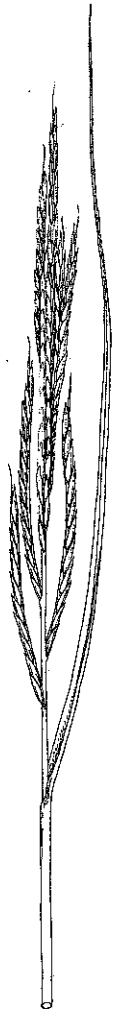
Coastal Marsh Fleshy Herbs and Flowering Herbs

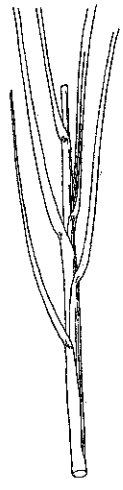


6. Salt Grass

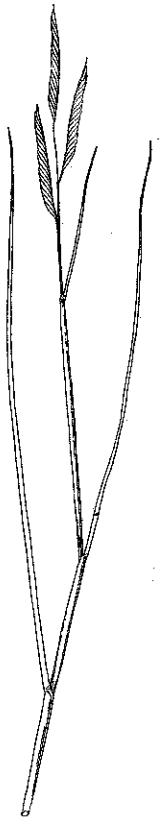


7. Common Reed

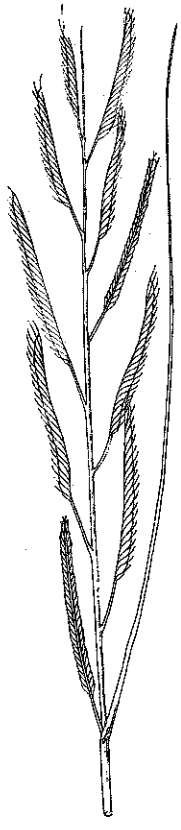




8. Smooth Cordgrass



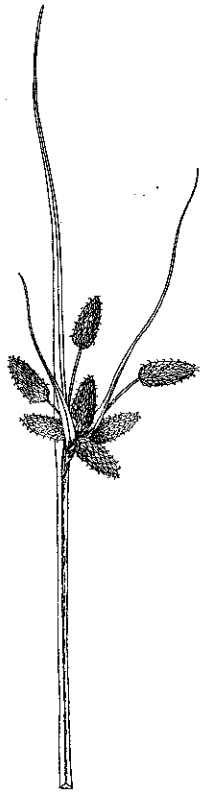
9. Salt-hay Grass



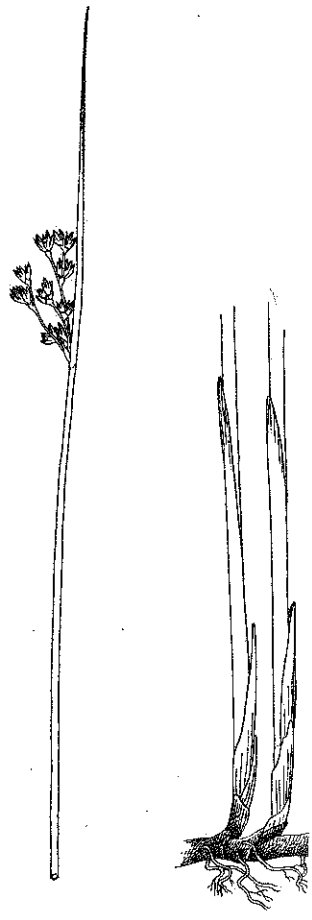
10. Prairie Cordgrass

Coastal Marsh Grasses

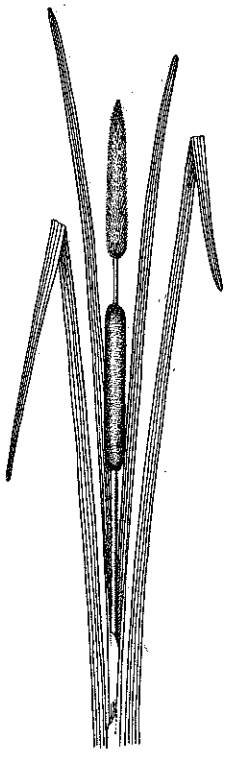
11. Salt Marsh Sedge



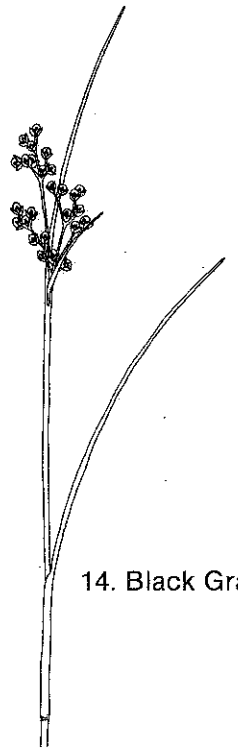
12. Salt Marsh Bulrush



13. Baltic Rush

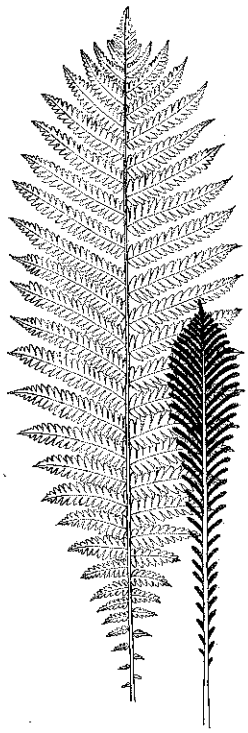


15. Narrow-leaved Cattail

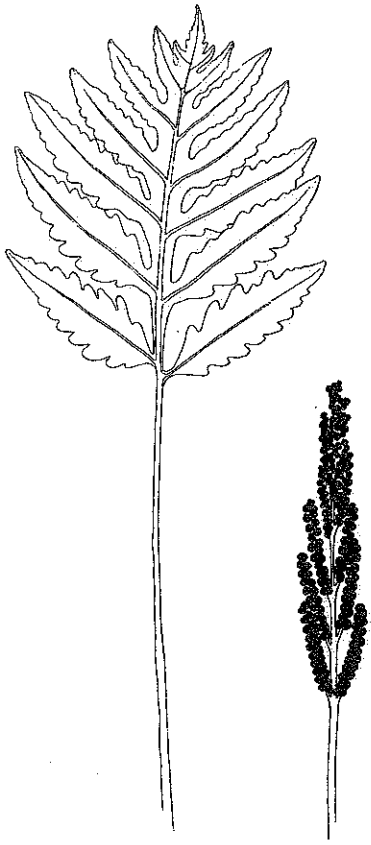


14. Black Grass

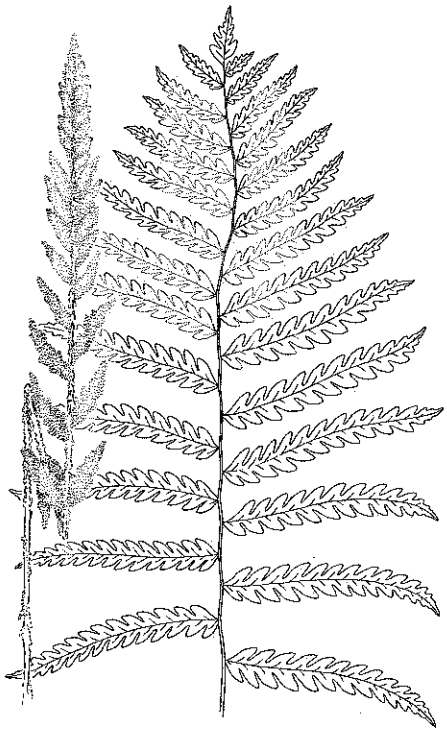
Coastal Marsh Sedges, Rushes, and Other Grasslike Plants



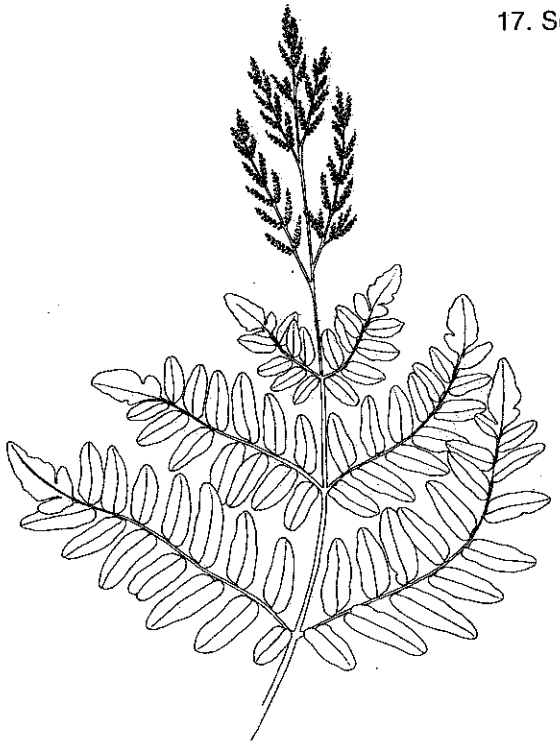
16. Ostrich Fern



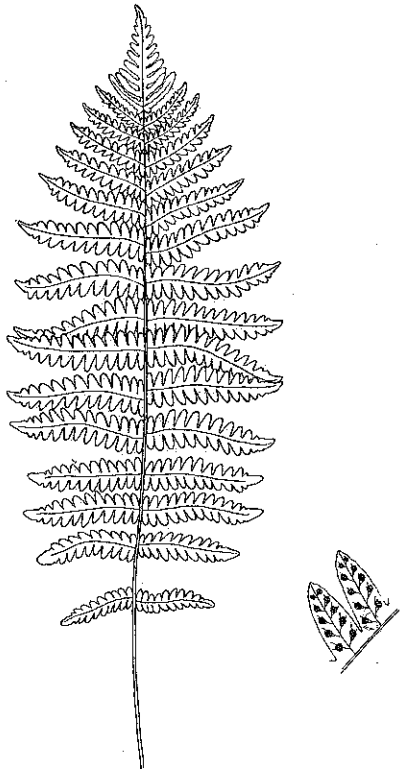
17. Sensitive Fern



18. Cinnamon Fern

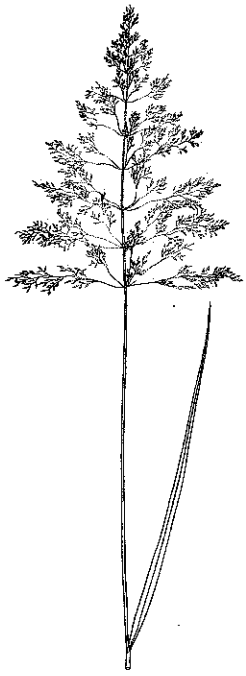


19. Royal Fern



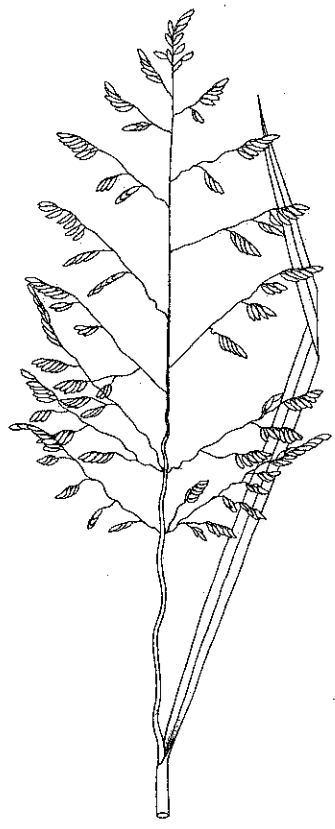
20. Marsh Fern

Freshwater Wetland Ferns

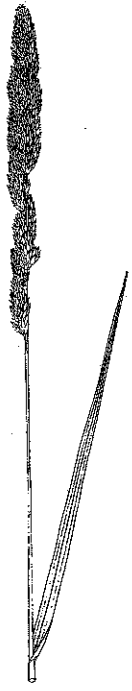


21. Bluejoint

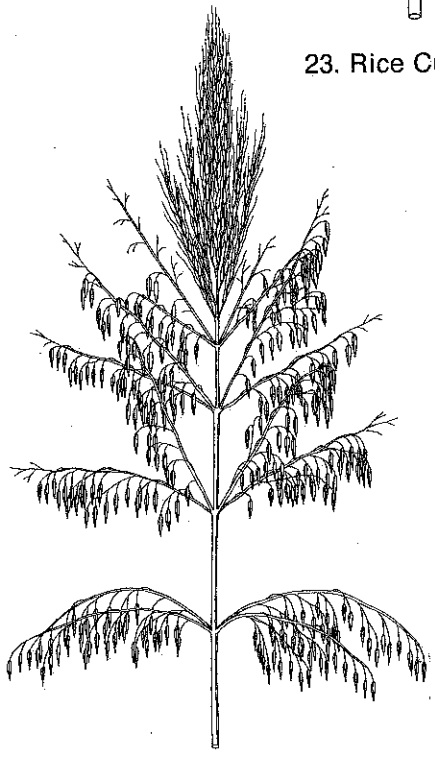
22. Manna Grass



23. Rice Cutgrass

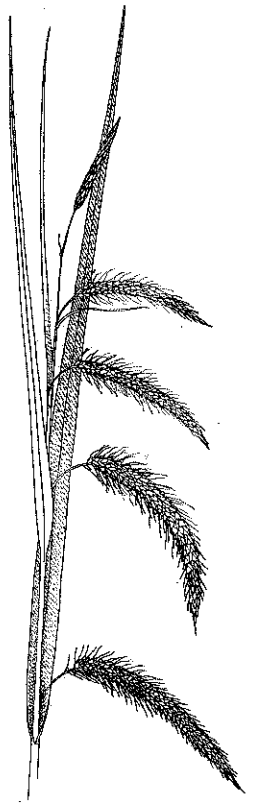


24. Reed Canary Grass



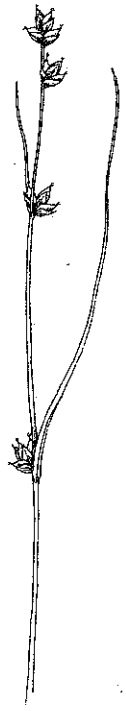
25. Wild Rice

Freshwater Wetland Grasses

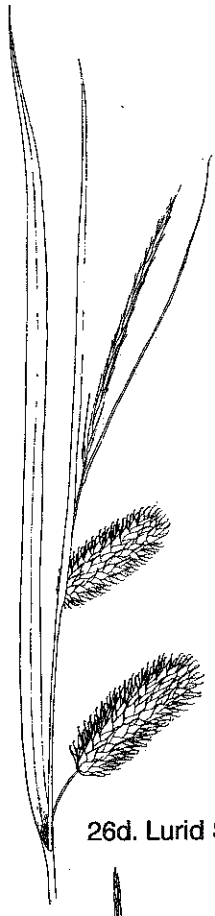


26a. Fringed Sedge X 1/2

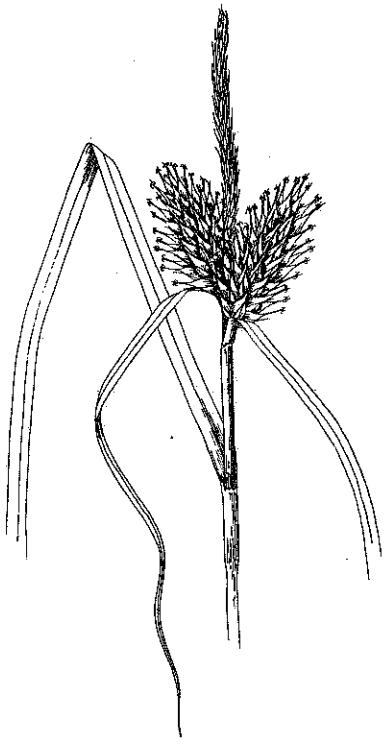
26b. Tussock Sedge X 1/2



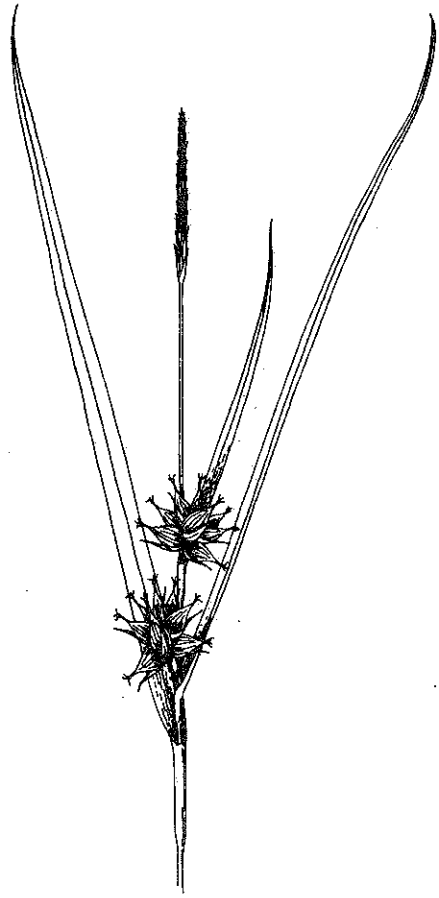
26c. Three-seeded Sedge X 1



26d. Lurid Sedge X 1/2



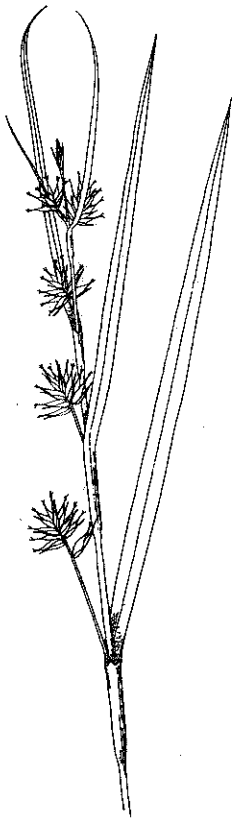
26e. Hop Sedge X 1/3



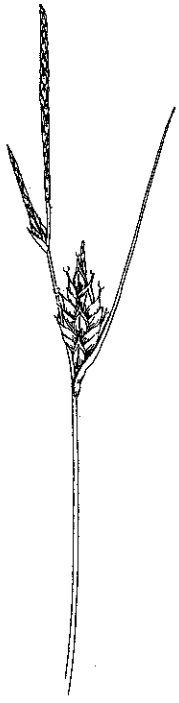
26f. Bladder Sedge X 3/4

26g. Beaked Sedge X 1/2

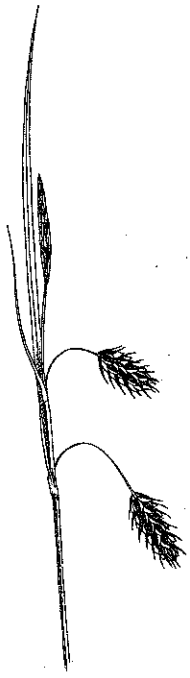
Freshwater Sedges I



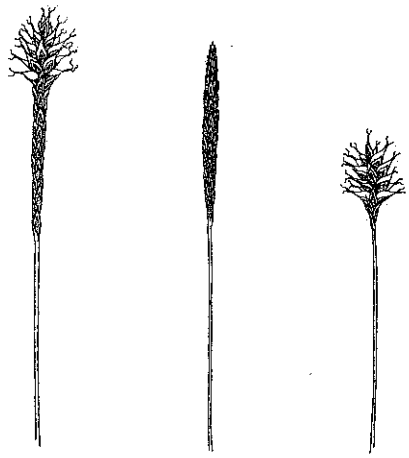
26h. Long's Sedge X 1/3



26i. Few-seeded Sedge X 3/4

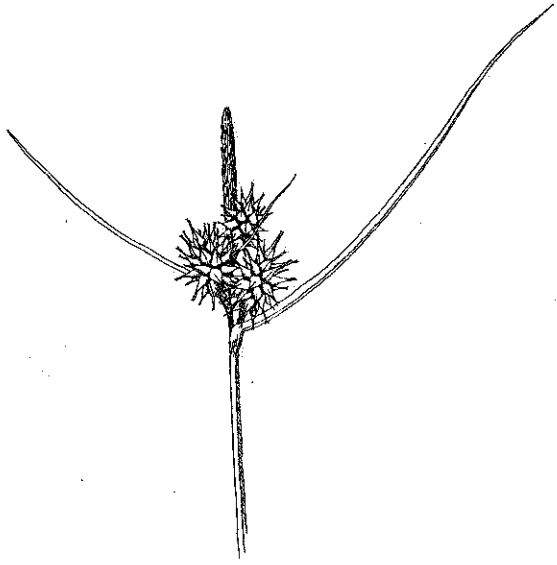


26j. Poor Sedge X 3/4



26k. Coast Sedge X 1

26l. Little Prickly Sedge X 2



26m. Yellow Sedge X 1

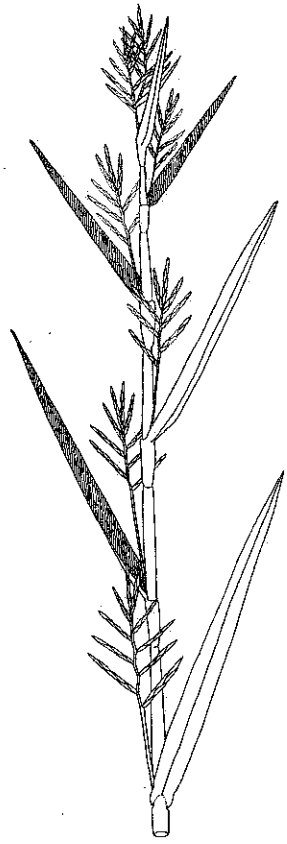
26n. Wooly-fruited Sedge X 1/2

Freshwater Sedges II

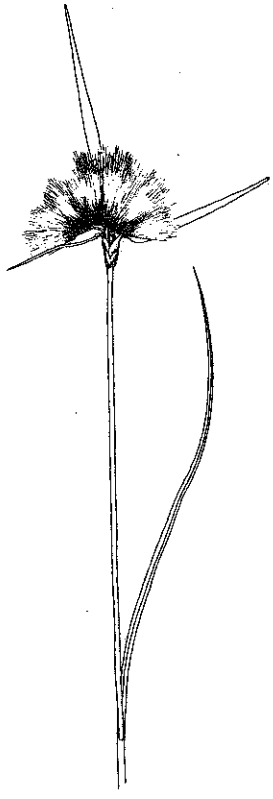
26o. Hoary Sedge X 1

26p. Bristlebract Sedge X 3/4

26q. Fox Sedge X 1/3



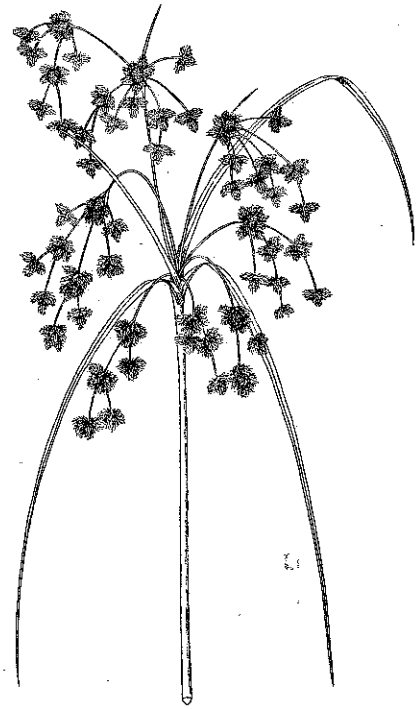
27. Three-way Sedge X 3/4



28a. Cotton-grasses X 1/2

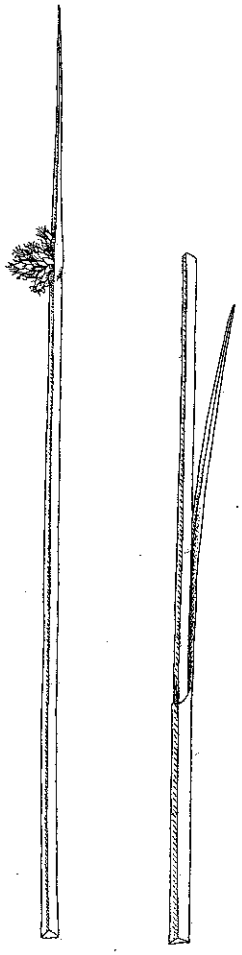
28b. Tufted Bulrush X 1

29. White Beak-rush X 1

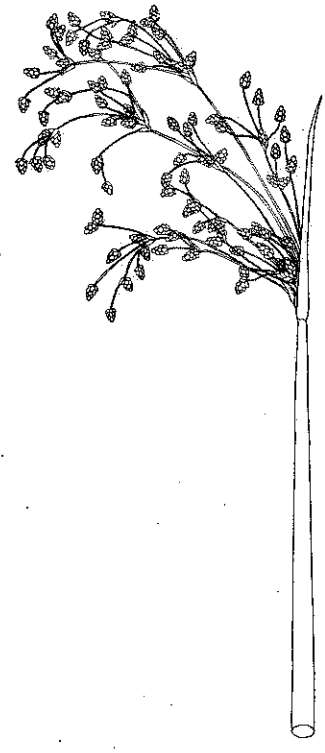


30. Wool Grass X 1/3

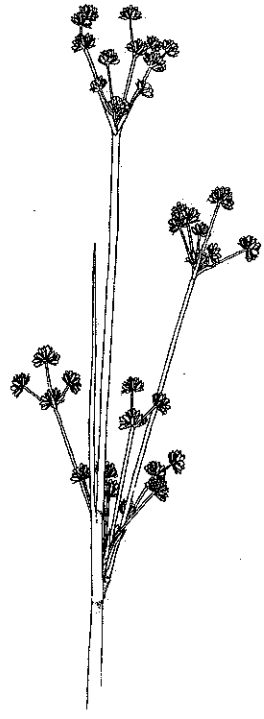
Freshwater Sedges III



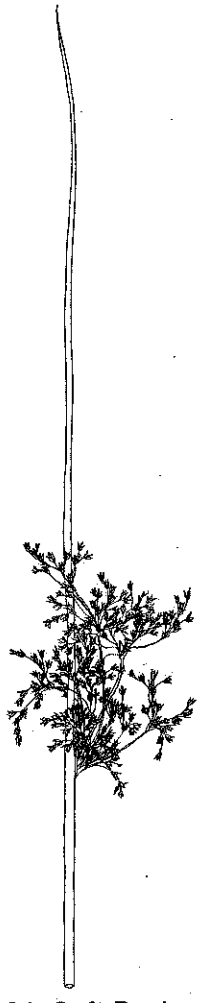
31. Common Three-square



32. Soft-stemmed Bulrush

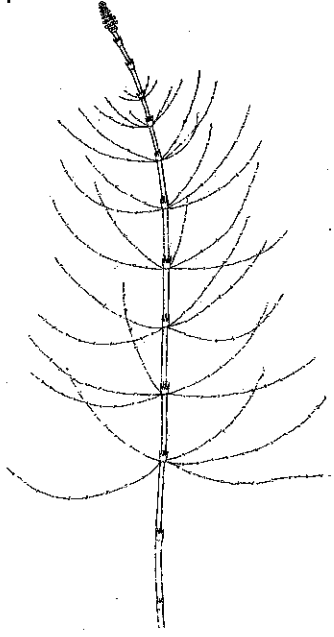


33. Canada Rush



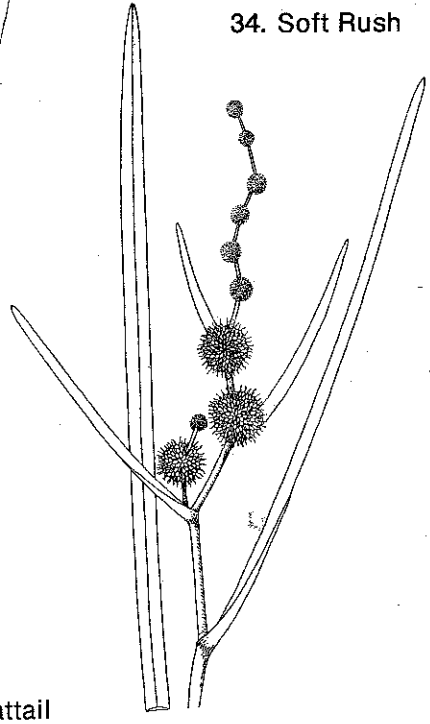
34. Soft Rush

35a. Rough Horsetail



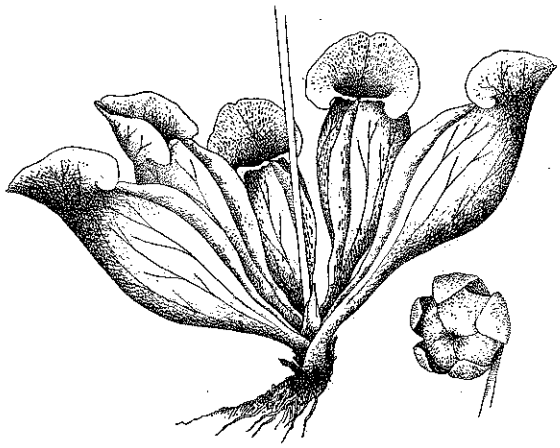
35b. Water Horsetail

37. Broad-leaved Cattail

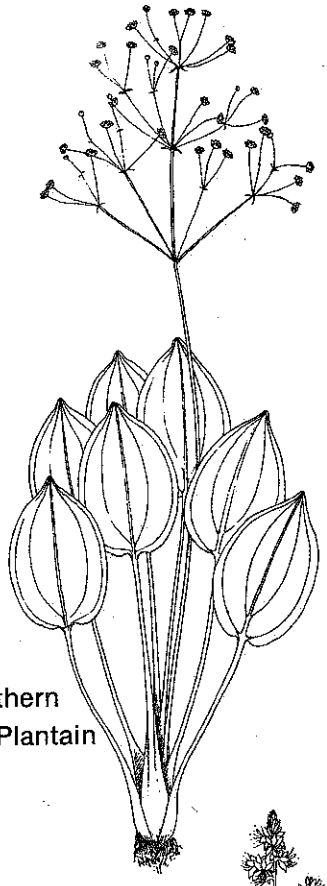


36. Eastern Bur-reed

Freshwater Wetland Sedges, Rushes, and Other Grasslike Plants

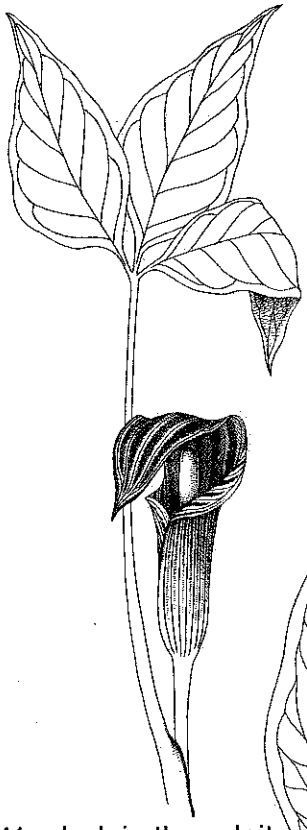


38. Pitcher-plant

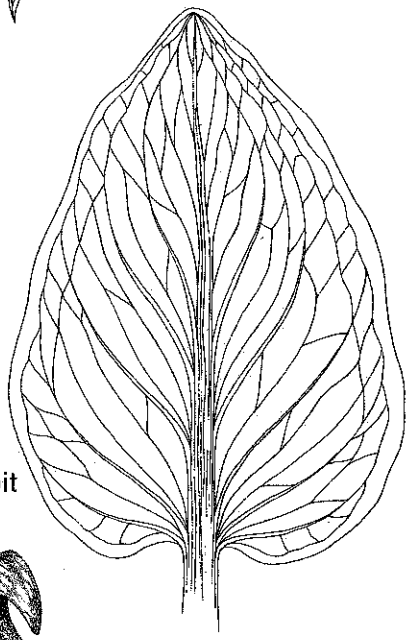


39. Northern
Water Plantain

40a. Big-leaved Arrowhead

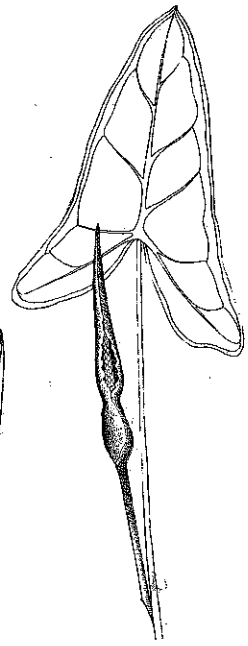


41. Jack-in-the-pulpit

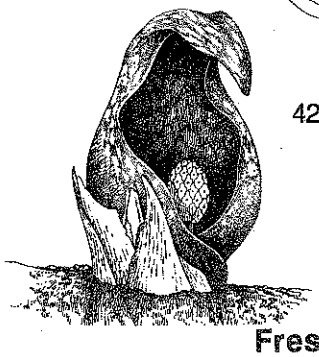


42a. Skunk Cabbage

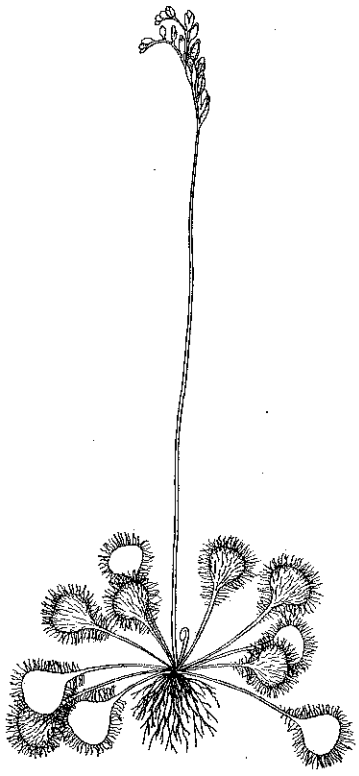
42b. False Hellebore



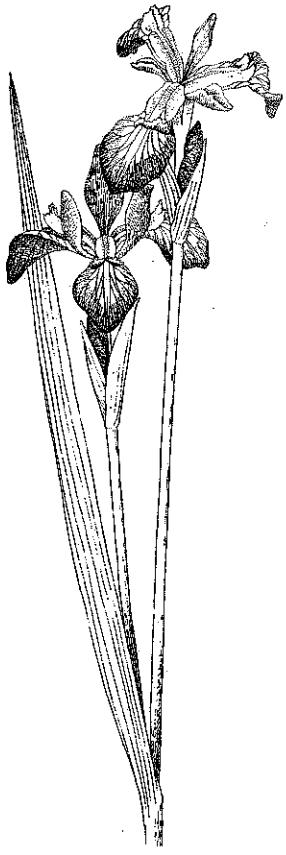
40b. Arrow Arum



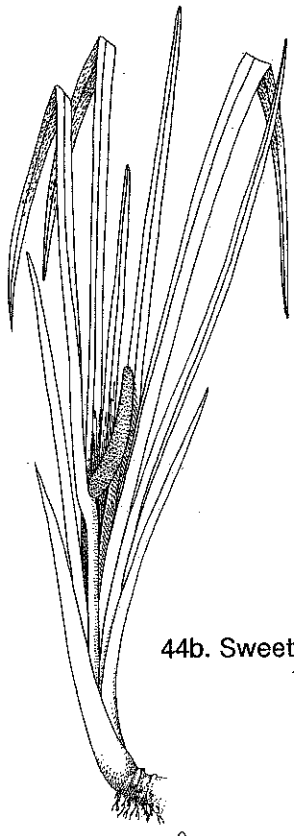
Freshwater Wetland Herbs With Basal Leaves



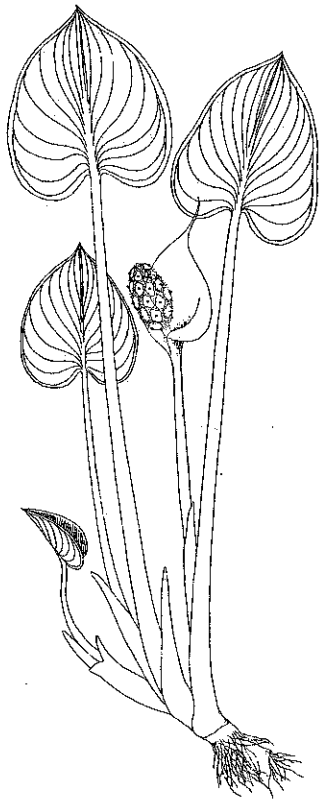
43. Round-leaved Sundew



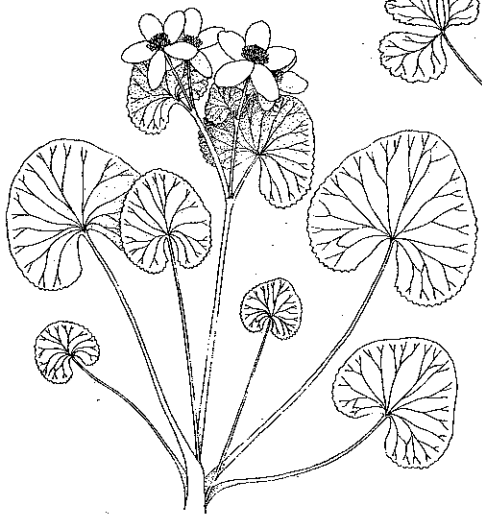
44a. Blue Flag



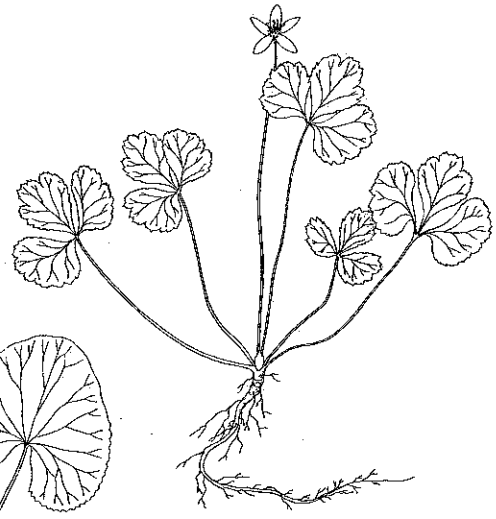
44b. Sweet Flag



45. Wild Calla

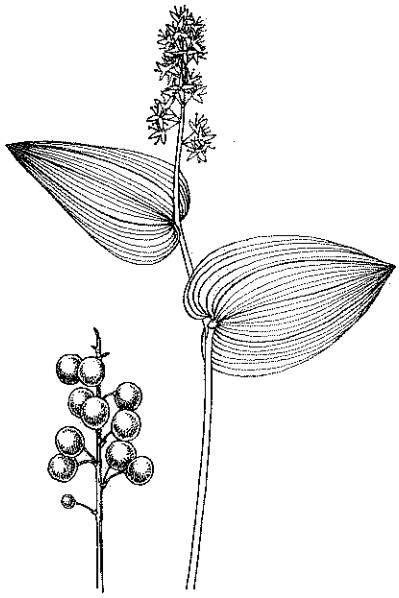


46. Marsh Marigold

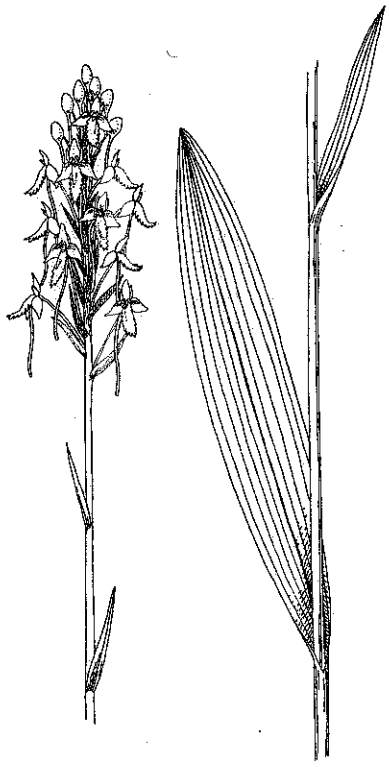


47. Goldthread

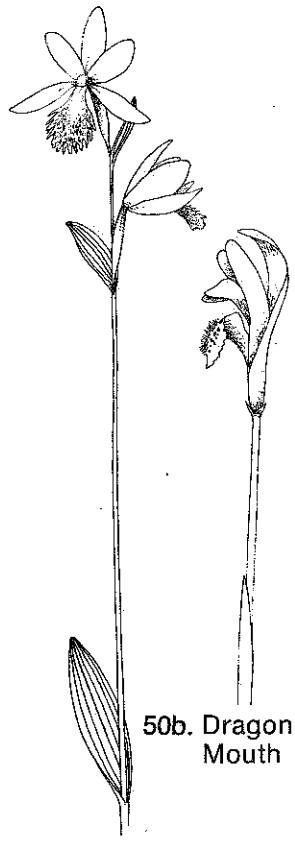
Freshwater Wetland Herbs With Basal Leaves



48. Canada Mayflower

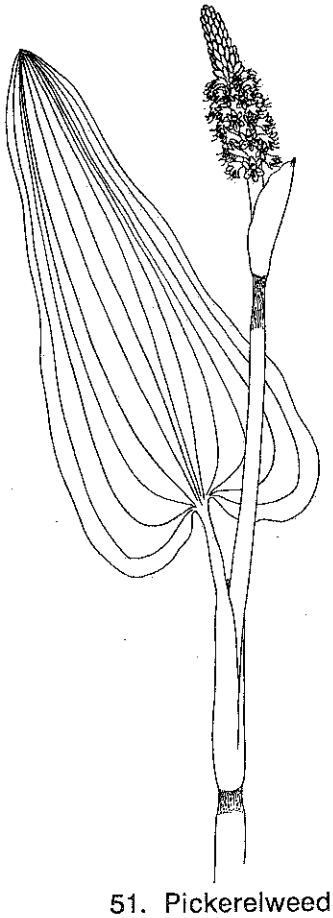


49. White-fringed Orchid



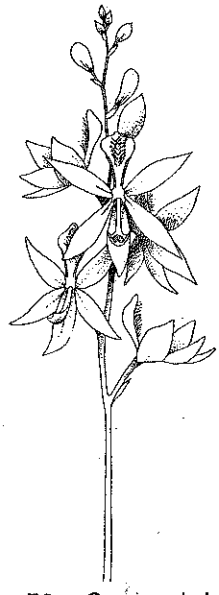
50b. Dragon's Mouth

50a. Rose Pogonia



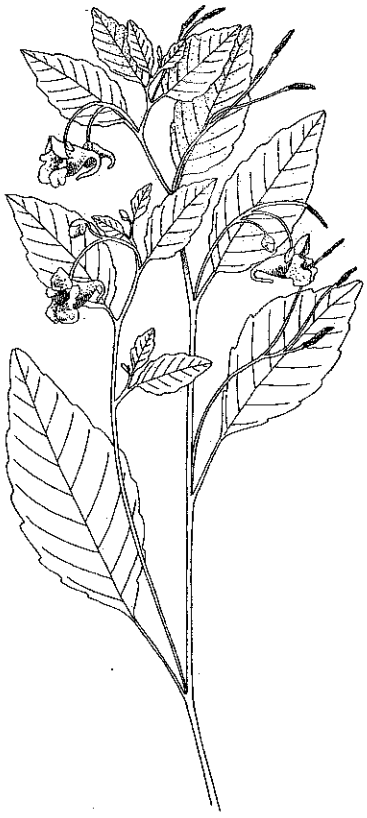
51. Pickerelweed

52. Flat-topped White Aster

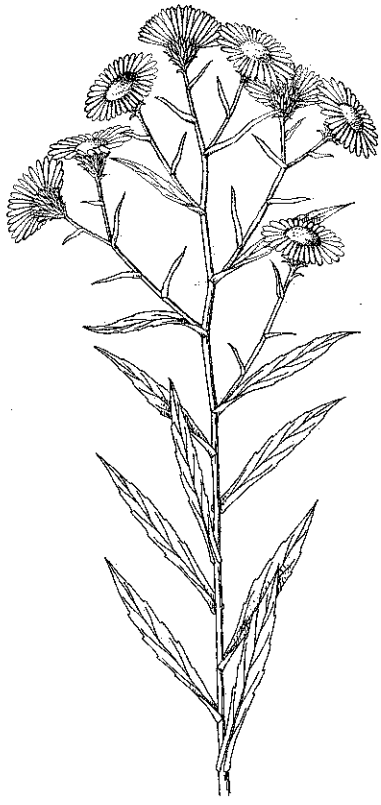


50c. Grass-pink

Freshwater Wetland Herbs With Simple Entire Alternate Leaves

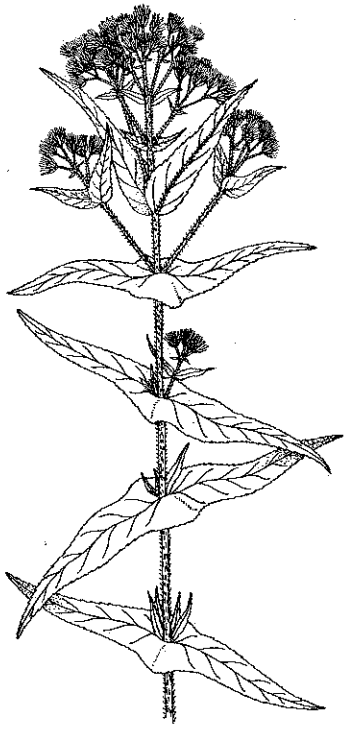


53. Jewelweed

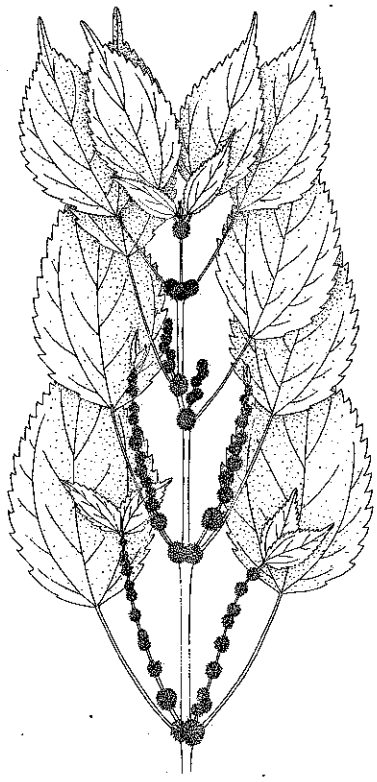


54. New York Aster

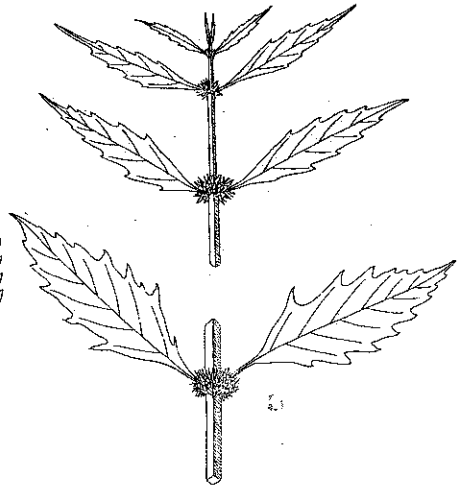
55. Bog Goldenrod



56. Boneset

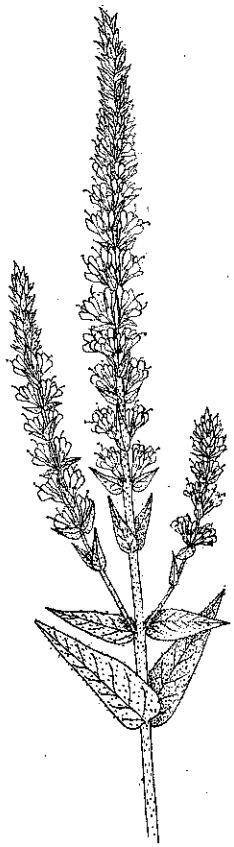


57. False Nettle

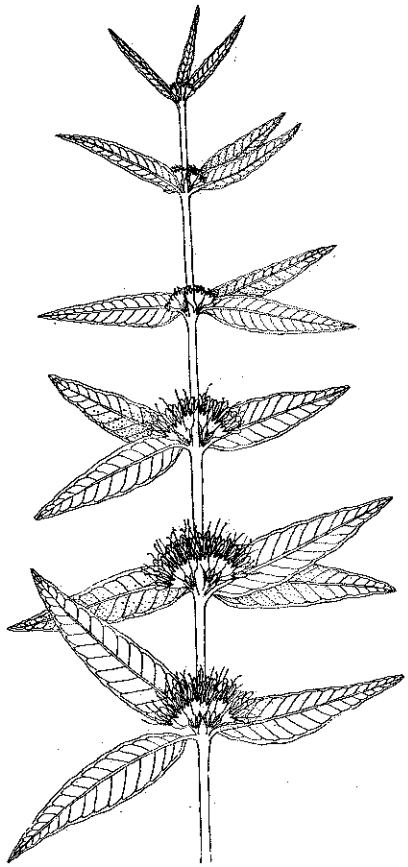


58. American Bugleweed

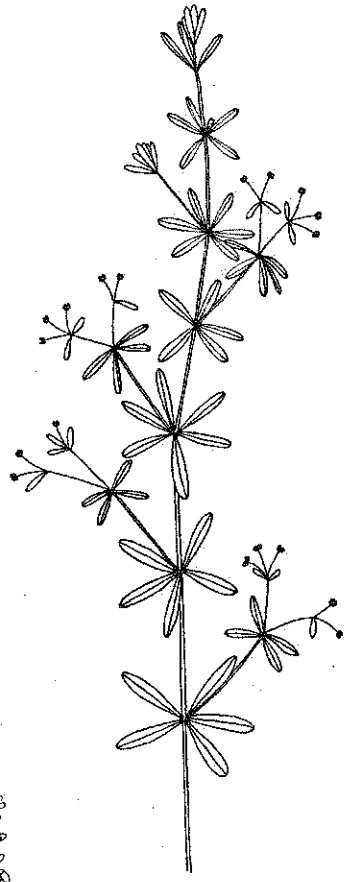
Freshwater Wetland Herbs With Simple Toothed Leaves



59a. Purple Loosestrife



59b. Swamp Loosestrife

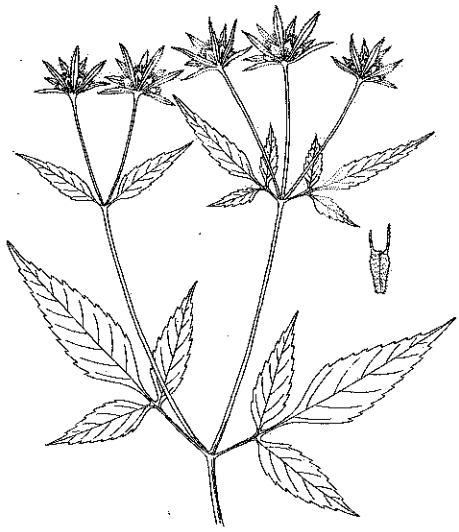


60. Dye Bedstraw

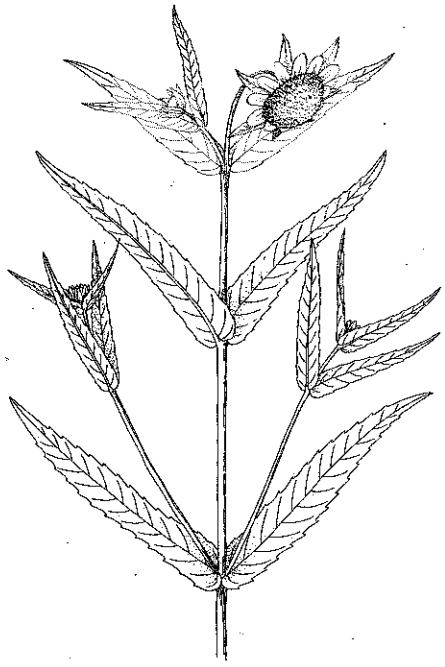
59c. Fringed Loosestrife

59d. Swamp Candles

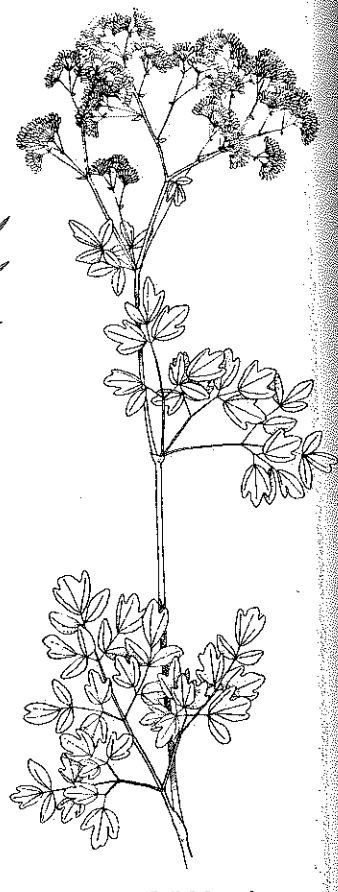
Freshwater Wetland Herbs With Simple Entire Opposite or Whorled Leaves



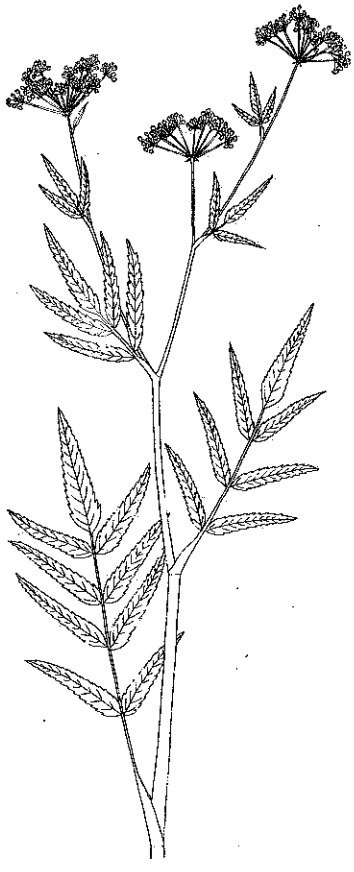
61a. Devil's Beggar-ticks



61b. Nodding Beggar-ticks

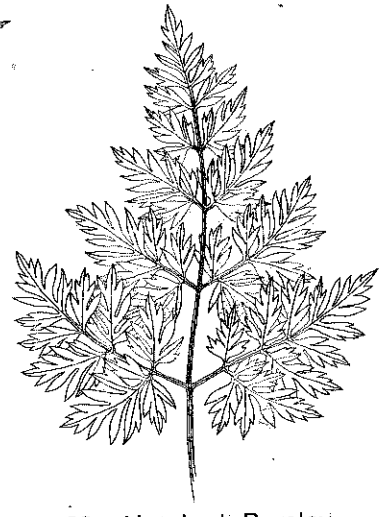


62. Tall Meadow-rue



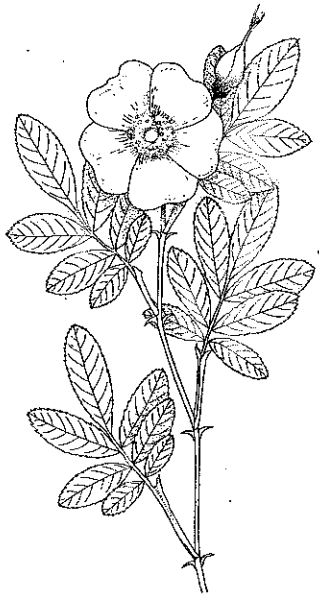
63a. Water Parsnip

63b. Water Hemlock

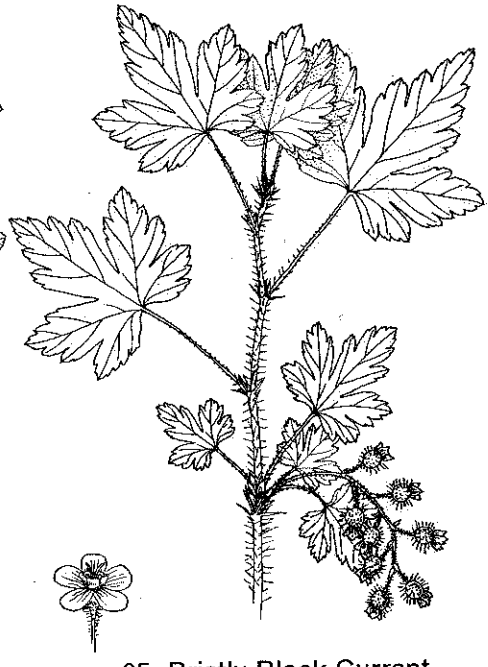


63c. Hemlock Parsley

Freshwater Wetland Herbs With Compound Leaves

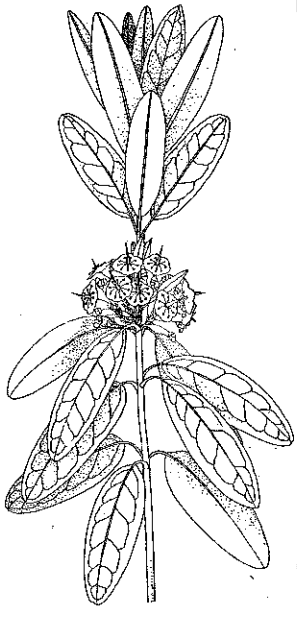


64. Swamp Rose



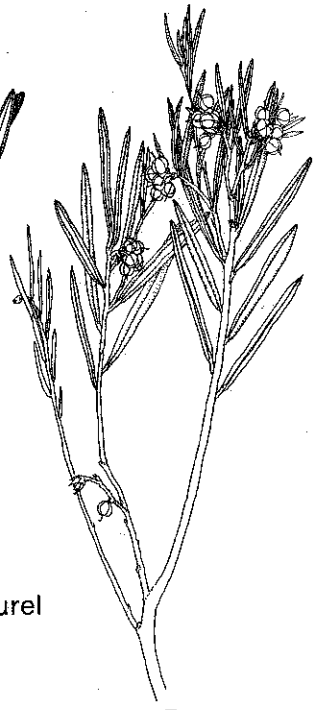
65. Bristly Black Currant

66. Leatherleaf



67. Sheep Laurel

68. Bog or Pale Laurel

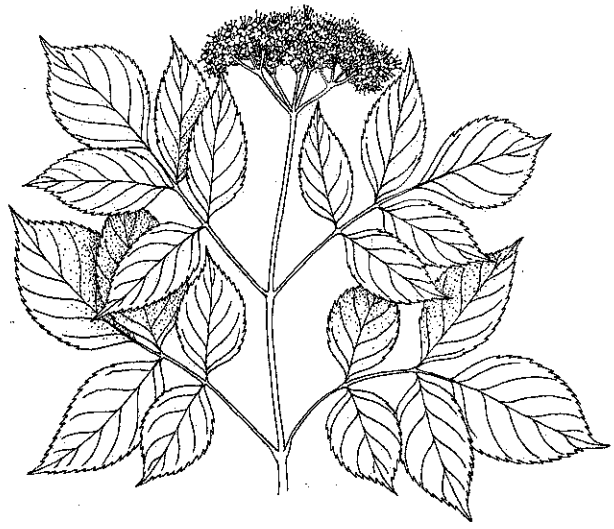


69. Bog Rosemary

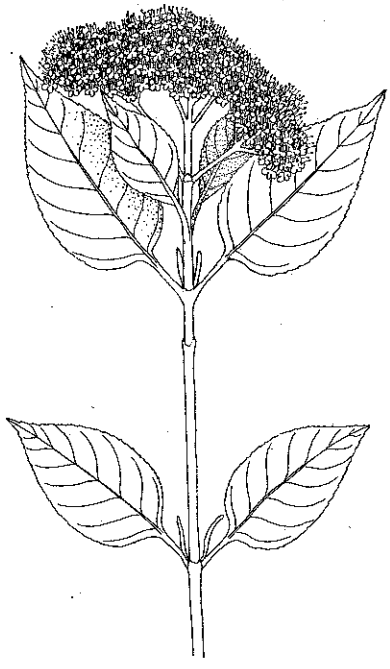
70. Labrador Tea

Freshwater Wetland Thorny Shrubs and Evergreen Shrubs

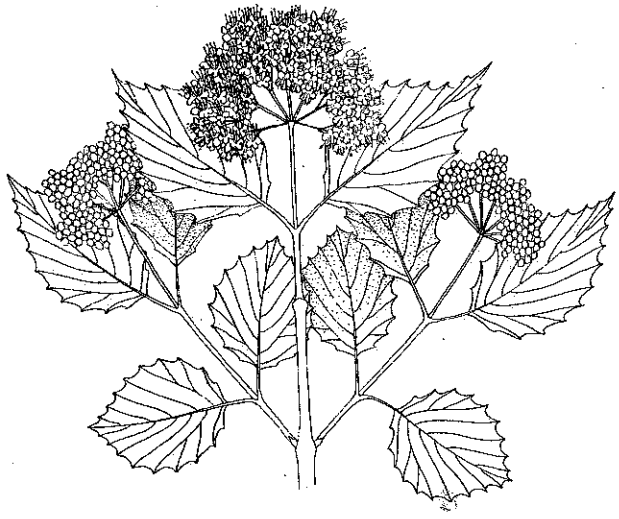
71. Poison Sumac



72. Common Elderberry



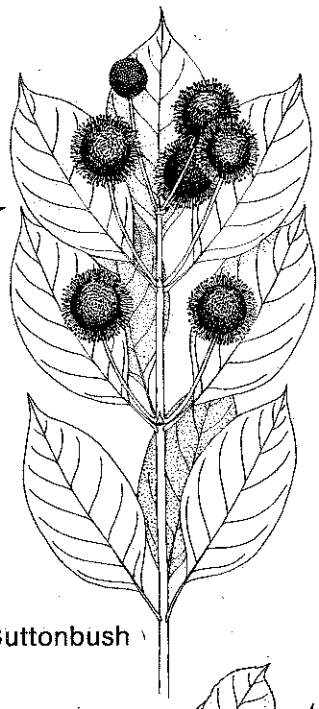
73. Northern Wild Raisin



74. Northern Arrowwood

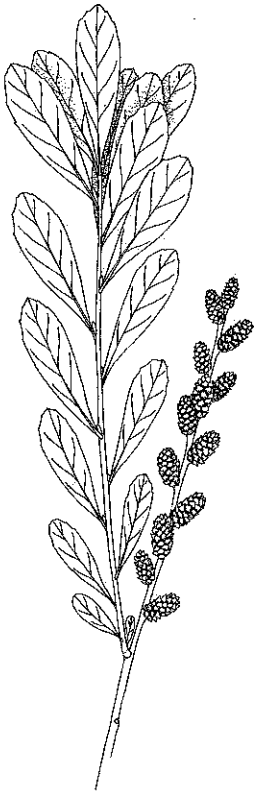
Freshwater Wetland Deciduous Shrubs With Compound or Simple Toothed Opposite Leaves

75. Red Osier Dogwood



76. Buttonbush

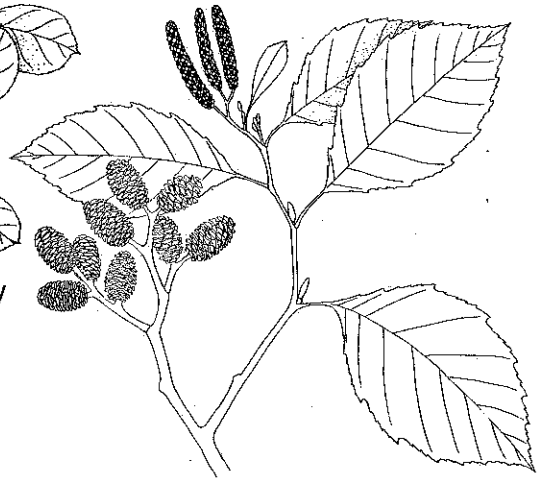
77. Swamp Fly-honeysuckle



78. Sweet Gale

79a. Common Winterberry

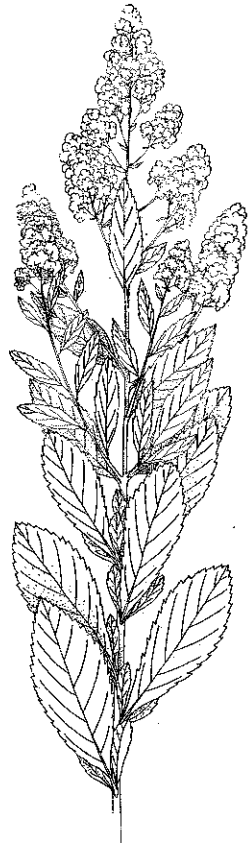
79b. Black Chokeberry



80. Speckled Alder

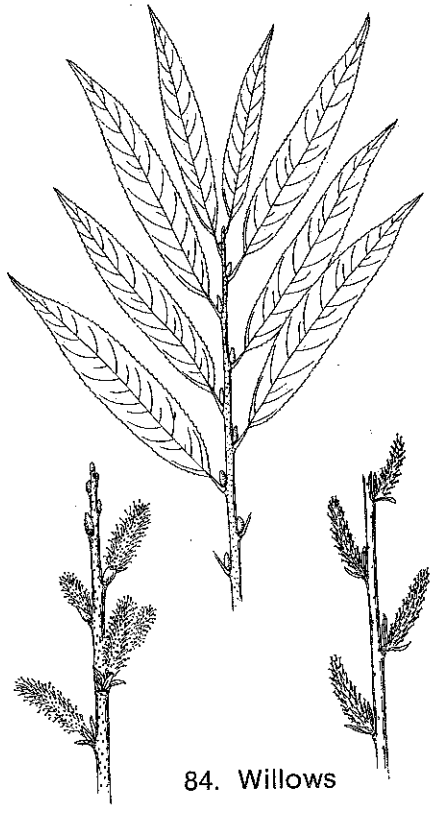
Deciduous Shrubs With Simple Entire Opposite or Whorled, or Toothed Alternate Leaves

81. Maleberry



82. Broad-leaved Meadowsweet

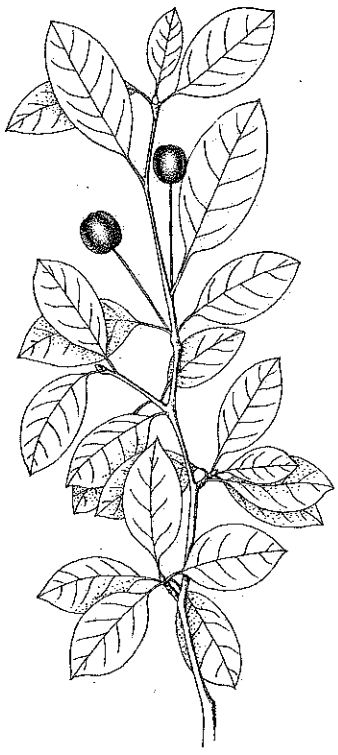
83. Steeplebush



84. Willows

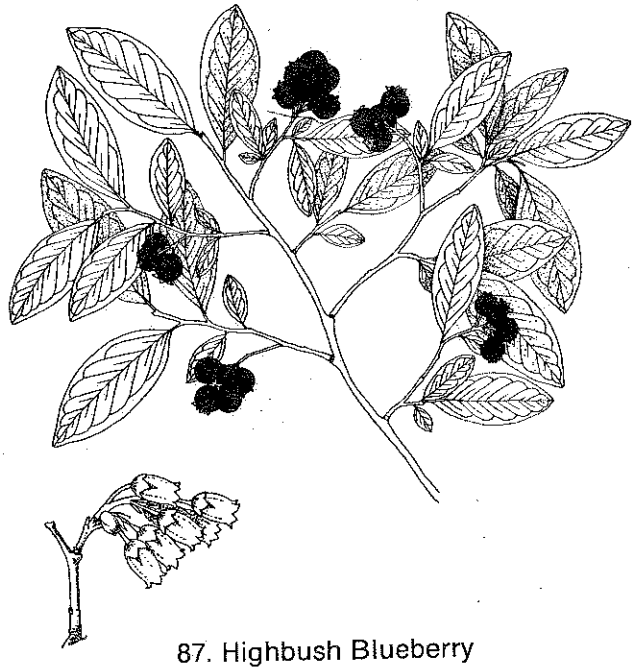
Freshwater Wetland Deciduous Shrubs With Simple Toothed Alternate Leaves

84. Willows

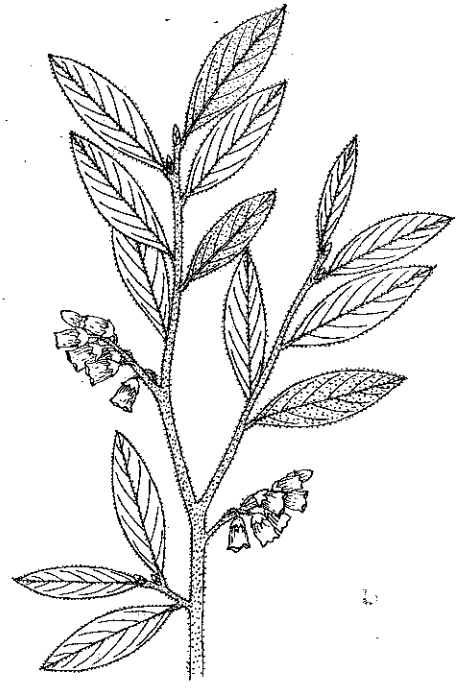


85. Mountain Holly

86. Rhodora

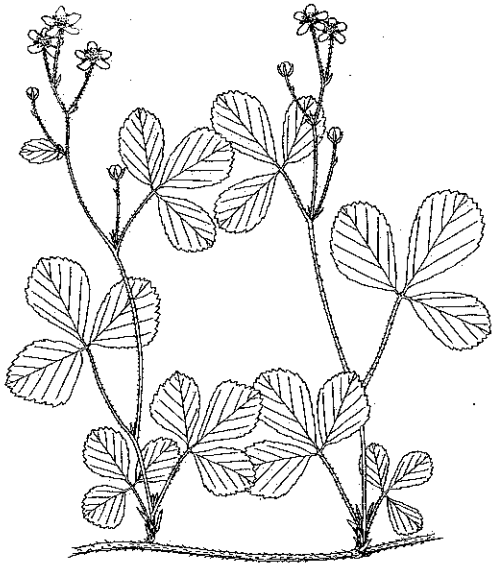


87. Highbush Blueberry

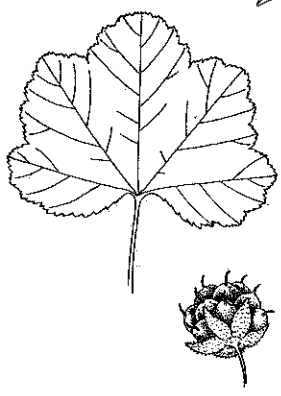


88. Velvet-leaf Blueberry

Freshwater Wetland Deciduous Shrubs With Simple Entire Alternate Leaves

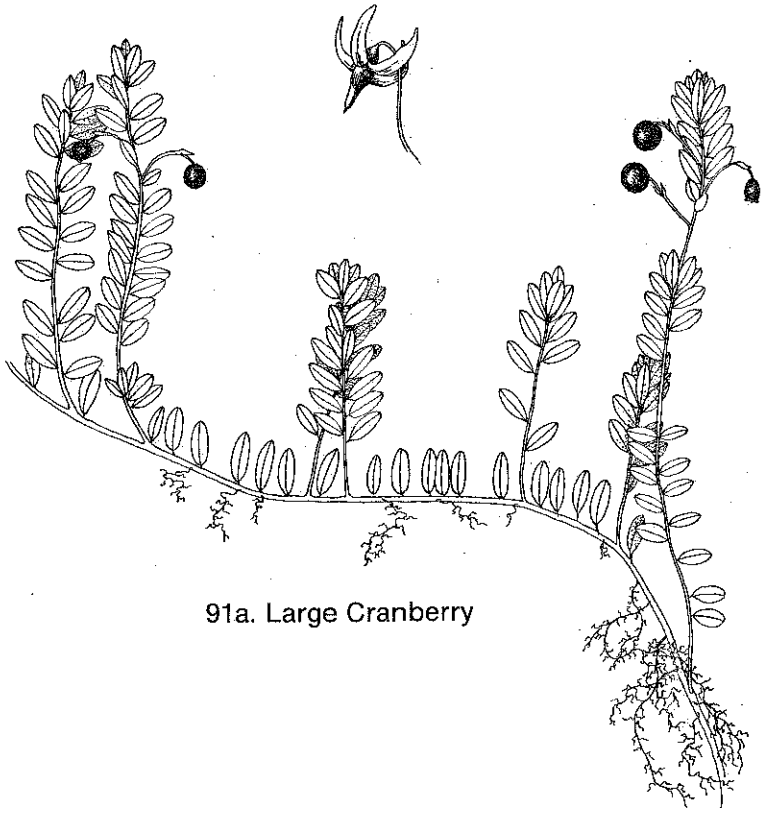


89a. Swamp Dewberry

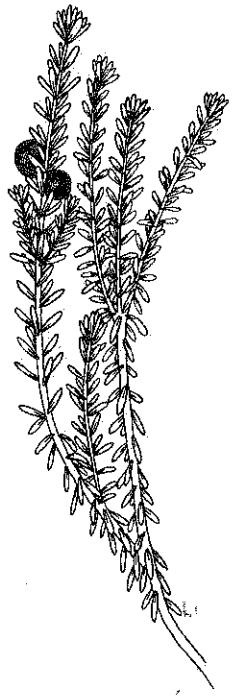


89b. Baked Appleberry

90. Poison Ivy

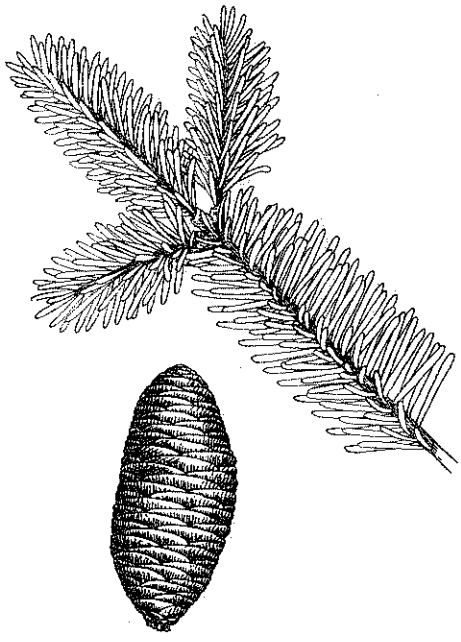


91a. Large Cranberry

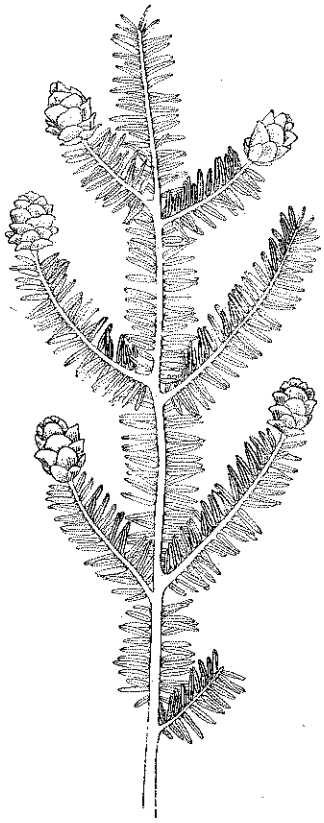


91b. Black Crowberry

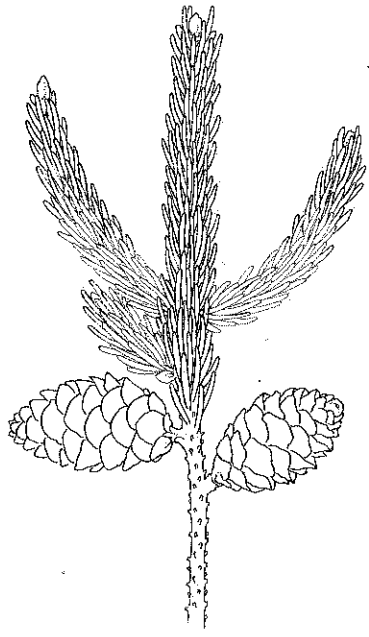
Freshwater Wetland Woody Vines



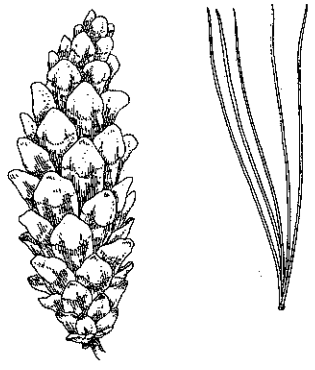
92a. Balsam Fir



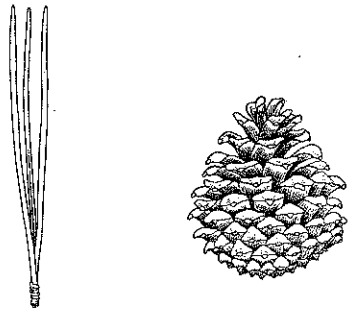
92b. Eastern Hemlock



93. Black Spruce

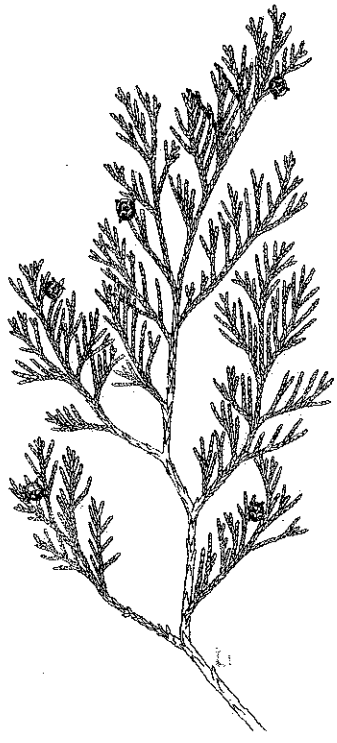


94a. White Pine



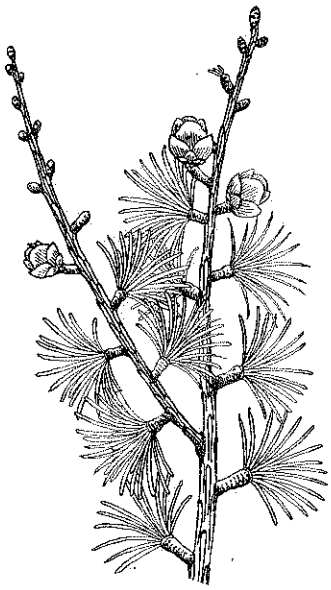
94b. Pitch Pine

95a. Northern White Cedar

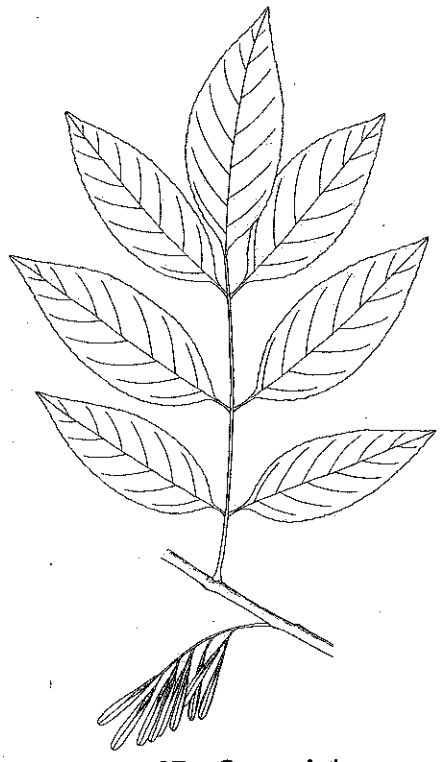


95b. Atlantic White Cedar

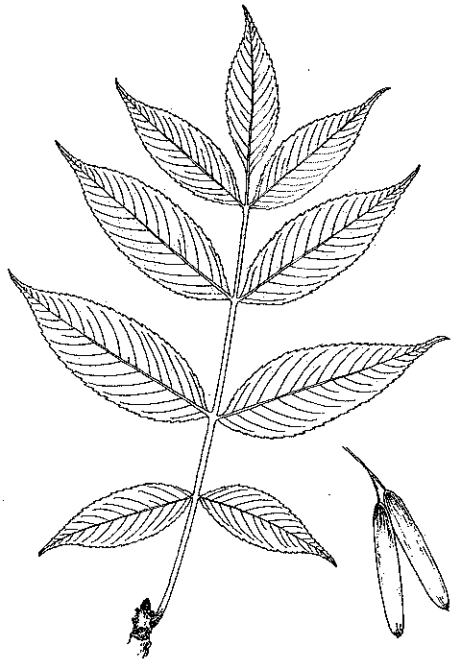
Freshwater Wetland Evergreen Trees



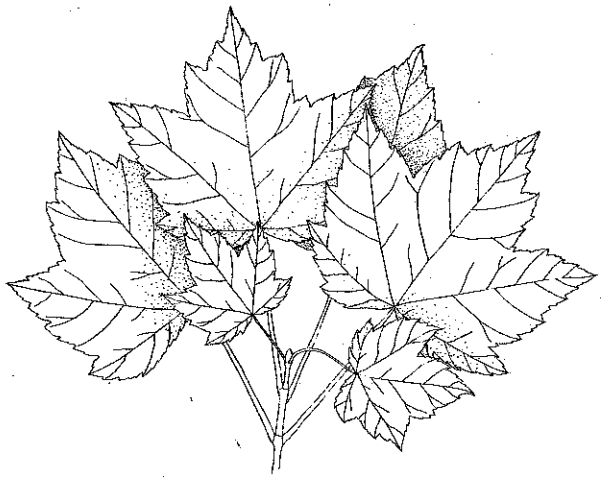
96. Larch

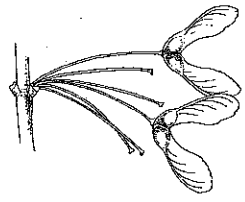


97a. Green Ash

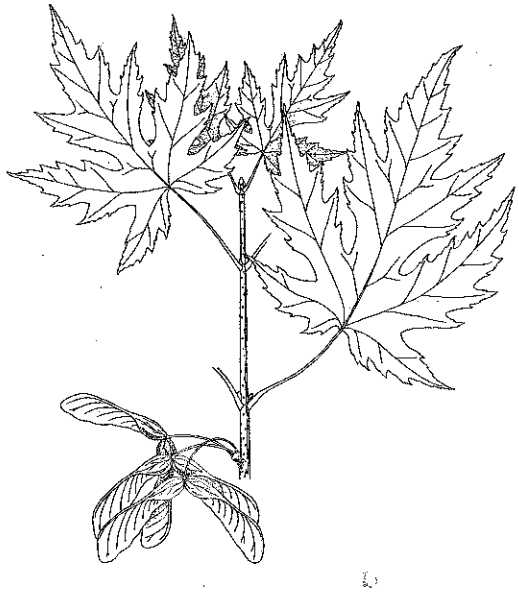


97b. Black Ash



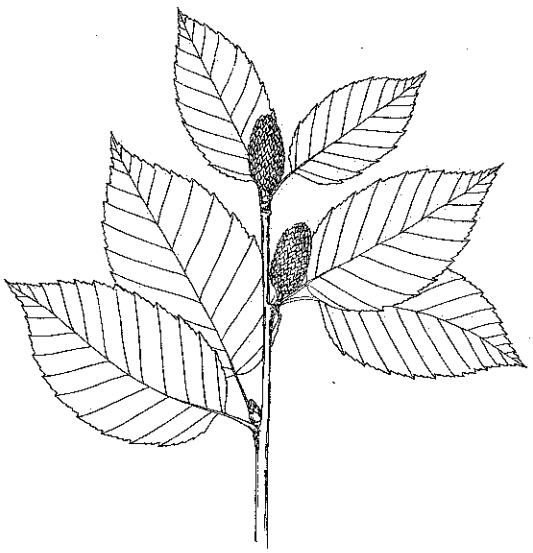


98a. Red Maple

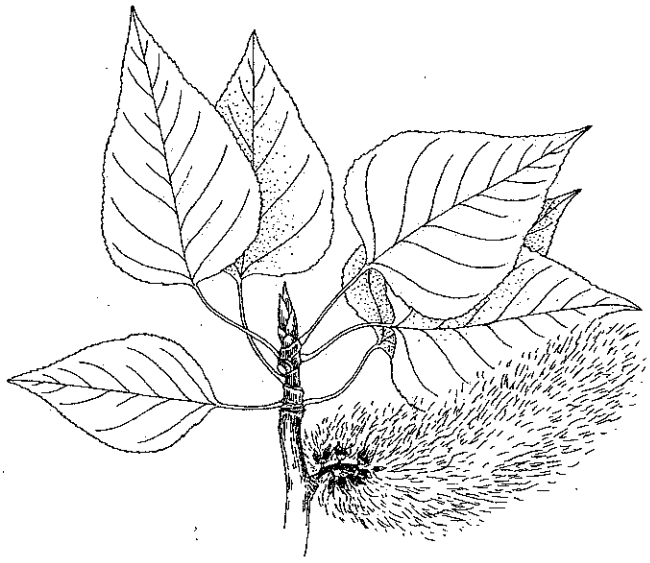


98b. Silver Maple

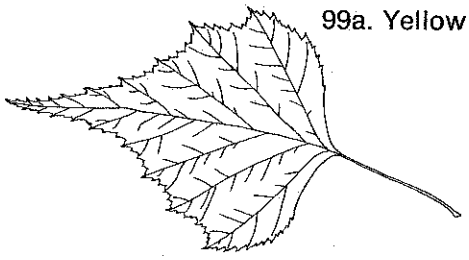
Freshwater Wetland Deciduous Trees With Needlelike, Compound, or Simple Toothed Opposite Leaves



99a. Yellow Birch

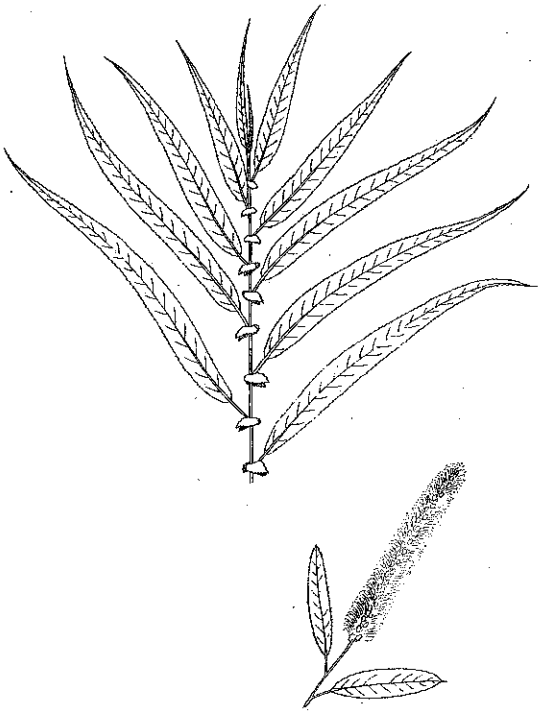


100. Balsam Poplar

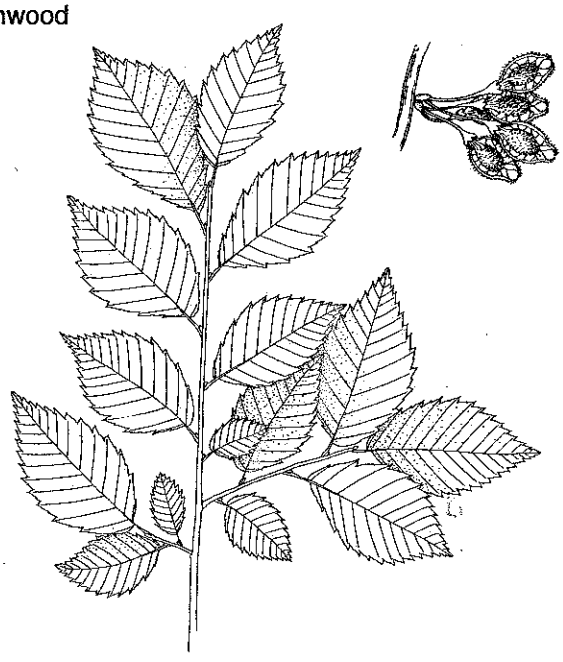


99b. Gray Birch

99c. Ironwood

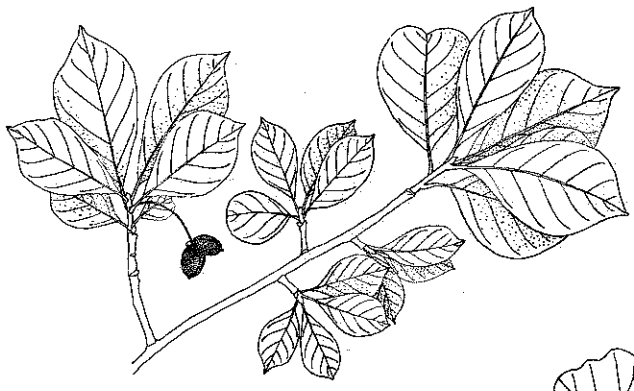


101. Black Willow



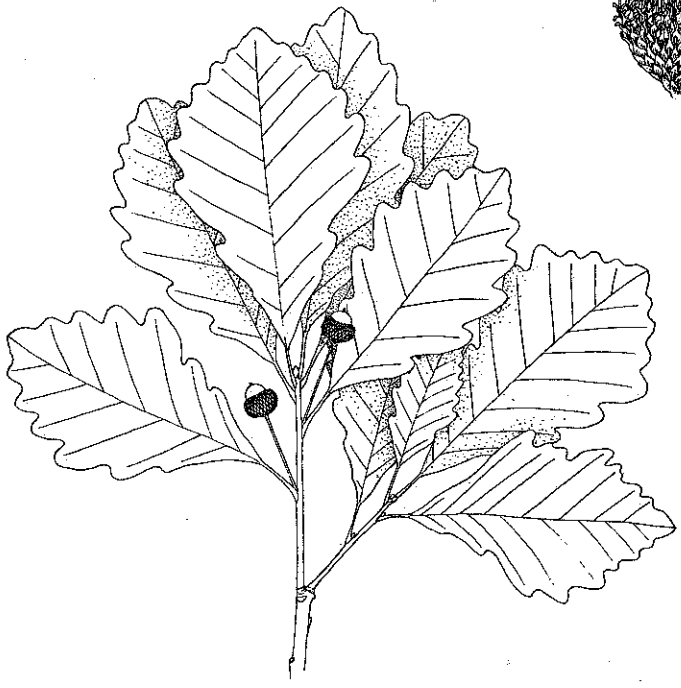
102. American Elm

Freshwater Wetland Deciduous Trees With Simple Toothed Alternate Leaves



103. Black Gum

104a. Bur or Mossy-cup Oak



104b. Swamp White Oak

Freshwater Wetland Deciduous Trees With Simple Entire or Lobed Alternate Leaves

HYDRIC SOILS

Your first experience with hydric soils probably came upon walking into a marsh or a swamp, when you either felt the spongy or soggy ground underfoot or, in more extreme cases, sank knee-deep or even waist-deep into the muck. It did not take long to realize that these soils were wet. Of course, in these situations, you most likely did not even have to consider the soils in determining that the area was wetland because there were probably good wetland indicator plants or other signs of wetland hydrology present. But given the variety of wetlands that exist along the natural soil wetness gradient, identification of hydric soils for recognizing wetlands becomes more important as the drier wetlands are encountered (e.g., those saturated for only the early part of the growing season).

State and Federal regulatory wetland definitions recognize the presence of flooded or saturated soils (hydric soils) as a major criterion for identifying wetland. This section addresses the concept of hydric soil and diagnostic characteristics, and describes how to recognize hydric soils in the field. Color photographs of hydric soils are provided as an aid to their identification, along with examples of nonhydric soils for comparison (Plates 20-29).

Hydric Soil Definition and Concept

Hydric soil has been defined by the U.S.D.A. Soil Conservation Service as soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part. Hydric soils in Maine consist of very poorly drained and poorly drained soils having a water table within about 12 inches of the surface for two weeks or more during the growing season and usually saturated to the surface at some time during the year. They also include soils ponded or frequently flooded for seven or more consecutive days during the growing season.

Central to the concept of hydric soil is flooding and/or soil saturation near the surface for significant periods sufficient to create anaerobic conditions during the growing season that favor the growth of hydrophytes. Under such conditions, free oxygen is not available to plant roots. During the growing season, most plant roots must have access to free oxygen for respiration and growth; flooding or soil saturation in the root zone at this time has serious implications for the growth and survival of most plants, except hydrophytes, which have developed various mechanisms for coping with these stressful conditions. If, however, flooding occurs in winter when plants are dormant, there may be little or no effect on the vegetation. Some hydric soils are submerged for the greater part of the year, while those hydric soils intergrading towards the better drained upland soils are wet for shorter periods and dry at the surface for much of the growing season. Soils that were formerly wet but are now effectively drained (i.e., incapable of supporting the growth and reproduction of wetland vegetation and no longer having wetland hydrology) are considered drained hydric soils and are not wetlands. These soils must be checked in the field to verify that drainage measures are still functional and prevent the regeneration of hydrophytes. Where drainage system failure occurs, such soils can revert to hydric conditions and return to wetland.

Key points to remember are:

- soil classified as hydric must be saturated or flooded long enough during the growing season to produce the low oxygen conditions that damage most plants but favor hydrophytes;
- soil that is well-drained but frequently flooded or saturated for short periods of time is not hydric;
- soil that was formerly wet but is now effectively drained is considered drained hydric soil and the area is not considered wetland.

Major Categories of Hydric Soils

Hydric soils are separated into two major categories on the basis of soil composition:

(1) ***organic soils*** - soils generally with at least 16 inches of organic material in the upper part of the soil profile;

(2) ***mineral soils*** - soils with less organic content and dominated by silt, sand, and/or clay.

Organic Soils

Accumulation of organic matter usually results from prolonged anaerobic soil conditions associated with long periods of inundation and/or soil saturation during the growing season. These saturated conditions impede aerobic decomposition (oxidation) of the bulk organic materials such as leaves, stems and roots and encourage their accumulation in the form of peat or muck over time. Consequently, *most organic soils are characterized as very poorly drained soils.*

Hydric organic soils typically form in:

- waterlogged depressions (e.g., glacially formed depressions called kettleholes) where peat or muck deposits range today from about 16 inches to more than 30 feet in depth;

- low-lying areas along coastal waters where tidal flooding is frequent and saturation is nearly continuous.

Organic soils are commonly called peats and mucks. Peats have recognizable decomposed plant materials, whereas the plants comprising mucks are decomposed beyond recognition (Plates 20 and 21). Almost all organic soils in Maine are hydric soils, except Folists which are nonhydric organic soils formed in mountains and in eastern coastal Maine due to cool temperatures and low evapotranspiration. These conditions allow for organic matter to accumulate over bedrock, bolders or shallow mineral soils. Folists can usually be recognized by landscape position and lack of a seasonal high water table.

Hydric Mineral Soils

Where organic matter does not accumulate in large quantities, the soil is classified as mineral soil. Some mineral soils may have thick organic surface layers related to excess soil moisture for long periods from heavy seasonal rainfall and/or a high water table, yet they are still mainly composed of mineral matter (sands, silts, and clays). Mineral soils exhibit a wide range of properties related to differences in parent material, climate, topography, age, and other factors. Soil saturation may result from the collection of surface water runoff in a low-lying area, groundwater seepage, or the presence of a slowly permeable layer (e.g., clay, fragipan, or dense basal till) that restricts the downward movement of water and perches water above this layer.

The duration and depth of soil saturation are essential criteria for identifying wetlands. Soil morphological features are commonly used to indicate long-term hydrology. The two most widely recognized features that reflect excessive wetness in mineral soils are *gleying* and *low chroma mottling.*

Gleyed soils and low chroma mottles are usually grayish in color reflecting the absence of manganese and iron oxides which tend to give upland or nonwetland soils their characteristic brownish or orange brownish color. Prolonged saturation of mineral soil converts iron and manganese from their otherwise stable oxidized forms to mobile reduced forms which may cause these compounds to be completely removed from the soil, resulting in a grayish color.

The activity of certain soil microorganisms influences this process. These microorganisms reduce iron when the soil environment is anaerobic, that is, when virtually no free oxygen is present, and when the soil contains organic matter. If the soil conditions are such that free oxygen is present, organic matter is absent, or temperatures are too low (below 41 degrees Fahrenheit) to sustain microbial activity, gleization will not begin and mottles will not form, even though the soil may be saturated for prolonged periods of time. Consequently, soils saturated only during the winter do not develop gleyed colors. Also, they are not considered hydric soils even though they are wet for some time of the year because they are not wet long enough during the growing season to have a significant impact on soil formation and plant growth. Gleyed soils are predominantly neutral gray in color and occasionally greenish or bluish gray. Soils gleyed to the surface layer (topsoil) are hydric soils (Plate 22). These soils often show evidence of oxidizing conditions only along root channels (oxidized rhizospheres; Plate 2). Mineral soils that are alternately saturated and oxidized (aerated) during the year are usually mottled with low chroma colors in the part of the soil that is seasonally wet. Mottled soils are distinguished by spots or blotches different in shade or color from the soil's predominant color or matrix color (Plate 23). The abundance, size, and color of the mottles usually reflect the duration of the saturation period and indicate whether or not the soil is hydric:

- many hydric mineral soils that have predominantly gray subsoil layers (immediately below the surface layer) with brown or yellow mottles are usually saturated for long periods during the growing season (Plates 23 and 27);

- soils that are predominantly brown or yellow with gray mottles are saturated for shorter periods and may or may not be hydric, depending on the depth to the mottles (Plates 24, 28, and 29);

- nonhydric mineral soils that are never saturated are usually bright-colored near the surface and are not gray-mottled.

How to Recognize Hydric Soils

In Maine, soils vary due to differences in parent material, climate (rainfall and temperature), age, topographic relief, and plant and animal life. Of particular interest from a wetland identification standpoint is the variation due to slope, since most wetlands occur at low positions on the landscape. Differences in landscape position create different natural soil drainage conditions, as shown in the illustration on page 55-

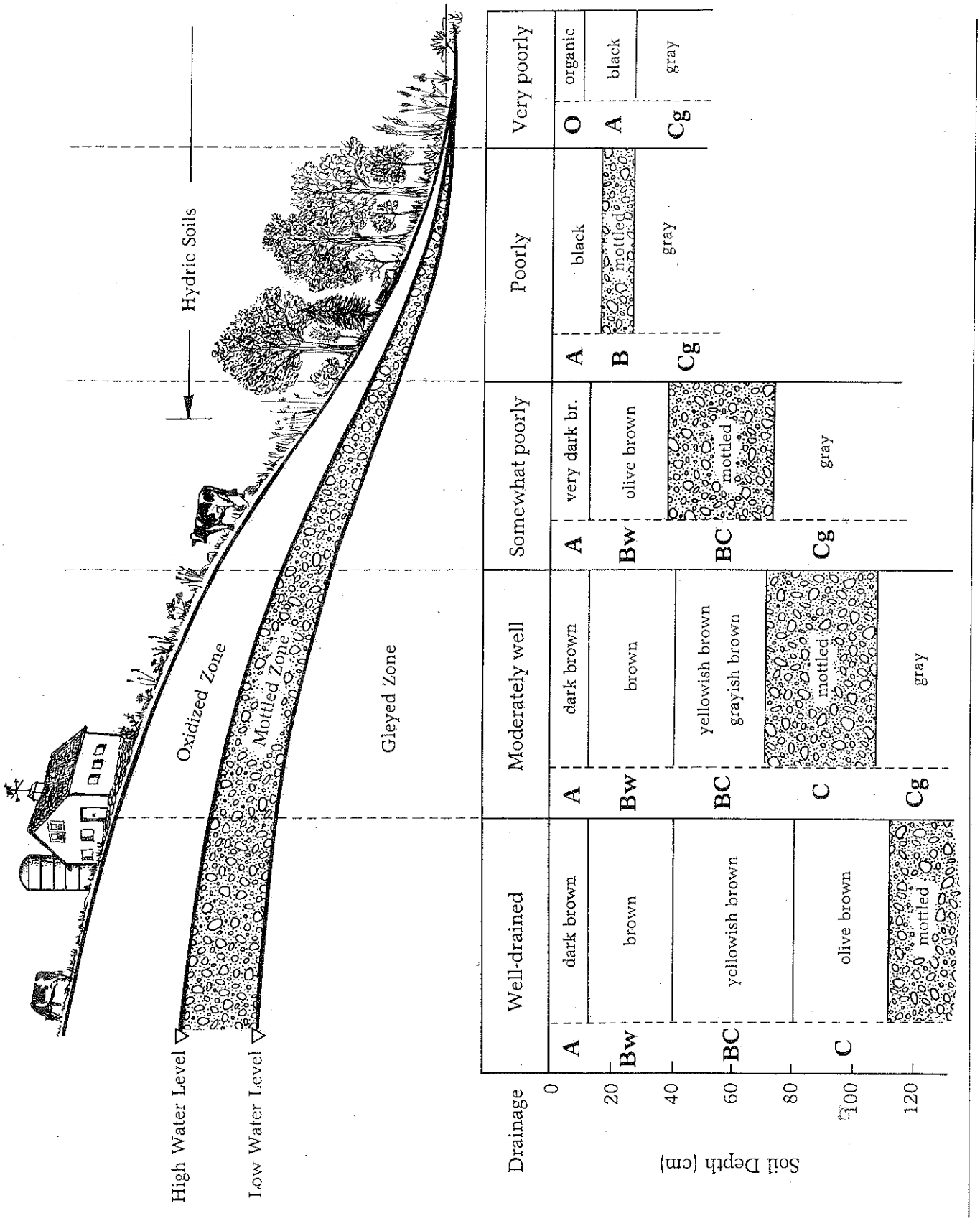


Figure 8. Simplified landscape showing soil property changes with slope. Note the changes in depth to the mottled zone with drainage class. **In Maine, somewhat poorly drained soils are not hydric.** (Source: *Hydric Soils of New England*, Tiner and Veneman 1987)

Table 3. Definitions of the seven classes of natural soil drainage.

Class	Definition
Excessively Drained	Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse-textured, rocky, or shallow, but some are very steep. They include knolls, convex slopes and terraces. All are free of the mottling related to wetness.
Somewhat Excessively Drained	Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.
Well-drained	Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well-drained soils are commonly medium-textured. They are mainly free of low chroma mottles within 40 inches of the mineral soil surface.
Moderately Well Drained	Water is removed from the soil somewhat slowly during some periods. Moderately well-drained soils are wet for only a short time during the growing season. They commonly have a slowly pervious layer at a considerable depth in the soil, or periodically receive high rainfall, or both. They vary from level to steep areas and include crests, upper parts of long smooth slopes, and broad upland terraces. These soils usually have low chroma mottles between 16 and 40 inches below the mineral soil surface.
Somewhat Poorly Drained	Water is removed slowly enough that the soil is wet for significant periods during the growing season. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these. They may experience anaerobic conditions for brief periods usually early in the growing season. They are represented by level to strongly sloping areas including long smooth side-slopes, broad depressions, and seasonal seepage areas. They usually have drainage (low chroma) mottles between 7 and 16 inches below the mineral soil surface.
Poorly Drained	Water is removed so slowly that the soil is saturated periodically at or near the surface during the growing season or remains wet for long periods sufficient to create prolonged anaerobic conditions. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall or a combination of these. Fine-textured poorly drained soils usually have a gleyed layer within 20 inches and drainage mottles within 7 inches of the mineral soil surface. If a fine-textured soil has a dark surface horizon greater than 7 inches thick, the surface layer must be value 3 or less and chroma 2 or less, with drainage mottles immediately beneath it and a gleyed horizon within 20 inches of the mineral soil surface to be poorly drained. Sandy-textured poorly drained soils usually have drained mottles between 0 and 7 inches below the mineral soil surface. If a sandy soil has a dark surface horizon greater than 7 inches thick, the surface layer must be value 3 or less and chroma 2 or less with drainage mottles directly beneath it to be poorly drained.
Very Poorly Drained	Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Anaerobic conditions persist for most of the season. Very poorly drained soils are commonly found in level areas or depressions that are frequently inundated. Yet, when rainfall is high and nearly continuous, they can develop on moderate to high slopes. Very poorly drained soils include organic soils, mineral soils with an organic surface layer usually 8 to 16 inches thick (histic epipedon), mineral soils with an organic layer 4 to 8 inches thick on top of a gleyed subsoil, tidal marsh soils, or floodplain (alluvial) soils with a dark-colored (umbric) mineral surface layer.

(SOURCES: Adapted from Soil Survey Manual, U.S. Department of Agriculture 1951 and *Key to Soil Drainage Classes,* Maine Association of Professional Soil Scientists 1988 4/93 revision)

Figure 8. Seven drainage classes are recognized by soil scientists: (1) excessively drained, (2) somewhat excessively drained, (3) well-drained, (4) moderately well drained, (5) somewhat poorly drained, (6) poorly drained, and (7) very poorly drained (see Table 3 for definitions). *Poorly and very poorly drained soils represent Maine's typical hydric soils.*

Hydric organic soils can easily be recognized by their characteristic black muck or black to orange brown peat (Plates 20 and 21). While it is not necessary to separate peats from mucks since both are obvious hydric soils, you might be interested in trying this simple finger rubbing test. When rubbed between your fingers:

- mucks have almost all of the plant remains decomposed beyond recognition and feel somewhat greasy;
- peats are slightly decomposed and when rubbed between the fingers, the plant materials of peat are not destroyed, but can be recognized as grasses, sedges, mosses, or types of wood.

Fine-textured hydric mineral soils are usually identified by their characteristic gray color and often by the presence of brighter colored mottles near the surface.

- Many fine-textured hydric mineral soils are characterized by a thick dark surface layer, a predominantly gray subsurface layer, and yellow, orange, brown, or reddish mottles and iron oxide concretions near the surface. Black concretions of manganese oxide may also be present near the surface. The gray color and thick dark surface layer are the best indicators of current wetness, since the iron oxide mottles and concretions are very insoluble and once formed will remain indefinitely as relic mottles.

- The wettest fine-textured mineral soils typically have subsoils which are neutral gray in color (gleyed soils), although occasionally the color may be greenish-gray or bluish-gray (Plate 22).

- Mineral soils with a grayish (gleyed) layer within 20 inches of the mineral soil surface and gray mottles within seven inches are considered hydric soils in Maine (Plates 24 and 27). Fine-textured mineral soil with very dark surface horizons more than 7 inches thick which also have drainage mottles directly below the dark surface horizon and a gleyed layer within 20 inches of the mineral soil surface are also considered hydric soils in Maine. *(Note: Beware of gray-colored E-horizons, see Spodosols discussion under "Problematic Hydric Soils").*

- Coarse-textured hydric mineral soils are usually more difficult to identify than fine-textured hydric mineral soils. In fact, color patterns may be reversed from fine-textured hydric mineral soils with gray colors near the surface (thick E-horizons) and reddish colors below (spodic horizon) (Plates 25 and 26). For specific clues to identifying coarse-textured hydric mineral soils, see "Problematic Hydric Mineral Soils", particularly Sandy Soils and Spodosols.

For wetland identification purposes, *drained hydric soils* must be separated from undrained hydric soils; this is by no means a simple task. Look for the presence of ditches or tile draining. If the soils are drained to the point where they are no longer capable of supporting the growth and regeneration of wetland vegetation, then they are drained hydric soils and not considered wetland. Evaluation by an expert is often required and detailed soil wetness studies may need to be conducted to assess this condition.

Munsell Soil Color Book

As is shown in Plates 20 through 29, soil colors can tell us a great deal about the soil's wetness regime, especially in mineral soils. Scientists and others examining the soil determine the approximate soil color by comparing the soil sample with a Munsell color chart. The Munsell soil color book, published by Munsell Color (a division of the Kollmorgen Corporation) of Baltimore, Maryland, contains charts with paint chips of soil colors (Plate 30). Soil colors are identified on the Munsell charts by three characteristics:

(1) ***hue*** **-** one of the main spectral colors: red, yellow, green, blue, or purple, or various mixtures of these principal colors;

(2) ***value*** **-** lightness or darkness of the hue;

(3) **chroma -** purity or saturation of the color.

In the Munsell soil color book, each individual hue has its own page, each of which is further subdivided into units for value (on the vertical axis) and chroma (horizontal axis). Plate 30 represents reproductions of the "gleyed" chart and the chart for hue 5Y (pronounced "five yellow"). These charts show the color of many hydric mineral soils. The gleyed chart represents only hydric soils, while only the two columns on the left of the 5Y chart represent hydric soil colors with the rest being essentially nonhydric soil colors. Although theoretically each soil color represents a unique combination of hues, values, and chromas, the number of combinations common in the soil environment usually is limited. Because of this situation and the fact that accurate reproduction of each soil color for a given chip is expensive, the Munsell soil color book contains a limited number of combinations of hues, values, and chromas. The color of the major portion (matrix) of a soil layer or a mottle is determined by comparing a soil sample with the individual color chips. Place the soil sample behind the color chart page, look through the holes, and move the sample from hole to hole until you match the soil to a color chip. Record the appropriate Munsell notation, e.g., 5Y 2/1, for the soil matrix and then for the mottles, as necessary. Be sure you have adequate light to view the soil sample and do not attempt to read the color charts with sunglasses on. The appropriate Munsell color name can be read from the page facing the color charts in the color book. *(Note: For hydric soil determinations, be sure to use the 1990 or a more recent edition of the Munsell soil color book.)*

What to Look for in the Field

To identify hydric soils using the charts, dig a hole about two feet deep, first look at the surface (topsoil) layer then take a soil sample from the next layer (horizon) down. The following properties usually indicate a hydric soil:

(1) ***a peaty or mucky surface layer eight inches or thicker;*** or

(2) ***a gleyed matrix (chroma 2 or less) immediately below the surface layer (A or Ap horizon);*** or

(3) ***for soils with a surface layer (A or Ap) less than 7 inches thick, the subsoil must have a gleyed matrix within 20 inches and drainage (low chroma) mottles present within 7 inches of the soil surface;*** or

(4) ***for soils with a surface layer (A or Ap) thicker than 7 inches, the subsoil must have a gleyed matrix within 20 inches and an overlying horizon with a value of three or less and a chroma of 2 or less with drainage mottles directly beneath the surface layer.***

Low chroma colors (chroma of 2 or less) include black, various shades of gray, and darker shades of brown. The colors below the topsoil layer must be examined because many cultivated soils (past and present) have been disturbed by plowing and have been enriched with organic matter, thereby affecting the origi-

nal soil color. This disturbed zone is called the plow layer. (Plate 22 shows evidence of a plow layer as indicated by the abrupt change from the brownish surface layer to the gray subsoil.)

Problematic Hydric Soils

It should be pointed out that certain reddish and other brighter-colored soils may also be hydric soils and that certain gray-colored soils are nonhydric. They require considerable soil science expertise for positive identification. Consequently, *in these and other problematic situations, evidence of wetland hydrology and the presence of wetland vegetation should be used to make a wetland determination rather than worrying about obscure or nonexistent soil properties.* Consult the Soil Conservation Service (SCS) for more information on these soils. Listed below are examples of these soils for your general information.

Sandy soils often pose the greatest problem in identifying hydric properties, since all or many of the diagnostic characteristics listed in the preceding text may not be present. Some hydric sandy soils have thick dark surface layers with high organic matter content (up to 10 or more inches thick), but the underlying subsoil layer (within 1.5 feet of the surface) has a chroma of 3 grading towards 2. Some hydric sandy soils show evidence of vertical streaking by organic matter below the surface layer, while others may simply have a blotchy colored subsoil due to organic coatings around some of the sandy grains. These organic materials leave a dark-colored stain on your skin when rubbed gently on the palm of your hand. Recently deposited sandy soils, such as sand bars along rivers, will not possess any typical hydric soil properties. They can be recognized by their landscape position and associated vegetation .

Rocky soils create problems for identifying hydric soils chiefly because there is little unconsolidated soil material to examine for hydric properties. These soils are often found on long glacial till slopes. Attempts to examine the soils are usually futile and unproductive. Wetland identification in these areas should focus on vegetation and other signs of hydrology. The presence of OBL and/or FACW species and hydrology indicators such as water-stained leaves are useful indicators of wetland and hydric soils in these situations.

Entisols are mostly floodplain (alluvial) soils that have little or no evidence of soil formation. They include sandy soils of riverine bars and islands mentioned above and of coastal marshes (Sulfaquents), and finer-textured alluvial soils. Some sandy hydric Entisols may be recognized by a subsoil matrix with a hue between 10YR and 10Y and a chroma of 3 or less, and distinct or prominent high chroma mottles.

Some ***hydric soils in limestone regions*** such as Aroostook County may not show typical hydric soil properties such as gleyed colors. The high pH of these soils affects the chemical processes of oxidation and reduction and iron and manganese are not readily mobilized and as a result may not form gleyed colors. They may be recognized by thick organic enriched surface layers or by the presence of wetland vegetation and signs of wetland hydrology.

Spodosols are associated with Maine's evergreen forests. Most Spodosols (hydric and nonhydric) have a characteristic gray E-horizon (eluvial layer) overlying a diagnostic spodic horizon of accumulated organic matter, iron and aluminum (Plates 25 and 26). The gray layer is not due to wetness, but is formed by a process called podzolization. Organic acids from the breakdown of evergreen leaves move down through the soil with rainfall cleaning the sand grains in one layer (the E-horizon or albic horizon) then coating sand grains with organic matter, iron, and aluminum in the next layer (the spodic horizon). Podzolization commonly occurs under hemlock, spruces, pines, and larches. Wet sandy Spodosols may be recognized by either: (1) a cemented spodic horizon within 12 inches of the soil surface, (2) drainage mottles (any chroma) in the E-horizon or in the upper part of the spodic horizon, or (3) a blotchy colored E-horizon with organic coatings around sand grains that leave a dark stain on your skin when rubbed in the palm of your hand.

Newly created hydric soils may be formed by beaver impoundments or by human activities that inundate or saturate a previous nonhydric soil for a sufficient frequency and duration (usually more than one week during the growing season in most years) to be considered hydric. Obviously, the permanency of the activity must be considered. For example, if a beaver dams a road culvert and floods nonhydric soils and it is likely that someone will remove the dam and attempt to keep beaver out of the area, the action is temporary and the area should not be considered to have newly created hydric soil or wetland. If the action has, however, lasted for some time and wetland vegetation has become established and upland plants are dying or dead, then the area should be considered to have newly created hydric soil and to be wetland.

List of Maine's Hydric Soils

Table 4 outlines drainage classes and hydrologic characteristics of Maine's hydric soils. This table includes only designated hydric soil series. Other soil areas not mapped to the series level on the soil survey maps are also hydric: Aquepts, Borosaprists, Hemists, Histosols, Mixed Alluvial Land, Muck, Peat, Saprists, Sulfaquents, Sulfihemists, and Tidal Marsh.

Table 4. Hydric soil series of Maine, including soil taxonomic names (series and soil subgroups), drainage class (VP - very poorly drained, P - poorly drained, SP - somewhat poorly drained), depth and period of high water table (+ denotes water level above the soil surface), frequency, duration, and period of flooding (+V indicates surface water at variable depths). An asterisk (*) indicates that these series may include nonhydric members. *Note*: Some Maine soils classified as poorly drained actually include somewhat poorly drained members which may be nonhydric. (Source: *Hydric Soils of New England*, Tiner and Veneman 1987)

		High Water Table			Flooding	
Series (Soil Subgroup)	**Drainage Class**	**Depth (in.)**	**Period (months)**	**Frequency**	**Duration**	**Period**
Atherton (Aeric Haplaquepts)	P, VP	0-6	Nov-Jun	None	---	---
*AuGres (Entic Haplaquods)	SP	6-18	Nov-May	None	---	---
*Aurelie (Aeric Haplaquepts)	P	0-12	Sep-Jun	None	---	---
Beseman (Terric Borosaprists)	VP	+24-12	Jan-Dec	None-Rare	---	---
Biddeford (Histic Humaquepts)	VP	+12-6	Nov-Aug	None-Rare	---	---
*Brayton (Aeric Fragiaquepts)	P, SP	6-18	Nov-May	None	---	---
Bucksport (Typic Borosaprists)	VP	+12-6	Sep-Jul	None-Rare	---	---
Burnham (Typic Haplaquepts)	VP	+12-6	Oct-Jul	None	---	---
Canandaigua (Mollic Haplaquepts)	P, VP	+12-12	Sep-May	None	---	---
Cathro (Terric Borosaprists)	VP	+12-12	Oct-Jun	None	---	---
*Charles (Aeric Fluvaquents)	P	0-18	Nov-Jun	Common	Brief	Mar-Oct
Chocorua (Terric Borohemists)	VP	+12-6	Jan-Dec	None	---	---
*Easton (Aeric Haplaquepts)	P	0-18	Oct-May	None	---	---
*Fredon (Aeric Haplaquepts)	SP, P	+V-18	Oct-Jun	None-Occasional	Brief	Jan-Apr
Gouldsboro (Typic Sulfaquents)	VP	+12-6	Jan-Dec	Frequent	V.Brief	Jan-Dec
Greenwood (Typic Borohemists)	VP	+12-12	Sep-Jun	None	---	---
Halsey (Mollic Haplaquepts)	VP	+V-6	Sep-Jun	None-Common	Brief	Sep-Jun
Ipswich (Typic Sulfihemists)	VP	+12-0	Jan-Dec	Frequent	V.Brief	Jan-Dec
*Kinsman (Aeric Haplaquods)	SP, P	0-18	Nov-May	None	---	---
*Leicester (Aeric Haplaquepts)	P	0-18	Nov-May	None	---	---
Limerick (Typic Fluvaquents)	P	6-18	Nov-Jun	Frequent	Brief	Jan-Jun
Loxley (Typic Borosaprists)	VP	+12-12	Nov-May	None	---	---
Lupton (Typic Borosaprists)	VP	+12-12	Sep-May	None	---	---
Lyme (Aeric Haplaquepts)	P	0-18	Nov-May	None	---	---
Medomak (Fluvaquentic Humaquepts)	VP	+12-6	Sep-Jun	Frequent	Long	Mar-Oct
*Monarda (Aeric Fragiaquepts)	P	0-18	Oct-May	None	---	---
*Moosilauke (Aeric Haplaquepts)	SP, P	0-18	Nov-May	None	---	---
*Naskeag (Aeric Haplaquods)	SP, P	0-18	Nov-May	None	---	---
*Naumberg (Aeric Haplaquods)	SP, P	6-18	Dec-Apr	None	---	---
Ossipee (Terric Borohemists)	VP	+12-6	Jan-Dec	None	---	---
Pawcatuck (Terric Sulfihemists)	VP	+12-0	Jan-Dec	Frequent	V.-Brief	Jan-Dec
Peacham (Histic Humaquepts)	VP	+12-6	Oct-Jun	None	---	---
*Raynham (Aeric Haplaquepts)	SP, P	0-24	Nov-May	None	---	---
*Ridgebury (Aeric Fragiaquepts)	SP, P	0-18	Nov-May	None	---	---
Rifle (Typic Borohemists)	VP	+12-12	Nov-Jun	None	---	---
*Roundabout (Aeric Haplaquepts)	SP, P	0-18	Nov-May	None	---	---
*Rumney (Aeric Fluvaquents)	P	+V-18	Nov-May	Common	Brief	Oct-May
Saco (Fluvaquentic Humaquepts)	VP	+V-6	Sep-Jun	Frequent	Brief	Oct-May
*Saugatuck (Aeric Haplaquods)	SP, P	+12-24	Dec-Jun	None	---	---
Scantic (Typic Haplaquepts)	P	0-12	Oct-Jun	None	---	---
Scarboro (Histic Humaquepts)	VP	+12-12	Jan-Dec	None	---	---
Searsport (Histic Humaquepts)	VP	+12-12	Sep-Jul	None-Rare	---	---
*Swanton (Aeric Haplaquepts)	SP, P	0-18	Nov-May	None	---	---
*Swanville (Aeric Hapliquepts)	P	0-18	Oct-May	None	---	---
Togus (Terric Borofibrists)	VP	+12-6	Sep-Jul	None-Rare	---	---
Vassalboro (Typic Borofibrists)	VP	+12-6	Sep-Jul	None-Rare	---	---
*Walpole (Aeric Haplaquents)	P	0-12	Nov-Apr	None	---	---
Washburn (Unclassified)	VP	+12-6	Oct-Jul	None-Rare	---	---
Waskish (Typic Spagnofibrists)	VP	0-24	Nov-Jul	None	---	---
Westbrook (Terric Sulfihemists)	VP	+12-0	Jan-Dec	Frequent	V.Brief	Jan-Dec
Whately (Mollic Haplaquepts)	VP	+12-12	Oct-Aug	None-Rare	---	---
Whitman (Typic Humaquepts)	VP	+12-6	Sep-Jun	None	---	---
Wonsqueak (Terric Borosaprists)	VP	+12-6	Sep-Jul	None-Common	Long	Mar-Oct

WETLAND RECOGNITION AND BOUNDARY DELINEATION

Positive identification of wetlands and accurate delineation of their boundaries require both reviewing existing information on the project location and conducting field investigations at the site. Existing information on wetlands (e.g., wetland maps and soil survey maps) should be part of your office's reference collection. This information should be reviewed prior to doing any on-site inspection.

Sources of Background Information

Available wetland information varies from place to place, but the two primary sources of wetland location information are:

(1) ***National Wetlands Inventory maps*** produced by the U.S. Fish and Wildlife Service and

(2) ***county soil survey reports*** published by the U.S.D.A. Soil Conservation Service.

These sources are available for many areas in Maine. Other sources of information that may be worth reviewing prior to the field inspection include U.S. Geological Survey topographic maps, tide or stream gauge data (valuable hydrologic data), floodplain maps, state or local wetland maps, and various reports on wetlands in the area (e.g., environmental impact statements and scientific reports).

Use of wetland and soil maps and general field procedures to identify wetlands and delineate boundaries are discussed below. While the field procedures have been intentionally simplified for the nonspecialist, the approach is based upon and consistent with the Federal interagency wetland delineation manual, but does not require documentation of hydrophytic vegetation, hydric soils, *and* wetland hydrology for obvious wetlands that can be readily identified by a single characteristic. More technical guidance for identifying Federally regulated wetlands is available from the actual manual.

Use of National Wetlands Inventory Maps

The Fish and Wildlife Service, through its National Wetlands Inventory (NWI) Project, is producing a series of large-scale (1:24,000) maps that show the location, size, and type of wetlands within defined geographical areas for the entire country. At this time, NWI maps are available for less than half of Maine, but in the near future, wetland maps should be available for the entire state. For other areas, use USGS topographic maps as a more general guide. An example of a 1:24,000 NWI map is shown in Figure 9.

NWI maps are useful tools for first identifying the likely presence of wetland in a given area. The minimum mapping unit (i.e., the smallest area mapped) varies with the scale of the photography used in the mapping effort. Source photography is designated on the legend of each map. The NWI maps show the following:

- wetlands generally one acre in size and larger are shown where 1:58,000 color infrared photography was used;
- wetlands three to five acres and larger where 1:80,000 black and white photography was used;
- the location and shape of wetlands;
- the type of wetland based on vegetation (or substrate, where vegetation is absent);
- water regime, salinity (for tidal areas), and other characteristics.

An alpha-numeric code designates the wetland type according to the Service's wetland classification system - *Classification of Wetlands and Deepwater Habitats of the United States*. For example, the code PFO1E, representing a common nontidal wetland type in Maine, can be broken down as follows: P-Palustrine (System); FO-Forested Wetland (Class); 1-Broad-leaved Deciduous (Subclass); and E-Seasonally Flooded/Saturated (Water Regime). This type includes red maple swamps. A leatherleaf bog would be classified as PSS3Ba: P-Palustrine (System); SS-Scrub-Shrub Wetland (Class); 3-Broad-leaved Evergreen (Subclass); B-Saturated (Water Regime); and a-acid (Water Chemistry). A legend at the bottom of each NWI map explains the alpha-numeric code symbology.

While the NWI maps give the location of a large number of wetlands, not all wetlands are shown. Since the maps were prepared through aerial photo interpretation techniques with spot field checking, there is an inherent margin of error. Some limitations are listed below:

- Wetlands smaller than one acre and those occurring as a thin fringing band along watercourses are usually not shown.
- Farmed wetlands are generally not mapped in Maine, with the exception of cranberry bogs.
- The aerial photographs reflect wetness conditions during the specific year and season when they were taken - if taken during a dry season or a dry

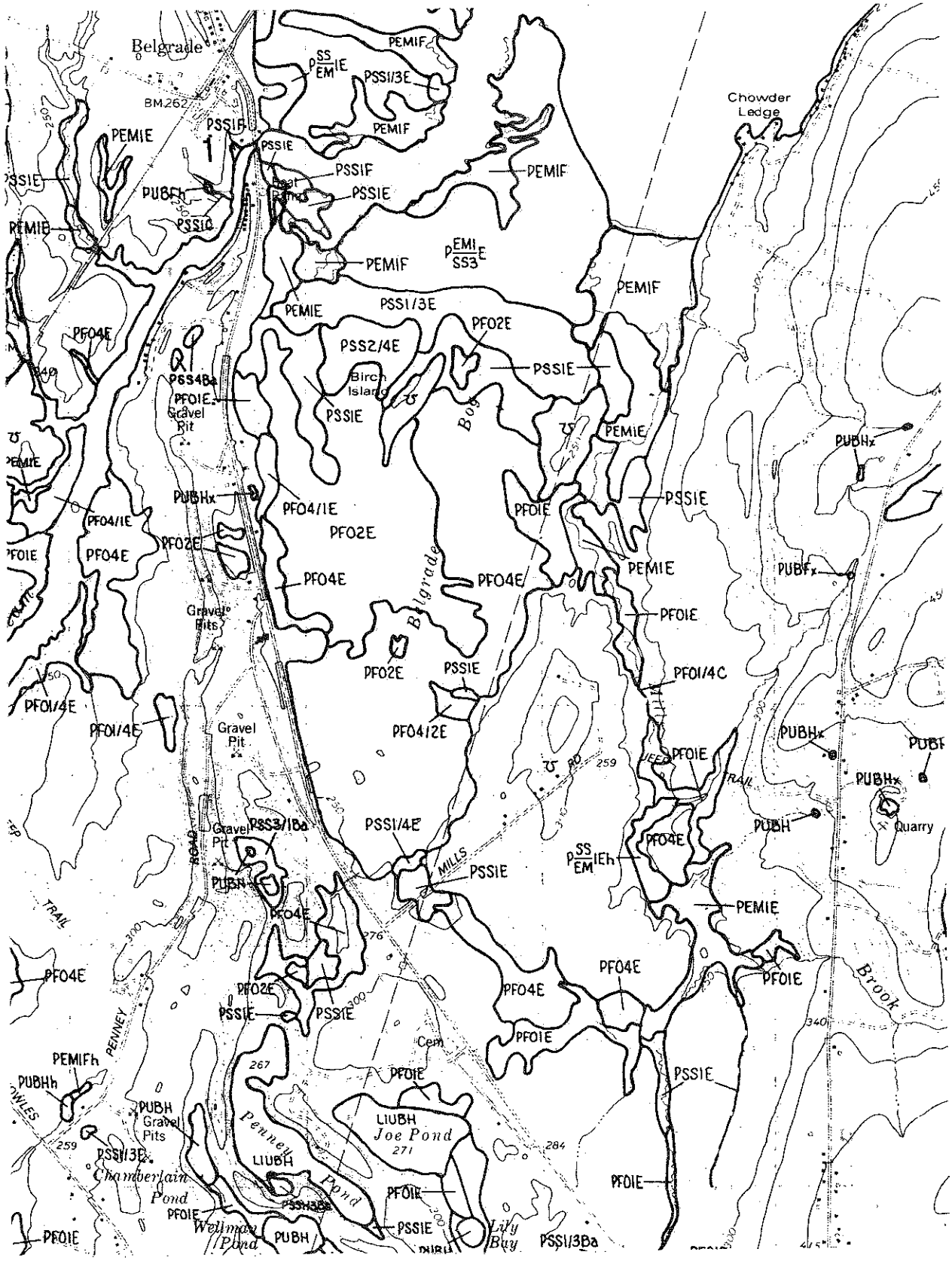


Figure 9. Example of a portion of a National Wetlands Inventory map (Belgrade, Maine). Alpha-numeric codes signify various types of wetlands and deepwater habitats: forested wetlands (e.g., PFO4E, PFO2E, PFO1/4E), inland marshes (e.g., PEM1F, PEM1E), and shrub swamps (e.g., PSS1E). Compare this map with the soil map for the same area (Figure 10).

year, some wetlands will be missed and not mapped.

- The mapped boundaries may be somewhat different than if based on detailed field observations, especially in areas with subtle changes in topography.
- The activities of humans (e.g., filling and drainage) or beavers may have caused changes in wetlands since the photos were acquired.

It is, therefore, important that you be aware of these limitations and use the NWI maps to establish the presence and general configuration (i.e., general boundary) of a wetland in a given location. A site inspection should always be conducted in order to accurately delineate the wetland boundary and identify missed wetlands for a specific project.

Use of County Soil Surveys

The Soil Conservation Service (SCS) is conducting soil surveys throughout Maine and the rest of the country. In the field, soil scientists correlate differences in soils with changes in landscape and then draw the boundaries of individual soil types on aerial photographs. Soil maps are subsequently prepared from these data. When the survey is completed for a given county, a county soil survey report is published. The report contains invaluable information about the county and its soils (e.g., climate, soil series and map unit descriptions, use and management of soils, and formation and classification of soils) plus large-scale (often 1:20,000) photo-based maps showing the location and configuration of individual soil map units. Soil map units represent mapped areas of various soil types (soil series and land types) designated by an alpha-code or number-code on the maps. An example of a soil survey map is presented in Figure 10.

When used in conjunction with a list of hydric soil map units (available for each county from SCS county offices), the soil survey maps can help identify the likely presence of wetland in a given area.

- In general, the minimum map unit of soil types ranges from 1.5 to 10 acres, depending on landscape diversity and survey objectives.
- Soil map units often have inclusions of other soils, so that a large area mapped as nonhydric (upland) soil may, in fact, have substantial acres of hydric soil (wetland) within its borders, and vice versa.
- Some obvious wet spots may be identified by a "wet" symbol within areas of upland soil.

The county list of hydric soil map units references both map units dominated by hydric soils and map units dominated by nonhydric soils but having possible hydric inclusions. In the latter, the hydric inclusions are listed by name and landscape position (usually in depressional areas). In addition, the map unit description in the county soil survey report also mentions these inclusions. In the field, they are often easily recognized by their landscape position, wetland vegetation, and signs of hydrology, as well as their soil morphological properties.

For wetland identification purposes, other limitations of the soil maps are that:

- they do not usually differentiate between drained and undrained hydric soil in Maine, thus making it virtually impossible to separate current wetlands from historic wetlands, except in uncommon instances where a flooded phase or undrained phase is mapped;
- some members of hydric soil series do not possess hydric properties and are not associated with wetlands, while other members are hydric; these "facultative hydric soils" may or may not be hydric depending largely on landscape position (those in depressions are usually hydric, but those on slopes are often not); soil maps do not distinguish between them. (*Note*: These transitional hydric soils have been marked with an asterisk on Table 4).

Unfortunately, many people have failed to recognize these points and have simply used the acreage of hydric soil series to indicate the acreage of land subject to wetland regulations. This has resulted in grossly exaggerated reports on acres of wetlands subject to Federal regulation across the country. The soil surveys and acreage of hydric soil map units should not, therefore, be the sole sources used to identify the presence of wetlands or to determine the acreage of land subject to regulation. Soil maps should be used in conjunction with the NWI maps, and other information to identify the likely presence of wetland in a given area and soils that may be encountered during field inspections. After reviewing these materials, on-site inspections should be performed to verify the presence of wetland and determine its boundaries.

Field Procedures

Field investigations are required to delineate the extent of wetland for a specific project. First, you must be able to recognize that a wetland is or is not present in the subject area. Then if a wetland is present, a boundary or upper limit must be delineated. Again, NWI maps, soil surveys and other available information about the site should be re-

Figure 10. Example of a portion of a soil survey map for Belgrade, Maine. Alpha codes represent different types of soil map units. Hydric soil map units include TO (Togus peat), VA (Vassalboro peat), Bo (Biddeford mucky peat), and ScA (Scantic silt loam).

viewed prior to conducting field work, to learn what to expect in terms of topography and other site characteristics and the likelihood of finding wetland there. This preview is essentially the off-site wetland determination method presented in the Federal wetland delineation manual (see manual for details). For onsite inspections, you will need to bring certain equipment and materials into the field (see Table 5 for recommended list).

Table 5. Recommended equipment and materials for use in the field.

Equipment	Materials
1. Boots	1. Field notebook and pen/pencil
2. Mosquito repellent	2. NWI map
3. Tile spade, soil auger, or soil probe	3. County soil survey
4. Pocketknife	4. U.S.G.S. topographic map
5. Camera and film	5. Munsell soil color charts book
6. Compass	6. This guidebook
7. Hand lens (10x)	7. State wetland plant list
8. Tape measure (100 ft.)	8. Flagging tape

General Guidance for Wetland Recognition

Upon arriving at the project site, walk the entire area to learn its topography and determine where wetlands probably exist. Wetlands usually can be identified by a prevalence of hydrophytes, a predominance of undrained hydric soils, and direct or indirect evidence of flooding, ponding, or soil saturation during the growing season. You should have little difficulty identifying a wetland where you get your feet wet in spring and summer. In these cases, OBL and FACW plants, characteristic of seasonally flooded and wetter wetlands, often predominate. Since all wetlands do not look alike (due mainly to differences in hydrology, vegetation, and soils), it is not always so easy to recognize wetlands on the ground. Remembering, however, that wetlands occur along a natural wetness (soil moisture) gradient, you should be able to recognize the range of Maine wetlands associated with various water regimes, from permanently flooded wetlands in shallow water to seasonally saturated wetlands that are only briefly saturated, usually early in the growing season. These latter wetlands pose the greatest problem in wetland recognition in Maine, since most, if not all, of the plants growing here may also be found on uplands. In fact, many of the plants in these drier wetlands may be even more characteristic of uplands; these plants include FAC and FACU species as listed on the wetland plant list for Maine. Thus, in these wetlands, vegetation alone will not often provide the answer to the question, is this wetland? Moreover, since saturation is short-lived and surface water is not present, obvious signs of flooding or soil saturation, will usually be absent. There may, however, be indirect evidence of inundation in nearby depressions, such as water-stained leaves or water marks (e.g., silt or stains) on plant parts, or signs of soil saturation (e.g., oxidized rhizospheres) in nonflooded microsites. These are useful indicators of wetland hydrology. You still need to confirm this observation by examining the soil for hydric properties within 1.5 feet of the surface, such as a thick organic soil layer or thick dark mineral surface layer, grayish subsoil, and bright-colored mottles. If positive indicators of undrained hydric soils (poorly and very poorly drained soils) are present, you should be confident that the area is wetland and can proceed to mark the upper boundary at the project site. If you find major drainage ditches or know of other activities (e.g., groundwater withdrawals) that may have significantly altered the area's hydrology, it is best to call in an expert to assess the current hydrology.

To achieve the best results in the field, visit the site in question at the beginning and the peak of the growing season, if possible. When conducting field work, avoid or at least be aware of extreme flooding conditions or periods immediately following heavy rains, because low-lying uplands could be flooded at these times. While early spring may be the best time for making a wetland determination from a hydrologic standpoint, it is not the optimal time for identifying many of the characteristic wetland plants. Mid- to late-summer is the best time for identifying most plants, since flowers or seeds are present at this time. Woody plants, however, can be identified in all seasons. While both spring and summer visits are recommended, experienced wetland specialists can usually make a wetland determination by a single site visit when the soil is not frozen. Even in winter, some preliminary boundaries may be delineated by considering vegetation (woody species and persistent herbs) and landscape position, recognizing that a follow-up verification during the growing season must be conducted to finalize the wetland boundary.

You should also be aware that small wetland areas may be scattered throughout a large upland tract of land and that these small areas should be treated separately for wetland determination purposes. The converse is also true: small upland islands may exist within large wetland complexes. Be sure to identify homogeneous areas having similar vegetation, topography, and

other characteristics within the project site for separate evaluation. An initial walk through the entire project area should reveal any differences.

Wetlands are identified in the field by the presence of hydrophytic vegetation, hydric soils, and signs of wetland hydrology. The earlier sections of this guide discuss these three diagnostic features of wetlands. Wetland determinations often require identification or verification of the upper boundary, that is, the boundary between wetland and upland (nonwetland).

General Approach to Wetland Boundary Delineation

Once an area has been designated as wetland, the limits of the wetland, that is, the wetland-upland boundary, must be identified. To draw this line, astute observations correlating changes in vegetation, soils, and/or hydrology with changes in topography must be made.

Where the change in slope is abrupt, a marked change in the vegetation community should occur as wetland plants quickly give rise to UPL plants and/or FAC and FACU plants growing under upland conditions. Even though these differences are apparent, it is still worth examining the soil along the transect to ensure that observed vegetation patterns are the result of a change in soil moisture, i.e., hydric soil to nonhydric soil, and not the result of other phenomena, such as soil fertility, soil chemistry, or human disturbance.

In many situations, topographic relief changes are more subtle, and the obvious differences in vegetation patterns are lacking. This happens along floodplains, where elevations are low and topographic changes are gradual, and also on gentle slopes in groundwater seepage areas. In these areas, and along the upper edges of many wetlands, OBL and FACW plants may gradually intermix with FAC and FACU plants to form what is sometimes called the "transition zone." Flooding and/or soil saturation may not be particularly evident here, since these wetlands may be only temporarily flooded, have water ponded on the surface only briefly during the growing season, or have soils saturated for only the early part of the season. In these cases, where hydrology is not apparent and vegetation is inconclusive, the soils need to be examined, for they reflect the long-term hydrology.

To identify a wetland boundary, follow these steps:

(1) First walk into the area to a point where good wetland indicator plants and/or other signs of wetland are present.

(2) Then walk in a straight line toward the perceived boundary, evaluating changes in vegetation, and periodically examining the soil to see if hydric soil properties (e.g., organic soil layer, thick dark surface layer, grayish subsoil colors, or iron and manganese mottles near the surface) are present.

(3) When the hydric properties are no longer present in the soil and hydrophytic vegetation is not present along the transect, mark that point with flagging tape on a nearby tree or shrub. You have just identified one boundary point. The boundary line for the wetland is created by repeating this procedure at other locations and connecting the points together (Figure 11). Be sure to take thorough notes on your observations, for good documentation is crucial for explaining your findings to others. Keep in mind that even when soils are examined, the wetland boundary may not be clear-cut, yet by examining vegetation, soils, hydrology, and landscape position, you will be able to draw a better line than without considering all of these features together.

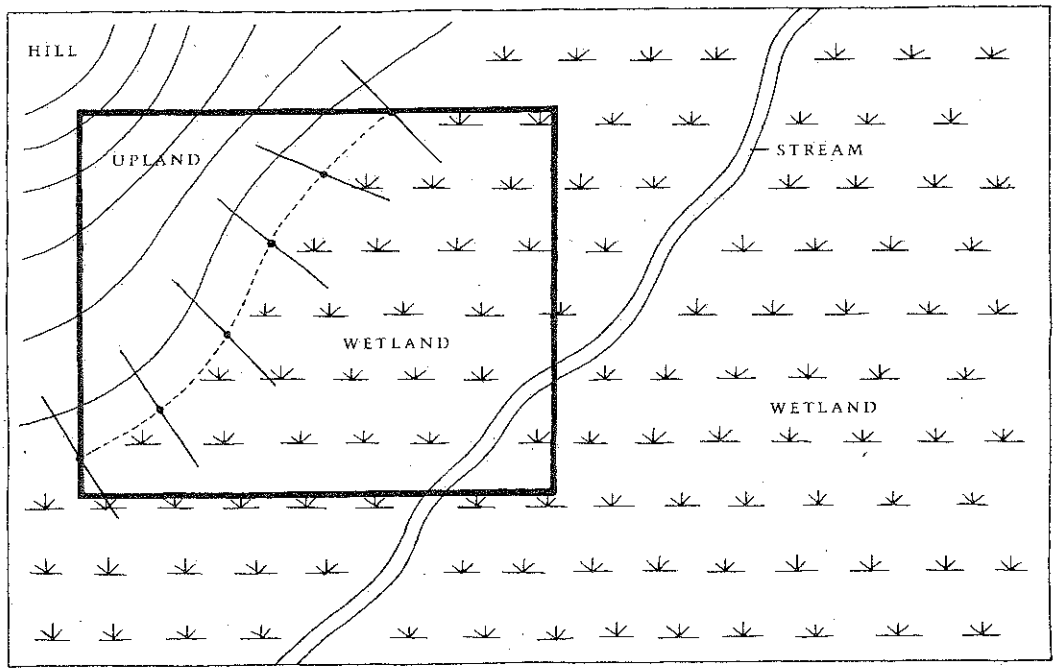
Specific Wetland Delineation Procedures

Outlined below is the most commonly used method from the Federal wetland delineation manual - the "routine plant community assessment procedure." The routine method should be used wherever possible. It can be used to identify most marshes, fens, swamps, and bogs in Maine. Areas where topographic change is gradual over long distances or where plant communities are extremely diverse and difficult to visually determine dominants may require more complicated methods and the services of an expert.

The outlined steps of the routine method are not taken verbatim from the manual, but condensed for the sake of simplicity. Table 6 contains an example of determining dominant species for a plant community with three vegetation layers (strata).

Step 1. **Walk the entire project area and identify plant communities for examination.** Pay attention to changes in elevation or landscape position that may result in changes in plant communities. Homogeneous plant communities (groups of similar plants) should be selected for evaluation; be sure to consider understory vegetation in identifying plant communities. If significantly disturbed areas (e.g., filled, excavated, heavily ditched, or graded areas) are encountered, they must be evaluated separately using special procedures in the Federal manual (refer to the manual for details); consult an expert. Go to Step 2.

Step 2. **Select one or more representative observation areas within each plant community.**



Project Area
Transect Line
Wetland–Upland Boundary Point
Designated Wetland Boundary

Figure 11. Transects are often established to determine wetland boundaries. These transects may be formal with specific data recorded or informal for making observations and putting up flagging to mark the wetland-nonwetland boundary.

Such sites should best reflect the overall characteristics of the community. Choose more than one area if necessary to represent significant variations within the community. Go to Step 3.

Step 3. **Visually identify dominant species in each applicable stratum (i.e., tree, sapling, shrub, herb, and woody vine) for the plant community.** Use the plant identification section of this guidebook. For plants which you cannot identify, consult other field guides or collect a specimen and consult a botanist. Dominant species within each stratum are the species that when ranked in descending order of dominance (e.g., areal cover) and cumulatively totaled, immediately exceed 50 percent of the total dominance measure for the stratum, plus any additional species comprising 20 percent or more of the total dominance measure. Record dominants for each stratum. (See example in Table 6.) Go to Step 4.

Step 4. **Record wetland indicator status from the Maine or regional wetland plant list for each dominant species for all strata.** Vascular plant species not on the list are considered UPL plants. Go to Step 5.

Step 5. **Determine whether the hydrophytic vegetation criterion is met.** If more than 50 percent of the dominant species (for all strata combined) are OBL, FACW, and/or FAC, the hydrophytic vegetation criterion is met; go to Step 6. If not, the plant community is usually nonwetland, with the exception of "problem area wetlands" (e.g., FACU-dominated wetlands such as a hemlock or white pine swamp) that are specified in the Federal manual. Landscape position (e.g., depressions, flat poorly drained areas, seepage slopes, and areas contiguous with waterbodies or easily identified wetlands) should help you identify potential locations of these problem area wetlands.

Step 6. **Determine whether soils must be examined.** Hydric soils are assumed to be present where: (1) all dominant species are OBL, or (2) all dominants are OBL and FACW *and* the topographic boundary is abrupt; go to Step 8. (*Note: These plant communities are virtually always wetlands and signs of wetland hydrology should be conspicuous.*) Other plant communities meeting the hydrophytic vegetation criterion must have soils examined, since they may be nonwetlands; go to Step 7.

Step 7. **Determine whether the hydric soil criterion**

Table 6. Sample problem for calculating dominant species for a plant community with three strata (tree, shrub, and herb). Dominant species are marked by an asterisk. The "dominance threshold number" equals 50 percent of the combined total of the dominance measure (e.g., areal coverage) for each species present in the stratum. It is used to identify dominant species. Also any species representing at least 20 percent of total dominance measure (e.g., areal coverage) of a stratum is also considered a dominant species.

Stratum	Plant Species	% Areal Coverage (Dominance Measure)	Calculations
Tree	Red Maple*	80	**Dominance Threshold Number** = 50% of 110% = 55%
	Black Ash	20	20% of 110% = 22%
	Yellow Birch	5	*Red Maple is the only dominant species in this stratum, since no other plant has 22% or more areal cover.*
	Hemlock	5	
	Total Areal Coverage for Tree Stratum	110%	
Shrub	Highbush Blueberry*	40	**Dominance Threshold Number** = 50% of 55% = 27.5%
	Sweet Pepperbush*	15	20% of 55% = 11%
	Total Areal Coverage for Shrub Stratum	55%	*Both Highbush Blueberry and Sweet Pepperbush are dominant species; the latter species is included as a dominant because it represents more than 11% areal coverage which is more than 20% of the total areal coverage for the stratum.*
Herb	Skunk Cabbage*	10	**Dominance Threshold Number** = 50% of 25% = 12.5%
	Tussock Sedge*	10	20% of 25% = 5%
	Canada Mayflower*	5	*Both Skunk Cabbage and Tussock Sedge are dominant species, since their combined areal coverage exceeds 12.5%; Canada Mayflower is also considered a dominant species, since it represents 20% of the total areal coverage of the stratum.*
	Total Areal Coverage for Herb Stratum	25%	

Dominant Species are Red Maple (FAC), Highbush Blueberry (FACW-), Sweet Pepperbush (FAC+), Skunk Cabbage (OBL), Tussock Sedge (OBL) and Canada Mayflower (FAC-). All dominants are OBL, FACW, or FAC, so the hydrophytic vegetation criterion is easily met. Remember that all dominants are treated equally for assessing this criterion.

is met. Examine the soil and use the soil survey report and county list of hydric soil map units to see if the soil is hydric. Consider properties discussed in this guidebook for recognizing hydric soils in Maine. Also verify that soil has been mapped correctly by comparing soil properties with description of soil map units in soil survey report. If hydric soils are present, then the hydric soil criterion is met; go to Step 8. If not, then the area is usually nonwetland. (*Note*: Beware of hydric soils that lack typical hydric soil properties; these soils are generally discussed in this guidebook, but consult your local SCS soil scientist for specific information. Also remember that certain hydric soil series may or may not be hydric (associated with wetland), so be sure to look for hydric soil properties in the field and not simply accept a hydric soil map unit as the limits of soils meeting the hydric soil criterion on the ground.)

Step 8. **Determine whether the wetland hydrology criterion is met.** Examine the plant community for signs of wetland hydrology or evaluate any available hydrologic records for supportive evidence of meeting the wetland hydrology criterion. Remember that areas subject to significant hydrologic modification should be evaluated using special procedures presented in the Federal manual; consult an expert. In the absence of significant hydrologic modification, plant communities with a predominance of OBL, FACW, and/or FAC dominants occurring on hydric soils should provide ample evidence to verify wetland hydrology. The strength of these vegetation and soil indicators clearly point to wetland rather than nonwetland. Go to Step 9.

Step 9. **After doing Steps 2-8 for all plant communities, examine data for each plant community and identify wetland plant communities.** Plant communities having hydrophytic vegetation, hydric soils, and wetland hydrology are wetland. Other plant communities are nonwetland. Go to Step 10.

Step 10. **Identify the specific boundary between**

wetlands and nonwetlands. Look for changes in elevation, vegetation, and soil types and identify where vegetation meeting the hydrophytic vegetation criterion and soils meeting the hydric soil criterion give way either to nonhydrophytic vegetation or nonhydric soils or potential hydric soils that do not exhibit hydric soil properties due to insufficient wetness. Mark the wetland boundary with flagging tape and record your reasons for delineating the boundary at this point.

OTHER SOURCES OF INFORMATION

Primary References

Primary sources of information referenced in this guidebook are listed below along with information on where to order them.

Publications:

Federal Manual for Identifying and Delineating Jurisdictional Wetlands. (1989) Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (*Note*: This is temporarily out of print for revision.)

Wetland Plants for the State of Maine 1988. National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161 (703) 487-4650. Stock# PB90-138124-AS.

Natural Landscapes of Maine: A Classification of Ecosystems and Natural Communities. Maine Natural Heritage Program, Office of Comprehensive Planning, SHS 130, Augusta, ME 04333

Maps:

National Wetlands Inventory Maps. Maine Department of Conservation, Geological Survey, SHS 22, Augusta , ME 04333 (287-2801)

County Soil Survey Reports. U.S. Department of Agriculture, Soil Conservation Service, County Offices, addresses, (phone number) listed below:

Androscoggin & Sagadahoc:	27 Westminster Street, Lewiston, ME 04240 (783-9196)
Aroostook (Central):	Aroostook Agriculture Center Building 744 Main Street, Presque Isle, ME 04769 (764-4153/4154)
Aroostook (St. John Valley)	96 Market Street, Fort Kent, ME 04743 (834-3311)
Aroostook (Southern):	RR3, Box 45, Houlton, ME 04730 (532-2087)
Cumberland:	1A Karen Drive, Westbrook, ME 04092 (871-9247)
Franklin:	2 Park Street, Farmington, ME 04938 (778-4767)
Hancock:	Federal Building, RR5 Box 508W, Ellsworth, ME 04605 (667-8663)
Kennebec:	Federal Building, 40 Western Avenue, Augusta, ME 04330 (622-8289)
Knox & Lincoln:	RR2 Box 3750, Warren, ME 04864 (273-2005)
Oxford:	1 Main Street, South Paris, ME 04281 (743-7019)
Penobscot SWCD:	970 Illinois Avenue, Bangor, ME 04401 (947-6622)
Piscataquis:	1073 West Main Street, Suite 7, Dover-Foxcroft, ME 04426 (564-2321)
Somerset:	7 High Street, Skowhegan, ME 04976 (474-8324)
Waldo:	69 Northport Avenue, Belfast, ME 04915 (338-2320)
Washington:	Federal Building, 49 Court Street, P.O. Box 121, Machias, ME 04654 (255-3995)
York:	160 Cottage Street, Sanford, ME 04073 (324-7015)
Topographic Maps.	U.S. Geological Survey, 26 Ganneston Drive, Augusta, ME 04333 (622-8201)
	Maine Department of Conservation, Geological Survey, SHS 22, Augusta, ME 04333 (287-2801)

Hydrologic Data:

Gauging Data.	U.S. Geological Survey, 26 Ganneston Drive, Augusta, ME 04333 (622-8201)

Technical Assistance:

Soils.	Soil Conservation Service as listed above by County.
Vegetation.	Maine Department of Environmental Protection, Division of Natural Resources, SHS 17, Augusta, ME 04333 (287-2111)
Hydrology.	Maine Department of Conservation, Geological Survey, SHS 22, Augusta, ME 04333 (287-2801)
	Maine Department of Environmental Protection, Division of Natural Resources, SHS 17, Augusta, ME 04333 (287-2111)

General/Enforcement Assistance.	Maine Department of Environmental Protection, Division of Natural Resources, SHS 17, Augusta, ME 04333 (287-2111) U.S. Army Corps of Engineers, Maine Project Office, RR2, Box 1855, Manchester, ME 04351 (623-8367/8124)

Other Useful References

The following field guides and manuals are useful for identifying wetland plants not included in this guidebook or for winter identification of woody species.

Coastal Wetland Plants:

A Field Guide to Coastal Wetland Plants of the Northeastern United States by R.W. Tiner, Jr. (1987). University of Massachusetts Press, Amherst, MA 01003

Inland Wetland Plants:

Field Guide to Nontidal Wetland Identification by R.W. Tiner, Jr. (1988). Maryland Department of Natural Resources, Nontidal Wetlands Division, Tawes State Office Building, Annapolis, MD 21401

Freshwater Wetlands: A Guide to Common Indicator Plants of the Northeast by D.W. Magee (1981). University of Massachusetts Press, Amherst, MA 01003

The Woody Plants of Sphagnous Bogs of Northern New England and Adjacent Canada byF. Hyland and B. Hoisington (1977). University of Maine, Life Sciences and Agriculture Experiment Station, Orono, ME 04473

Woody Plants in Winter:

Winter Keys to Woody Plants of Maine by C.S. Campbell and F. Hyland (1978). University of Maine at Orono Press, Orono, ME 04473

Other Plant Field Guides:

Newcomb's Wildflower Guide by L. Newcomb (1977). Little, Brown and Company, Boston, MA.

The following publication summarizes information on hydric soils in New England.

Hydric Soils Guide:

Hydric Soils of New England by R.W. Tiner, Jr. and P.L.M. Veneman (1987).

University of Massachusetts Cooperative Extension Service, Amherst, MA 01003 (Bulletin C-183R)

Key to Soil Drainage Classes by the Maine Association of Professional Soil Scientists. Contact SCS Offices for information on how to order.

Some books or reports covering Maine wetlands that may be of interest include the following.

Bogs of the Northeast by C.W. Johnson (1985). University Press of New England, Hanover, NH 03755

The Ecology of Peat Bogs of the Glaciated Northeastern United States: A Community Profile by A.W.H. Damman and T.W. French (1987). U.S. Fish and Wildlife Service, Office of Information Transfer, Washington, DC 20240 (Biol. Rept. 85 (7.16))

The Ecology and Distribution of Ribbed Fens in Maine by E.R. Sorenson (1986). Maine State Planning Office, Critical Areas Program, Augusta, ME 04383 (Planning Rept. No. 81)

Botanical and Ecological Aspects of Coastal Raised Peatlands in Maine by I.A.Worley (1980). Maine State Planning Office, Critical Areas Program, Augusta, ME 04333 (Planning Rept. No. 69)

The Ecology of New England High Salt Marshes: A Community Profile by S.W. Nixon (1982). U.S. Fish and Wildlife Service, Office of Information Transfer, Washington, DC 20240 (FWS/OBS-81/55)

A Focus Peatlands and Peat Mosses by H. Crum (1988). University of Michigan Press, Ann Arbor, MI.

Wetlands: Guide to Science, Law and Technology edited by M.S. Dennison and J.F. Berry (1993). Noyes Publications, Park Ridge, NJ 07656

Ecology of Red Maple Swamps in the Glaciated Northeast: A Community Profile by F.C. Golet and others (1993). U.S. Fish and Wildlife Service, Office of Information Transfer, Washington, DC 20240. (Biol. Rept. 12).

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Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. U.S. Fish and Wildlife Service, Washington, D.C. FWS/OBS-79/31. 103 pp.

Federal Interagency Committee for Wetland Delineation. 1989. Federal Manual for Identifying and Delineating Jurisdictional Wetlands. U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, and U.S.D.A. Soil Conservation Service, Washington, D.C. Cooperative technical publication. 76 pp. plus appendices.

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Gleason, H.A. 1952. The New Britton and Brown Illustrated Flora. Hafner Press, New York, NY. (Three Volume Set)

Little, E.L. 1980. The Audubon Society Field Guide to North American Trees. Eastern Region. Alfred A. Knopf, New York. 714 pp.

Lyford, W.H. 1964. Water Table Fluctuations in Periodically Wet Soils of Central New England. Harvard University, Harvard Forest, Petersham, MA. Paper No. 8. 15 pp.

Magee, D.W. 1981. Freshwater Wetlands: A Guide to Common Indicator Plants of the Northeast. The University of Massachusetts Press, Amherst. 245 pp.

Maine Association of Professional Soil Scientists. 1988. Key to Soil Drainage Classes. Mimeo. 2 pp.

Maine Natural Heritage Program. 1991. Natural Landscapes of Maine: A Classification of Ecosystems and Natural Communities. State Planning Office, Augusta, ME.

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Novitski, R.P. 1982. Hydrology of Wisconsin Wetlands. U.S. Geological Survey, Reston, VA. Information Circular 40. 22 pp.

Petrides, G.A. 1972. A Field Guide to Trees and Shrubs. Houghton Mifflin Company, Boston, MA. 428 pp.

Reed. P.B., Jr. 1988. National List of Plant Species that Occur in Wetlands: Northeast Region. U.S. Fish and Wildlife Service, Washington, D.C. Biol. Rept. 88(26.1). 111 pp.

Soper, J.H., and M.L. Heinburger. 1990. Shrubs of Ontario. Royal Ontario Museum, Toronto. 495 pp.

Sorenson, E.R. 1986. The Ecology and Distribution of Ribbed Fens in Maine. Maine State Planning Office, Critical Areas Program, Augusta. Planning Report No. 81. 159 pp.

Tiner, R.W. 1991. The concept of a hydrophyte for wetland identification. BioScience 41(4): 236-247.

Tiner, R.W. Jr. 1988. Field Guide to Nontidal Wetland Identification. Maryland Department of Natural Resources, Annapolis and U.S. Fish and Wildlife Service, Newton Corner, MA. 283 pp. plus color plates.

Tiner, R.W. Jr. 1987. A Field Guide to Coastal Wetland Plants of the Northeastern United States. The University of Massachusetts Press, Amherst. 285 pp.

U.S.D.A. Soil Conservation Service. 1989. Hydric Soils in Maine. Orono, ME.

U.S.D.A. Soil Conservation Service. 1982. National List of Scientific Plant Names. Washington, D.C. SCS-TP-159. 416 pp.

Worley, I.A. 1980. Botanical and Ecological Aspects of Coastal Raised Peatlands in Maine. Maine State Planning Office, Critical Areas Program, Augusta. Planning Report No. 69. 175 pp.

INDEX TO PLANTS

Plants are arranged by habitat (coastal marsh vs. freshwater wetland) and life-form and then listed alphabetically by common name. Scientific name and wetland indicator status are also given along with the page reference where the plant is described .

COASTAL MARSH PLANTS

Fleshy Herbs

Flowering Herbs

Grasses

Sedges

Rushes

Other Grasslike Plants

FRESHWATER WETLAND HERBS

Ferns

Grasses

Sedges

Rushes

Other Grasslike Plants

Flowering Herbs

FRESHWATER WETLAND SHRUBS

Thorny Shrubs

Evergreen Shrubs

Deciduous Shrubs

FRESHWATER WETLAND WOODY VINES

FRESHWATER WETLAND TREES

Evergreen Trees

Deciduous Trees