

TA7
W34
no. Y-
78-9
cop. 2



US-CE-C Property of the United States Government



TECHNICAL REPORT Y-78-9

PRELIMINARY GUIDE TO THE ONSITE IDENTIFICATION AND DELINEATION OF THE WETLANDS OF ALASKA

by

Robert T. Huffman, Gary E. Tucker

Environmental Laboratory

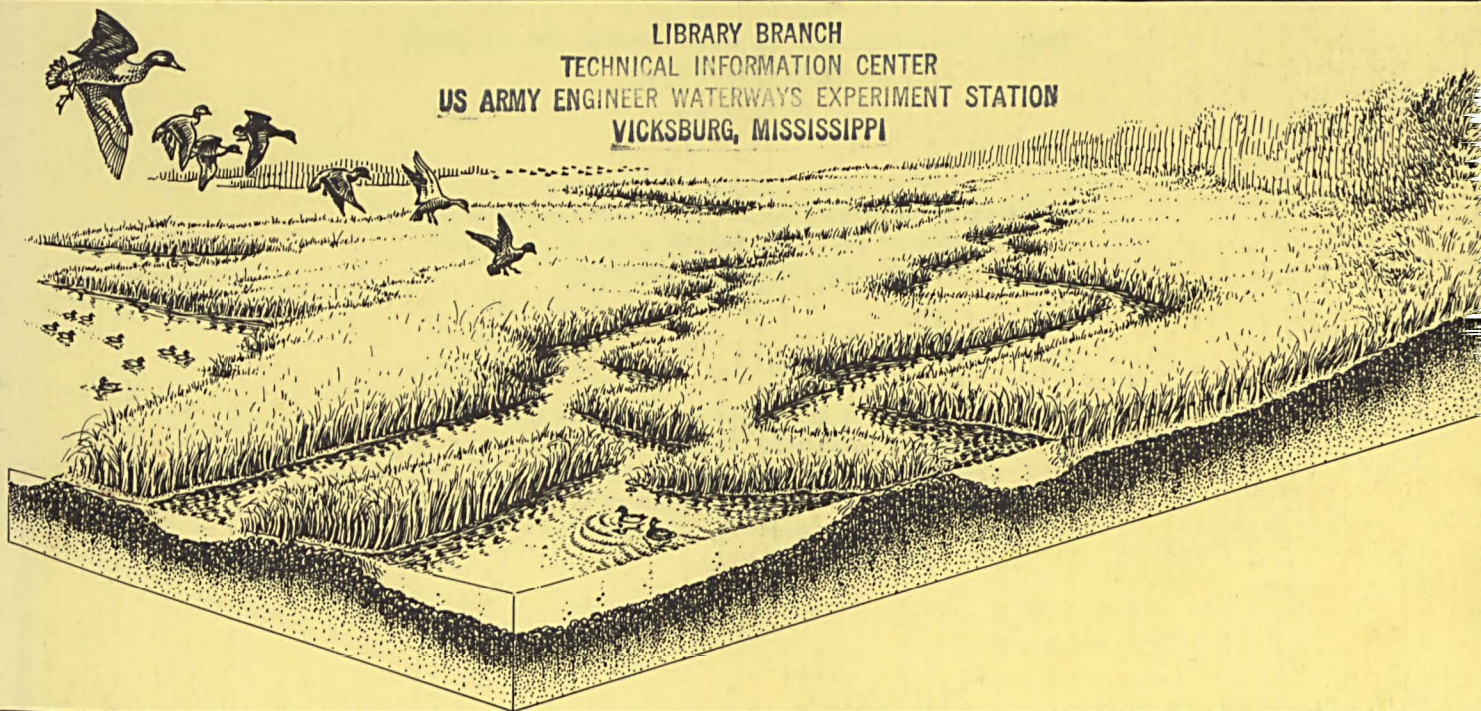
U. S. Army Engineer Waterways Experiment Station
P. O. Box 631, Vicksburg, Miss. 39180

February 1984

Final Report

Approved For Public Release; Distribution Unlimited

LIBRARY BRANCH
TECHNICAL INFORMATION CENTER
US ARMY ENGINEER WATERWAYS EXPERIMENT STATION
VICKSBURG, MISSISSIPPI



Prepared for Office, Chief of Engineers, U. S. Army
Washington, D. C. 20314



DEPARTMENT OF THE ARMY

WATERWAYS EXPERIMENT STATION, CORPS OF ENGINEERS

P.O. BOX 631

VICKSBURG, MISSISSIPPI 39180

REPLY TO
ATTENTION OF

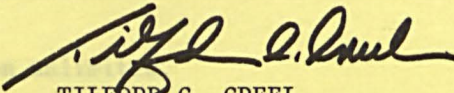
WESEV

1 June 1984

SUBJECT: Transmittal of Technical Report Y-78-9

TO: All Reports Recipients

The report transmitted herewith provides preliminary technical guidance for the onsite identification and delineation of wetlands to Corps of Engineers personnel responsible for the implementation of Section 404 of the Clean Water Act in Alaska. This guide, sponsored by the Office, Chief of Engineers, represents one of a series of eight guides to the wetlands of the United States. Other guides include Peninsular Florida, Puerto Rico, West Coast States, Gulf Coastal Plain, Interior, South Atlantic States, and North Atlantic States.


TILFORD C. CREEL
Colonel, Corps of Engineers
Commander and Director

(Continued)

HYDRAULICS
LABORATORY

GEOTECHNICAL
LABORATORY

STRUCTURES
LABORATORY

ENVIRONMENTAL
LABORATORY

COASTAL ENGINEERING
RESEARCH CENTER

108 54781

C.2

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER Technical Report Y-78-9	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) PRELIMINARY GUIDE TO THE ONSITE IDENTIFICATION AND DELINEATION OF THE WETLANDS OF ALASKA		5. TYPE OF REPORT & PERIOD COVERED Final report
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Robert T. Huffman Gary E. Tucker		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U. S. Army Engineer Waterways Experiment Station Environmental Laboratory P. O. Box 631, Vicksburg, Miss. 39180		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Office, Chief of Engineers, U. S. Army Washington, D. C. 20314		12. REPORT DATE February 1984
		13. NUMBER OF PAGES 111
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES Available from National Technical Information Service, 5285 Port Royal Road, Springfield, Va. 22161.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Alaska Plant community Community Wetlands Flooding Wetland soils Hydrology Wetland vegetation		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This guide to the major wetland plant associations and communities found in Alaska is one of a series of eight such guides, each prepared by a specialist or specialists familiar with the wetlands in the region covered by the guide. The guides are intended for distribution to the various U. S. Army Engineer Districts for use in the onsite technical identification and delineation of wetland boundaries. The classification system in this guide is adapted from (Continued)		

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

20. ABSTRACT (Continued).

that utilized by the National Wetlands Inventory (NWI) Project of the U. S. Fish and Wildlife Service, but frequently departs from NWI's system to describe common and/or distinct wetland communities or associations.

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

SUMMARY

This report represents one of a series of eight preliminary guides to the dominant plant associations and communities found in the major wetlands of the United States. The purpose of this guidebook is to aid personnel in Regulatory Functions in the onsite technical recognition and geographic delineation of wetland boundaries. This guidebook is designed to be self-contained and consists of seven parts. An introduction covers the objectives and use of the guidebook, as well as general information about wetlands. The second part, entitled "Wetlands of Alaska," discusses regional environment; wetland values; and wetland vegetation, soils, and hydrology. The third through seventh parts describe the regional wetland types.

PREFACE

At the request of the Office, Chief of Engineers (OCE), the Environmental Laboratory (EL) of the U. S. Army Engineer Waterways Experiment Station (WES) initiated production of a series of regional guidebooks designed to aid Regulatory personnel with the onsite technical recognition and delineation of wetland boundaries. This report, which pertains to Alaskan wetlands, is one of a series of eight preliminary guidebooks to the wetlands of the United States. Other reports in the series apply to Puerto Rico; the West Coast, Interior, Gulf Coast, North Atlantic, and South Atlantic States; and Peninsular Florida. The reports are listed on the inside front cover.

The draft guidebook was prepared by Drs. R. T. Huffman and Gary E. Tucker, formerly of EL. The final report was reviewed and prepared by Dr. D. R. Sanders, Sr., EL, and Ms. Linda Brown, EL. The project was conducted under the general supervision of Dr. Hanley K. Smith, Environmental Resources Division (ERD), EL; Dr. Conrad J. Kirby, Chief, ERD, EL; Mr. Charles C. Calhoun, Program Manager, Dredging Operations Technical Support Program, EL; and Dr. John Harrison, Chief, EL. OCE Technical Monitors for the Wetland Research Program were Dr. John R. Hall and Mr. Phillip C. Pierce.

The Commanders and Directors of WES during the study and the preparation of this report were COL George H. Hilt, CE; COL John L. Cannon, CE; COL Nelson P. Conover, CE; and COL Tilford C. Creel, CE. Technical Director was Mr. F. R. Brown.

This report should be cited as follows:

Huffman, R. T., and Tucker, G. E. 1984. "Preliminary Guide to the Onsite Identification and Delineation of the Wetlands of Alaska," Technical Report Y-78-9, U. S. Army Engineer Waterways Experiment Station, CE, Vicksburg, Miss.

CONTENTS

	<u>Page</u>
SUMMARY	1
PREFACE	2
LIST OF FIGURES	4
PART I: INTRODUCTION	5
Background	5
Objectives	6
Wetland Identification and Boundary Determinations	6
PART II: WETLANDS OF ALASKA	8
Regional Environment	8
Values	12
Wetland Vegetation	12
Wetland Soils	13
Wetland Hydrology	14
PART III: REGIONAL WETLAND TYPES OF SOUTHERN ALASKA	16
Aquatic Bed Wetlands--Southern Alaska	16
Emergent Wetlands--Southern Alaska	20
Scrub-Shrub Wetlands and Forested Wetlands--Southern Alaska	28
PART IV: REGIONAL WETLAND TYPES OF WESTERN ALASKA	32
Aquatic Bed Wetlands--Western Alaska	32
Emergent Wetlands--Western Alaska	35
Scrub-Shrub Wetlands and Forested Wetlands--Western Alaska	43
PART V: REGIONAL WETLAND TYPES OF INTERIOR ALASKA	46
Aquatic Bed Wetlands--Interior Alaska	46
Emergent Wetlands--Interior Alaska	48
Scrub-Shrub Wetlands and Forested Wetlands--Interior Alaska	54
PART VI: REGIONAL WETLAND TYPES OF THE NORTH SLOPE	57
Aquatic Bed Wetlands--North Slope	57
Emergent Wetlands--North Slope	59
Scrub-Shrub Wetlands and Forested Wetlands--North Slope	67
PART VII: REGIONAL WETLAND TYPES OF THE ALEUTIAN ISLANDS	69
Aquatic Bed Wetlands--Aleutian Islands	69
Emergent Wetlands--Aleutian Islands	72
Scrub-Shrub Wetlands and Forested Wetlands--Aleutian Islands	78
REFERENCES AND SELECTED BIBLIOGRAPHY	80

	<u>Page</u>
APPENDIX A: GLOSSARY	A1
APPENDIX B: COMMON AND SCIENTIFIC NAMES OF PLANTS OF ALASKA . .	B1

LIST OF FIGURES

<u>No.</u>		
1	Size relation of Alaska to the continental United States .	8
2	Geographic regions of Alaska	9
3	Outline of the five Alaskan wetland regions and their subregions.	10

PRELIMINARY GUIDE TO THE ONSITE IDENTIFICATION AND
DELINEATION OF THE WETLANDS OF ALASKA

PART I: INTRODUCTION

Background

1. Under the various laws of the United States, Congress has assigned a number of nonmilitary functions to the U. S. Army Corps of Engineers. In addition to the more traditional roles in flood control, hydropower production, navigation, water supply storage, and recreation, the Corps has Regulatory authority for the control of the discharge of dredged or fill material into waters of the United States. The primary legislative basis for the Corps' Regulatory authority and subsequent program is the Clean Water Act. Section 404 of the Clean Water Act gives authority to the Secretary of the Army, acting through the Chief of Engineers, to regulate the discharge of dredged or fill material into the waters of the United States.

2. The objectives of the legislation cited above are to maintain and restore the biological, physical, and chemical integrity of the water quality of the Nation's waterways through regulation of the discharge of dredged and fill material into "Waters of the United States." "Waters of the United States" has broad meaning, incorporating both aquatic areas and wetlands,* and includes the following (Federal Register 1977):

- a. The territorial seas with respect to the discharge of fill material.
- b. Coastal and inland waters, lakes, rivers, and streams that are navigable waters of the United States, including their adjacent wetlands.
- c. Tributaries to navigable waters of the United States, including adjacent wetlands.

* Definitions of technical terms included in this report are presented in Appendix A.

- d. Interstate waters and their tributaries, including adjacent wetlands.
- e. All other waters of the United States not identified above, such as isolated wetlands and lakes, intermittent streams, prairie potholes, and other waters that are not a part of a tributary system to interstate waters or navigable waters of the United States, the degradation or destruction of which could affect interstate commerce.

Objectives

3. The objective of this report was to present information to assist Regulatory personnel in the onsite identification of wetlands and delineation of the boundaries. Therefore, the approach was to describe the diagnostic environmental characteristics of wetlands and provide the user with a general description of the wetland types of Alaska. Part II summarizes the environmental characteristics of Alaskan wetlands; presents a list of wetland values; and describes the vegetation, soil, and hydrology characteristics used to identify an area as a wetland. Parts III-VII present general descriptions of the five Alaskan regional wetland types.

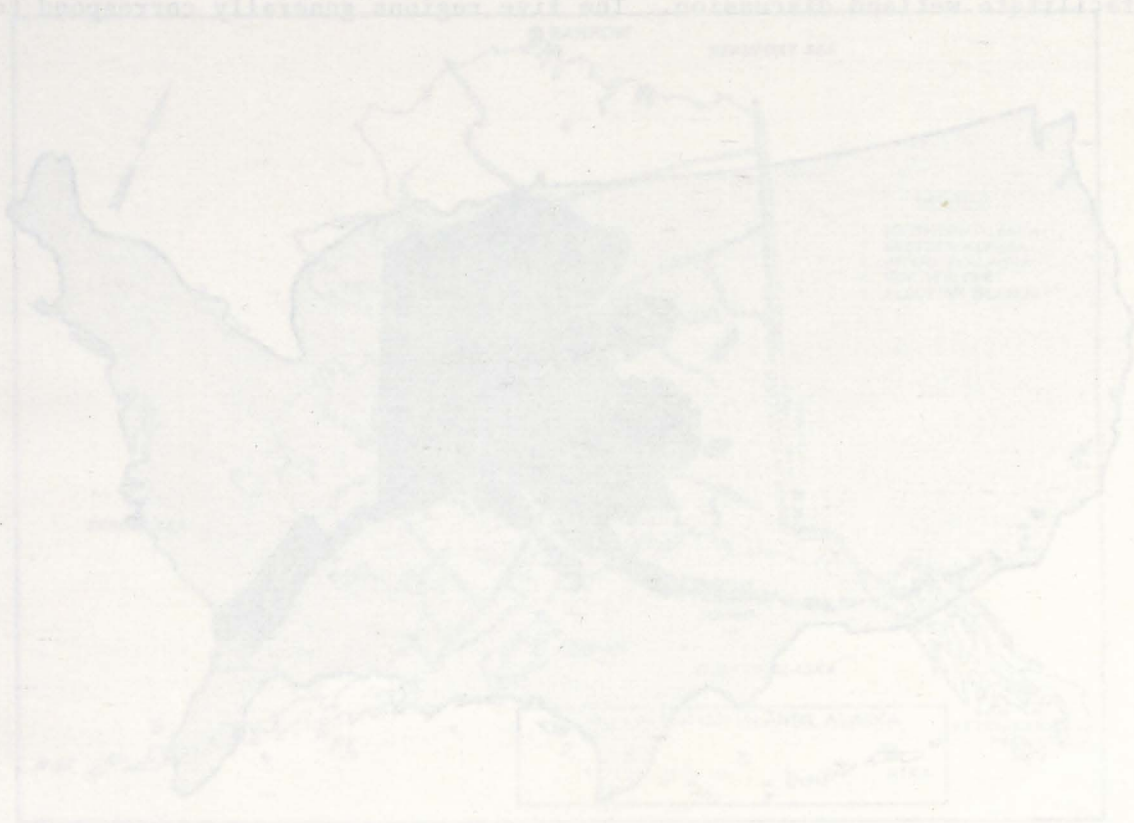
Wetland Identification and Boundary Determinations

4. Definition of jurisdictional limits is of obvious importance to any regulatory program. However, legislation authorizing the Corps' Section 404 Regulatory Program provided little guidance, except in a broad context, regarding the technical identification and geographic delineation of areas subject to jurisdiction. This is especially true in determining the landward extent of wetland areas.

5. Presently, the delineation of landward jurisdictional authority lies in the technical identification of ecosystems that have two key environmental characteristics:

- a. Inundated or saturated soil conditions that are the result of periodic or permanent inundation by groundwater or surface water.
- b. A prevalence of vegetation typically adapted for life in inundated or saturated soil conditions.

Often these characteristics can be readily identified in the field; however, field personnel are cautioned not to rely solely on vegetation, but to look for indicators of wetland soil and hydrology conditions such as those outlined by paragraphs 20 and 22. Evidence of one or more indicators of wetlands soil and hydrologic conditions will demonstrate a logical, as well as easily defensible, technical tie to why the vegetation is considered to be characteristic of wetland ecosystems for the particular situation of concern. Many wetland species can be found growing successfully in both wetland and nonwetland habitats. Combined use of wetland vegetation, soil, and hydrologic indicators can, therefore, greatly enhance the technical accuracy, consistency, and credibility of wetland determinations, particularly within the transition zone between wetland and nonwetland ecosystems.



PART II: WETLANDS OF ALASKA

Regional Environment

6. Alaska is primarily a vast subarctic peninsula with an arctic segment on the north and west, but with a temperate panhandle on the southeast (Johnson and Hartman 1969). The State consists of approximately 1,478,960 km² (571,027 square miles) and is comparable to approximately one-fifth the size of the contiguous United States (Figure 1). It ranges through 20 deg latitude from the Aleutian Islands to Point Barrow and through 58 deg longitude from Hyder in southeastern Alaska to Attu Island at the western end of the Aleutian Islands (Orth 1967, Johnson and Hartman 1969).

7. Because of its vast extent, diverse climate, physiography, and other environmental factors, Alaska can be divided into five regions to facilitate wetland discussion. The five regions generally correspond to

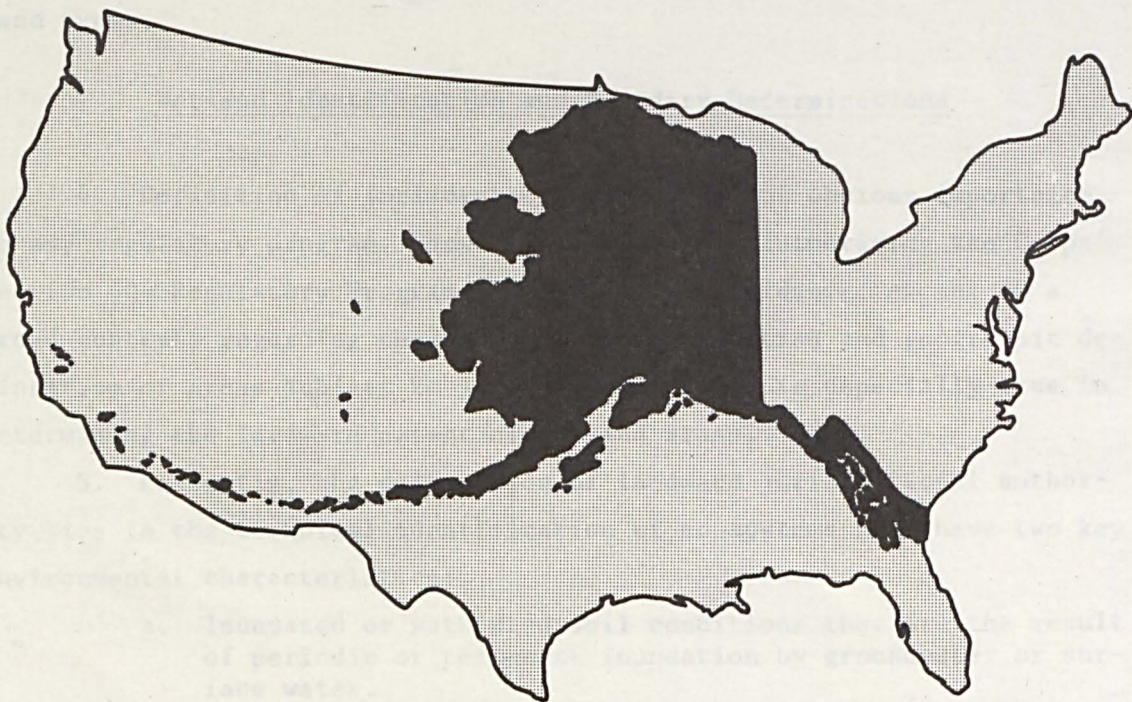


Figure 1. Size relation of Alaska to the continental United States

the ecologic regions discussed by Hultén (1968) and include: (a) southern Alaska, (b) western Alaska, (c) interior Alaska, (d) the North Slope, and (e) the Aleutian Islands (Figure 2). These regions are further subdivided as shown in Figure 3.

8. The climate of Alaska is varied, and a good description is not possible at this time because weather stations and data are widely scattered. Data are available from river valley and coastal sites, but little information is available from the remote, mountainous areas (Johnson and Hartman 1969). Watson (1959) recognized four major climatic zones based on the presence or absence of maritime influences: maritime, transitional, continental, and arctic climates. A second climatic system based primarily on forest types divides the State into temperate, subarctic, and arctic zones (Johnson and Hartman 1969).

9. Mean annual temperatures decrease from south to north in a nearly regular pattern and range from $+2^{\circ}$ to $+4^{\circ}$ C along the southern

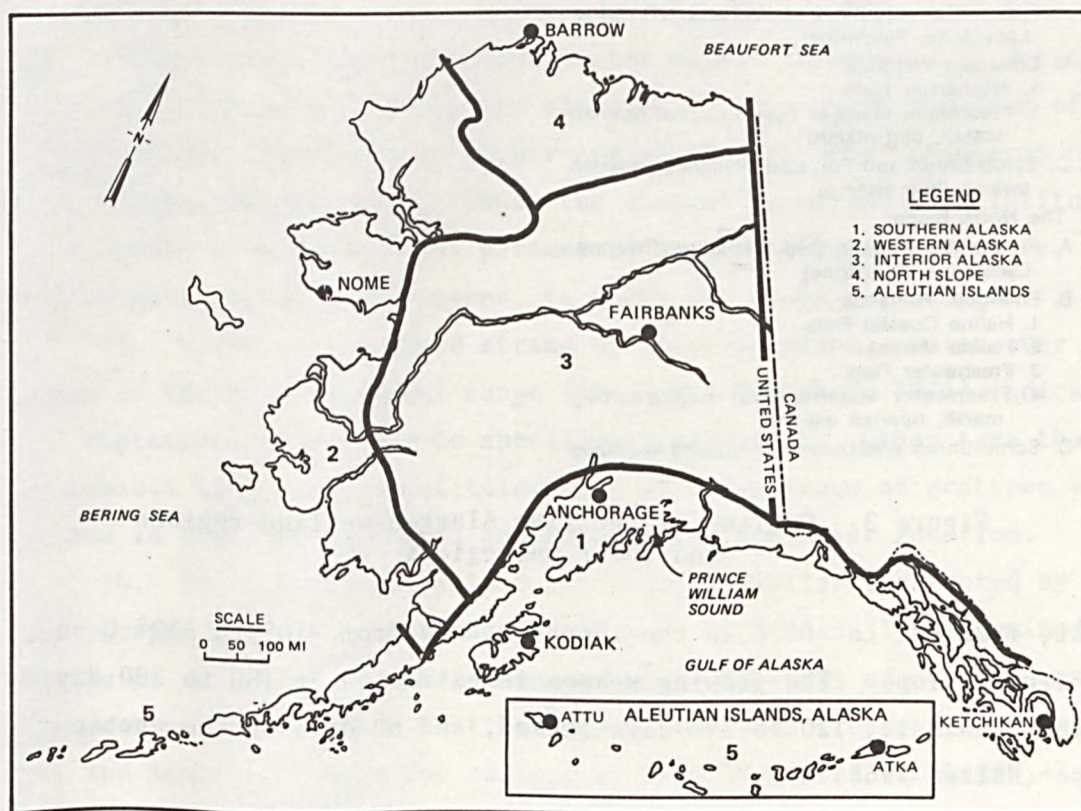


Figure 2. Geographic regions of Alaska

- I. Southern Alaska
 - A. Aquatic Bed Wetlands
 - 1. Haline (Marine, Estuarine)
 - 2. Freshwater (Riverine, Lacustrine, Palustrine)
 - B. Emergent Wetlands
 - 1. Haline Coastal Flats
 - 2. Haline Marshes
 - 3. Freshwater Flats
 - 4. Freshwater Marshes (wet meadow, riparian marsh, bog marsh)
 - C. Scrub-Shrub Wetlands and Forested Wetlands (riparian swamp, bog swamp)
- II. Western Alaska
 - A. Aquatic Bed Wetlands
 - 1. Haline (Marine, Estuarine)
 - 2. Freshwater (Riverine, Lacustrine, Palustrine)
 - B. Emergent Wetlands
 - 1. Haline Coastal Flats
 - 2. Haline Marshes
 - 3. Freshwater Flats
 - 4. Freshwater Marshes (wet meadow, riparian marsh, bog marsh)
 - C. Scrub-Shrub Wetlands and Forested Wetlands (bog swamp, riparian swamp)
- III. Interior Alaska
 - A. Freshwater Aquatic Bed Wetlands (Riverine, Lacustrine, Palustrine)
 - B. Emergent Wetlands
 - 1. Freshwater Flats
 - 2. Freshwater Marshes (wet meadow, riparian marsh, bog marsh)
 - C. Scrub-Shrub and Forested Wetlands (riparian swamp, bog swamp)
- IV. The North Slope
 - A. Freshwater Aquatic Bed Wetlands (Riverine, Lacustrine, Palustrine)
 - B. Emergent Wetlands
 - 1. Haline Coastal Flats
 - 2. Haline Marshes
 - 3. Freshwater Flats
 - 4. Freshwater Marshes (wet meadow, bog marsh, riparian marsh)
 - C. Scrub-Shrub Wetlands and Forested Wetlands
- V. The Aleutian Islands
 - A. Aquatic Bed Wetlands
 - 1. Haline (Marine and Estuarine)
 - 2. Freshwater (Riverine, Lacustrine, Palustrine)
 - B. Emergent Wetlands
 - 1. Haline Coastal Flats
 - 2. Haline Marshes
 - 3. Freshwater Flats
 - 4. Freshwater Marshes
 - C. Scrub-Shrub Wetlands and Forested Wetlands (bog swamp, riparian swamp)

Figure 3. Outline of the five Alaskan wetland regions and their subregions

coast, from -2° to -6° C in the interior, and from -10° to -12° C on the arctic slope. The growing season is estimated at 180 to 200 days in the panhandle, 120 to 140 days inland, and 60 days on the arctic slope (Hultén 1968).

10. Mean annual precipitation varies from more than 5100 mm (200 in.) in parts of southeastern Alaska to approximately 100 mm (4 in.)

along the arctic coast (Johnson and Hartman 1969). The interior and arctic regions have been incorrectly classified as arid or semiarid because of low precipitation. However, permafrost prevents subterranean drainage and reduces evaporation rates as well as transpiration rates. Therefore, water budgets are less for these areas than in the lower latitudes.

11. A diverse array of coastal and inland freshwater wetland types exist in Alaska due to the above factors. For example, the coastline from Ketchikan to Point Barrow includes the Pacific Coastal, Subarctic, and Arctic zones. Coastal wetlands throughout the Alaskan coastal range are therefore subjected to differences in the amplitude of tides, discontinuities in bedrock geology, and vastly different shoreline conditions influenced by historical and present glacial activity.

12. Over the full latitudinal extent, variations of solar radiation--angle of incidence, intensity, and diurnal and seasonal duration--present an enormous cline with markedly distinct extremes. Summer temperatures and total accumulated warmth (degree days) during the growing season vary along the cline as do the amount and form of precipitation. The seasonal occurrence of sea ice also influences near-shore terrestrial habitats. Thus, the changes in values with latitude for a number of environmental parameters produce an array of sites, each with slightly different features, to which the biota are adapted.

13. Widely distributed strand or maritime plant species over the length of the Alaska coastal range (Breckon and Barbour 1974) indicate the adaptation of ecotypes to specific environments. Other taxa that do not exhibit broad ecological tolerances or a continuum of ecotypes are limited in their distribution and help define the major zonation.

14. The freshwater wetland systems are similarly affected by physiography and history of the landscape. Latitudinally determined aspects of the physical environment produce different adaptive norms and different wetland types. Most freshwater wetlands freeze during the winter, and some are frozen for as long as 9 or 10 months in arctic Alaska.

15. Large meandering rivers in each region actively erode steep cutbanks and deposit point bars and constantly rework the riparian zone.

Periodic flooding, either during spring breakup or during late summer warm spells (for rivers with headwaters in glaciated mountains), produces overbank deposits of silts and sands, but also accounts for occasional catastrophic changes in the landscape. Channel changes produce quiet sloughs and oxbow lakes, both of which contain important freshwater wetland types. Therefore, Alaskan vegetation is in a continual state of destruction and renewal.

Values

16. The wetlands of Alaska often have certain useful attributes that make them valuable and productive resources of local, regional, or national significance. The following is a list of values that are of notable importance:

- a. Wetlands often serve as key areas for biotic productivity and cycling of nutrients associated with the formation and maintenance of food chains.
- b. Wetlands provide food, cover, rest, reproduction, and nursery habitat for associated biota.
- c. Wetlands typically have a major influence on drainage, salinities, flushing characteristics, and current and sedimentation patterns.
- d. Certain wetlands influence surface water and groundwater recharge.
- e. Many wetlands provide physical protection against erosion and storm damage.
- f. Many wetlands serve as storage areas for storm and floodwaters.
- g. Wetlands affect water quality variables such as dissolved oxygen, temperature, turbidity, and nutrient load.
- h. Wetlands provide opportunities for recreation, education, and research.
- i. Wetlands serve as nutrient traps and process natural or introduced organic wastes. They may serve as indicators of pollutant levels in both air and water.

Wetland Vegetation

17. Wetland plant species are organisms that, because of

morphological, physiological, and/or reproductive adaptation(s), have the ability to perform certain requisite life functions that enable the species to achieve maturity in an environment where the soils within the root zone become inundated or saturated permanently or periodically.

18. The determination of whether a particular plant species can be found in wetlands is made according to evidence provided by any one of the indicators given below:

- a. Visual observation of survival of the plant species in habitat conditions exhibiting the wetland hydrology/soil-moisture characteristics described in the following sections on wetland soils and wetland hydrology.
- b. Identification of the species in the technical literature as a component of the vegetation in one of the wetland types described in this guide.
- c. Indication in the technical literature of the species' morphological, physiological, or reproductive adaptations for survival in aquatic or wetland habitats.

Wetland Soils

19. Wetland soils are those that become saturated permanently or periodically within the root zone during the growing season of the prevalent vegetation.

20. The determination of whether a particular soil is indicative of a wetland can be made by finding evidence of any one of the following indicators:

- a. The dominant chroma of the matrix within a major portion of the root zone is two or less if mottling is present or one or less if mottling is absent.
- b. The soil is gleyed within a major portion of the root zone.
- c. The soil has other hydric soil characteristics, such as thick organic surfaces or iron and manganese concretions.
- d. The soil is classified as organic, but is not permanently drained. Organic soils are defined in Soil Taxonomy Agricultural Handbook-436. For permafrost areas where the active soil layer is shallow, this criterion is met when the majority of the active layer is composed of organics.

- e. The soil is saturated to the soil surface for a significant portion of the growing season of the prevalent vegetation. Situations exist in which soils are saturated for nearly the entire growing season, but environmental conditions preclude sufficient biological activity to produce other characteristics of wetland soils.

Wetland Hydrology

21. Wetland hydrology connotes the inundation or saturation of areas by surface water or groundwater either permanently or periodically during the growing season of the prevalent vegetation.

22. The determination of hydrologic conditions indicative of wetlands can be made by finding evidence of any one of the indicators discussed below:

- a. Drainage pattern: visible surface evidence of runoff or drainage flow; the pattern may be either eroded into the soil or marked by debris left in the wake of the flow.
- b. Drift lines: debris (logs, litter, and soil) deposited in upland areas by floodwaters; the drift line usually marks the furthest upland extent of flooding.
- c. Silt deposition on vegetation: the deposit of organic matter, fine sand, or other materials on aboveground portions of plants.
- d. Water marks: the line or stain left on a tree or other vegetation making the upward extent of floodwaters.
- e. Active water table within a major portion of the root zone: frequent fluctuation of the water table, which is the upper limit of the zone of saturation, indicating a large and mobile groundwater supply.
- f. Stream gage data and flood predictions: indications in the recorded data of water higher than the streambanks and the predictions of floods based on these data and meteorologic reports.
- g. Ice scars: visible marks or gashes left on plants, especially upland species, by ice moving downstream during periods of high water.
- h. Historic records: any documents or information (stream gage data, newspapers, local knowledge, etc.) recording the presence of water, especially floods.

- i. Visual observation of inundation or soil saturation: a field observation of water standing on a site or saturated soil conditions.
- j. Solifluction: any evidence of the slow flowage from higher to lower ground of masses of soil saturated with water.

PART III: REGIONAL WETLAND TYPES OF SOUTHERN ALASKA

AQUATIC BED WETLANDS--SOUTHERN ALASKA

DEFINITION: The Aquatic Bed Wetlands class includes areas having a prevalence of vegetation that grows principally on or below the surface of the water for most of the growing season in most years (Cowardin et al. 1979). Aquatic beds existing beyond a depth of 2 m (6.6 ft) are classified as deepwater habitats and therefore will not be considered in this guide.

23. In the hierarchical classification system of the National Wetlands Inventory (NWI), the Aquatic Bed Wetlands can be categorized under each of the five major systems (Marine, Estuarine, Riverine, Lacustrine, and Palustrine). The class itself includes four subclasses: (a) Algal, (b) Aquatic Moss, (c) Rooted Vascular, and (d) Floating Vascular. To assist in field recognition, however, this guide will discuss Haline Aquatic Bed Wetlands found in Marine and Estuarine systems, and Freshwater Aquatic Bed Wetlands found in Riverine, Lacustrine, and Palustrine systems. Use of recognized subclasses will be retained where applicable.

Haline Aquatic Bed Wetlands--Southern Alaska

24. Haline Aquatic Bed Wetlands are found scattered along the coast in southern Alaska. This class is absent from waters near glaciers, apparently because of the turbidity caused by the glaciers. In south-central Alaska, eelgrass* beds are found in Prince William Sound, but farther to the southeast along the Gulf of Alaska they are rare, apparently because of exposure to the sea and because the few bays are fed by glaciers. Similarly, eelgrass does not grow on the outer coast of the Kenai Peninsula and Cook Inlet because of strong currents and high turbidity. Haline Aquatic Bed Wetlands also occur in southeastern Alaska.

* Alphabetical listings of common/scientific and scientific/common names are presented in Appendix B.

Vegetation

25. Growth form and physiognomy. Submerged algae and seagrasses occur frequently in dense stands that may be either scattered or in extensive beds.

26. Species composition. Prevalent and common associated species include:

a. Subclass: Algal. Various marine algae.

b. Subclass: Rooted Vascular.

Phyllospadix scouleri (Scouler's surfgrass)

Ruppia spiralis (Ditch-grass)

Zostera marina (Eelgrass)

Environmental conditions

27. Below the intertidal zone, the aquatic environment is fairly constant except where there is strong influence from freshwater runoff or from glaciers, which may create turbid conditions as they drop their scour. Eelgrass usually grows on soft silt and clay substrates.

Field identification

28. The lower or outer limit of the Haline Aquatic Bed Wetlands community is the limit of rooted or attached plant growth, not exceeding a depth of 2 m (6.6 ft). The upper boundary usually is the lower limit of the adjacent Haline Coastal Flats and Haline Marshes (paragraphs 41-53), and is normally near the high tide level. The prevalent plants of the Haline Aquatic Bed Wetlands are submersed species, while the prevalent plants of the adjacent wetlands are rooted, emersed herbs.

Freshwater Aquatic Bed Wetlands--Southern Alaska

29. Freshwater Aquatic Bed Wetlands are scattered throughout southern Alaska in ponds and lakes and along the shallow edges of streams or rivers. They are particularly abundant in south-central Alaska northwest of Prince William Sound in the vicinity of Anchorage, where thousands of glacial ponds dot the landscape.

Vegetation

30. Growth form and physiognomy. Submersed rooted aquatic herbs,

such as yellow pond-lily, occur in open to dense stands. Free-floating aquatic herbs are rarely found.

31. Species composition. Prevalent species include:

Hippuris vulgaris (Common maretail)

Nuphar polysepalum (Yellow pond-lily)

Nymphaea tetragona (Dwarf water-lily)

Potamogeton filiformis (Filiform pondweed)

Ranunculus trichophyllus (Water crowfoot)

Common associated species include:

Callitriche verna (Vernal water-starwort)

Fontinalis antipyretica (Aquatic moss)

Myriophyllum spicatum (Spike watermilfoil)

32. The relatively large number of species found in the Freshwater Aquatic Bed Wetlands reflects its close association with Freshwater Emergent Wetlands. Freshwater Aquatic Bed Wetlands are relatively homogeneous throughout southern Alaska; yellow pond-lily, dwarf water-lily, and various pondweeds are of widespread occurrence.

33. Differences between the vegetation of bog ponds and other ponds and streams have not been determined. Bog ponds contain some species not found in the other freshwater communities, such as vernal water-starwort; however, the prevalent species in the deeper portions of bog ponds is usually yellow pond-lily, which is also very common in other freshwater ponds.

34. Areas of standing open water, characterized by the absence of or minimal cover of largely aquatic species, usually occur in close association with the Freshwater Aquatic Wetlands. The plant communities in many ponds are often zoned according to depth. The deepest areas may have only algae; shallower areas will usually support submerged species, such as spike watermilfoil and stonewort; even more shallow areas will support species whose leaves float on the surface.

35. Characteristic species of open water areas are essentially the same as those associated with the Freshwater Aquatic Wetlands, although a few species, such as stonewort, appear to be more prevalent in

standing open water that has minimal vegetation than in the Freshwater Aquatic Wetlands.

36. The species composition of the open-water areas depends on flow, depth, and substrate accumulation. In swiftly flowing streams, in rivers, and in deep ponds, the species most likely to occur are algae. Graminoids usually border the margins of these areas, but since the prevalent species (such as spikerush and rush) are not true aquatics, these areas are classified as Emergent Wetlands. Succession is clearly from the open-water type to the vegetated type of wetlands because the vegetative cover becomes increasingly dense. In bog ponds, sphagnum moss may cover the entire water surface, after which freshwater (bog) marsh species become established.

37. Successional trends. Some of the deeper freshwater ponds may be relatively stable successional, but semiaquatic plant species become established in most shallower ponds and in some deeper ones. Most of these will eventually become marshes.

Environmental conditions

38. Standing water is permanent in most areas of the freshwater community. Mineral, not organic, soils predominate.

Field identification

39. The Freshwater Aquatic Bed Wetlands community may be recognized by the usual prevalence of true aquatic species (paragraph 31).

EMERGENT WETLANDS--SOUTHERN ALASKA

DEFINITION: The Emergent Wetlands class includes areas in which erect, rooted, herbaceous hydrophytes, excluding mosses and lichens, are prevalent. The vegetation is prevalent for most of the growing season in most years. These wetlands are usually dominated by perennial plants (Cowardin et al. 1979).

40. Within the Emergent Wetlands class, NWI includes two sub-classes: (a) Persistent and (b) Nonpersistent, based on the duration of the standing vegetation through the nongrowing season. Because of the variability of persistence/nonpersistence from one geographic area to another, this guide will describe four common plant communities to assist in field recognition: (a) Haline Coastal Flats, (b) Haline Marshes, (c) Freshwater Flats, and (d) Freshwater Marshes (including wet meadows, riparian marsh, and bog marsh). These plant communities are included for identification purposes and do not preclude the use of NWI classification, although each of these plant associations can be classified under this system.

Haline Coastal Flats--Southern Alaska

41. A sparsely vegetated zone, the Haline Coastal Flat lies near the lower tide level along much of the coast. It commonly has scattered vegetation.

Vegetation

42. Growth form and physiognomy. Scattered grasses such as hairgrass, and forbs such as oysterleaf occur.

43. Species composition. Prevalent and common associated species include:

Alaria spp. (Brown alga)

Cochlearia officinalis (Scurvy-grass)

Deschampsia spp. (Hairgrass)

Fucus spp. (Rockweed)

Lathyrus maritimus (Beachpea)

Mertensia maritima (Oysterleaf)
Plantago maritima (Goosetongue)
Potentilla egedii (Pacific silverweed)
Puccinellia spp. (Alkaligrass)
Senecio psuedo-arnica (Groundsel)
Suaeda depressa (Sea blite)
Triglochin maritima (Maritime arrow-grass)
Zostera marina (Eelgrass)

44. The species composition of the Haline Coastal Flat vegetation is somewhat similar to that of haline marshes, but the flats are less diverse. Since the vegetation consists of scattered individuals, any given stand may contain one, or any combination, of the species listed above.

Environmental conditions

45. The Coastal Flats are exposed directly to tides in most areas, and consequently these sandy beaches are haline. A few hyperhaline pools may be formed in depressions that are inundated only by storm tides. As tidal pools evaporate, the pools become hyperhaline and only a few halophytic herbs can survive.

Field identification

46. Haline coastal flats are readily recognized as they occur in the intertidal zone (except for hyperhaline pools) and have sparse vegetative cover.

Haline Marshes--Southern Alaska

47. Haline Marshes are prevalent along the coast of southern Alaska. Although a few of them are larger than 40 hectares (98.8 acres), they do not form the extensive stands common along much of the nation's coastline. This is primarily because of the rugged topography of the southern Alaskan coast with the mountains reaching to, or very near, the sea. The largest salt marshes in this area are on the Kenai Peninsula, adjacent to the Cook Inlet south of Anchorage.

Vegetation

48. Growth form and physiognomy. Dense stands of graminoids, such as Lyngbye's sedge, are found to a height of 1.5 m (4.9 ft). Forbs also occur as scattered individuals or occasionally in small dense stands.

49. Species composition. Prevalent species include:

Carex lyngbyaei (Lyngbye's sedge)

Deschampsia beringensis (Bering hairgrass)

Elymus mollis (Dunegrass)

Fragaria chiloensis (Beach strawberry)

Puccinellia nutkaensis (Pacific alkaligrass)

Common associated species include:

Achillea borealis (Yarrow)

Atriplex gmelini (Sparscale)

Calamagrostis canadensis (Bluejoint)*

Festuca rubra (Red fescue)

Glaux maritima (Sea milkwort)

Honckenya peploides (Sea-beach sandwort)

Hordeum brachyantherum (Meadow barley)

Lathyrus maritimus (Beachpea)

Myrica gale (Sweet gale)

Plantago maritima (Goosetongue)

Potentilla egedii (Pacific silverweed)

Triglochin maritima (Maritime arrow-grass)

50. The Haline Marsh typically has grasses, especially dunegrass, Bering hairgrass, and Pacific alkaligrass, and Lyngbye's sedge as the prevalent species. The areas at lower elevations tend to have more dunegrass, Pacific alkaligrass, maritime arrow-grass, and various forbs than the higher areas. Areas above this zone, which have hairgrasses and Lyngbye's sedge as prevalent species, are flooded regularly by tides and have fewer forbs. Lyngbye's sedge is also common in the lower zone and may form the leading edge of the marsh. Dunegrass normally is less

* Common only in transition areas to Freshwater Marsh.

common in the zone between the lower and the higher marshes, which is only rarely flooded by tides, but it is a prevalent species on higher ground or the seaward edges of marshes or at the higher edges of some marshes.

51. Successional trends. The lowest portions of the marshes that are flooded by every high tide are successional stable, but the higher marshes may be invaded by willows or even by spruce and hemlock.

Environmental conditions

52. Haline Marsh soils are haline in the lower areas and brackish at the higher elevations, where they are only rarely flooded by tides. The soils are clayey or silty and may have significant organic matter (peat) built up beneath them.

Field identification

53. The Haline Marsh is unmistakable by its grassland physiognomy and its location adjacent to the ocean. Marshes penetrate up the mouth of rivers for at least short distances.

Freshwater Flats--Southern Alaska

54. Freshwater Flats occur along streams, rivers, ponds, and lakes. Flats are local in southern Alaska, and little is known of their vegetation. Usually some species that grow in the freshwater marshes occur also on inland flats, either as scattered individuals or in small, widely spaced stands. The relatively sparse vegetation on flats distinguishes them from marshes, which have a high degree of vegetative cover.

Freshwater Marshes--Southern Alaska

55. Freshwater marshes are common in southern Alaska around ponds, lakes, streams, and in some peatlands. Some gravel bars have sufficient vegetative cover that they are classified as Freshwater Marsh Wetlands.

Vegetation

56. Growth form and physiognomy. Dense stands of graminoids

such as water sedge, and scattered forbs such as broadleaf marsh marigold occur.

57. Species composition. For the following subtypes, the following species are included:

a. Wet meadow subtype. Prevalent species include:

Calamagrostis canadensis (Bluejoint)

Carex aquatilis (Water sedge)

Carex sitchensis (Caric-sedge)

Menyanthes trifoliata (Buckbean)

Common associated species include:

Arctophila fulva (Pendent grass)

Caltha biflora (Broadleaf marsh marigold)*

Carex saxatilis (Caric-sedge)

Carex stylosa (Variegated sedge)

Eleocharis palustris (Creeping spikerush)

Equisetum palustre (Marsh horsetail)

Equisetum variegatum (Variegated scouring-rush)

Eriophorum scheuchzeri (White cotton-grass)

Fauria crista-galli (Deer cabbage)

Juncus oreganus (Oregon rush)

b. Riparian marsh subtype. Prevalent species include:

Carex spp. (Sedge, Caric-sedge)

Ranunculus trichophyllus (Water crowfoot)

Common associated species include:

Calamagrostis spp. (Reedgrass)

Caltha palustris (Yellow marsh marigold)

Menyanthes trifoliata (Buckbean)

Potentilla palustris (Marsh cinquefoil)

c. Bog marsh subtype. Prevalent species include:

Andromeda polifolia (Bog rosemary)

Carex limosa (Shore sedge)

Carex spectabilis (Showy sedge)

* In south only.

Drosera rotundifolia (Round-leaf sundew)

Eriophorum spp. (Cotton-grass)

Rhynchospora alba (White beaked sedge)

Sphagnum spp. (Sphagnum moss)*

Common associated species include:

Betula nana (Dwarf birch)

Calamagrostis spp. (Reedgrass)

Caltha palustris (Yellow marsh marigold)

Carex spp. (Sedge, Caric-sedge)

Cassiope stellariana (Alaska moss-heath)

Chamaecyparis nootkatensis (Alaska cedar)

Empetrum nigrum (Crowberry)

Equisetum fluviatile (Swamp horesetail)

Kalmia polifolia (Bog laurel)

Ledum palustre (Labrador-tea)**

Lysichiton americanum (Skunk cabbage)

Menyanthes trifoliata (Buckbean)

Oxycoccus microcarpus (Swamp cranberry)

Pinus contorta (Lodgepole pine)

Rhynchospora alba (White beaked sedge)

Rubus chamaemorus (Cloudberry)

Salix spp. (Willow)

Saxifraga hirculus (Yellow marsh-saxifrage)

Tsuga heterophylla (Western hemlock)

Tsuga mertensiana (Mountain hemlock)

Vaccinium spp. (Blueberry)

58. Freshwater Marshes on mineral soils, called "wet meadows" in this guide, are usually associated with ponds and lakes. Wet meadows are

* Areas are more properly classified as Moss-Lichen Wetlands where sphagnum moss is prevalent and covers substrates other than rock and where emergents, shrubs, or trees make up less than 30 percent of the areal cover (Cowardin et al. 1979).

** *Ledum decumbens* and *Ledum groenlandicum* are included under this taxon wherever it appears in this report.

not associated with coastal or riparian marshes. Although they are quite common due to the abundance of ponds, they are often relatively small. Characteristically, sedges are the prevalent species, with some grasses and forbs scattered through the sedge mat. They contain relatively few forbs, although buckbean is very common in the wettest areas and broadleaf marsh marigold is also common in wet meadows.

59. The species composition of the riparian marsh resembles that of wet meadows, with a tendency for forbs, particularly crowfoot and horetail, to be more common in riparian marshes. Even so, species of these genera are also common in some wet meadows.

60. Marshes on peat soils are called "bog marsh" in this guidebook. Vegetation of bog marshes is quite variable, but, as in wet meadows, sedges are frequently abundant. Unlike in wet meadows, mosses (particularly sphagnum moss) are so abundant that they often form a mat over the surface. Usually bog marshes have ericaceous shrubs and subshrubs scattered throughout, including bog rosemary, bog laurel, labrador-tea, and blueberry. Ericaceous shrubs are recognizable by their small, leathery, persistent (evergreen) leaves. Since these shrubs, along with species of trees, are also typical of Scrub-Shrub Wetlands and Forested Wetlands (bog swamps), these wetland classes must be distinguished by the amount of woody cover.

61. Successional trends. Succession in wet meadows and riparian marshes is generally toward forest (Forested Wetlands), beginning with willow, followed by ericaceous shrubs such as blueberry, and finally by spruce or hemlock. The rate of change from one class to another is variable, ranging from rapid (a few years) to extremely slow (an indeterminate length of time). Succession seldom leads to nonwetland* vegetation because such sites typically remain wetland.

62. In marsh bogs, succession is always toward forested bogs (Forested Wetlands), with the ericaceous shrubs and trees increasing in abundance. Again, the area normally remains a wetland.

* As used herein, the term nonwetland refers to both true uplands and lowland areas that do not meet the criteria of wetlands.

Environmental conditions

63. Freshwater Marsh vegetation is influenced heavily by whether or not the soil is mineral or organic. The distinction is often not clear in the field because organic soils frequently are formed on top of mineral soils. Consequently, many areas exhibit peat layers atop soils of mineral origin. Once the peat is several inches thick, it strongly influences the species composition.

64. Flooding occurs regularly along many rivers, tributary streams, and riparian marshes. Although flooding is less predictable in wet meadows and bog marshes, these areas are flooded at least once every few years for several weeks and normally more often. Except in dry years, the soils are saturated and usually spongy or springy.

Field identification

65. Freshwater marshes can be distinguished from other freshwater wetlands by their dense cover of emerged herbs. It is more difficult to separate them from some uplands; separation must be based upon species composition and on whether or not the soils are flooded periodically or are saturated.

SCRUB-SHRUB WETLANDS AND FORESTED WETLANDS--SOUTHERN ALASKA

- DEFINITION:
- a. Vegetation of the Scrub-Shrub Wetlands class is characterized by woody species less than 6 m (20 ft) in height. The species include true shrubs, young trees, and trees or shrubs that are small or stunted because of environmental conditions. Scrub-Shrub Wetlands include many of the young tree and shrub species found in Forested Wetlands (Cowardin et al. 1979).
 - b. Forested Wetlands are characterized by woody species equal to or greater than 6 m (20 ft) in height (Cowardin et al. 1979).

66. Within the Forested Wetlands class, NWI includes five subclasses: (a) Broad-leaved Deciduous, (b) Needle-leaved Deciduous, (c) Broad-leaved Evergreen, (d) Needle-leaved Evergreen, and (e) Dead. To assist in the field recognition of wetlands, this guide will deviate from the NWI classification system and describe two distinct wooded wetland associations: (a) Bog Swamp and (b) Riparian Swamp. These plant communities are included for identification purposes and do not preclude the use of NWI classification, although each of these plant associations can be classified under this system.

67. Wooded wetlands occur in association with many so-called bogs and along streams and rivers. Although many bogs have shrubs and trees, woody species are only occasionally prevalent; consequently, many stands that appear to be wooded wetlands are actually Emergent Wetlands. Nonetheless, some bogs have sufficient woody cover to be classified as Scrub-Shrub Wetlands or Forested Wetlands. Wooded wetlands are probably most common in floodplains where willows and alders are prevalent; these are called riparian swamps.

Vegetation

68. Growth forms and physiognomy. Dense stands of shrubs, usually willows and alders on floodplains and heath shrubs in bogs, occur with or without trees and with an understory of grasses and forbs.

69. Species composition. For the following subtypes, the following species are included:

a. Bog swamp subtype. Prevalent species include:

Andromeda polifolia (Bog rosemary)
Betula nana (Dwarf birch)
Empetrum nigrum (Crowberry)
Eriophorum angustifolium (Tall cotton-grass)
Kalmia polifolia (Bog laurel)
Ledum palustre (Labrador-tea)
Myrica gale (Sweet gale)
Sphagnum spp. (Sphagnum moss)
Oxycoccus microcarpus (Swamp cranberry)
Vaccinium uliginosum (Bog blueberry)
Vaccinium vitis-idaea (Mountain cranberry)

Common associated species include:

Caltha palustris (Yellow marsh marigold)
Carex spp. (Sedge, Caric-sedge)
Cornus canadensis (Bunchberry)
Drosera rotundifolia (Round-leaf sundew)
Equisetum fluviatile (Swamp horsetail)
Larix laricina (Tamarack)
Lysichiton americanum (Skunk cabbage)
Menyanthes trifoliata (Buckbean)
Picea mariana (Black spruce)
Potentilla palustris (Marsh cinquefoil)
Rhynchospora alba (White beaked sedge)
Rubus chamaemorus (Cloudberry)
Tsuga mertensiana (Mountain hemlock)

b. Riparian swamp subtype. Prevalent species include:

Alnus spp. (Alder)
Populus balsamifera (Balsam poplar)
Populus trichocarpa (Black cottonwood)
Salix spp. (Willow)

Common associated species include:

Cornus stolonifera (Red-osier dogwood)
Equisetum spp. (Horsetail)

Rubus spectabilis (Salmonberry)

Viburnum edule (Highbush cranberry)

70. Bog swamps are scattered throughout southern Alaska. They are characterized more by ericaceous shrubs than by the two most common trees, black spruce and tamarack. As often occurs in bogs, these wetlands frequently have sphagnum mats covering much of the ground layer; other mosses are also present, and sphagnum moss is not always the prevalent species in many bogs, although it is the most common moss from a regional perspective. Tall cottongrass is abundant in many of these bog swamps and in marshes that have peat soils. Successional patterns in bogs are very poorly understood, but most forested bogs are probably relatively stable.

71. Riparian swamps consisting of alder and willow thickets are abundant. All four species of Alaskan alders are found along streams in the area, but American green alder is more abundant farther north. Many of the willows are common, and since it is difficult to distinguish among the Alaskan willows, no attempt is made to separate them more. Balsam poplar and black cottonwood are both common on floodplains and on gravel bars, and, because of their height, they dominate the alders and willows when they occur together. There is a tendency for the alders and willows to form narrow bands in front of the larger poplars. Successionally, the floodplain forests appear to be relatively stable.

Environmental conditions

72. Wooded wetlands occur on either peat soils (bog swamps) or mineral soils (riparian swamps). Standing water is uncommon in bogs, but the soils are saturated. Riparian swamps are flooded periodically.

Field identification

73. The majority of bogs are classified here as Emergent Wetlands (freshwater marshes) even though shrubs and trees are common in many of them. This is because the woody species found in bogs, which usually are exemplified by black spruce, have narrow crowns; consequently, they may be relatively dense, but they are still not be the prevalent species. Since bogs with trees and shrubs share most species with some Emergent Wetlands (freshwater marshes), the two wetland classes are distinguished

mainly by the amount of woody cover. Riparian swamps are usually conspicuous because of the dense stands of alder and willow.

74. Separation of bog swamps from nonwetlands sometimes can be made on the basis of species composition, but in many cases it may be necessary to consider whether or not the soil is saturated. Nonwetland forests generally occur on relatively well-drained sites compared to bogs and swamps, which occur on saturated sites.

PART IV: REGIONAL WETLAND TYPES OF WESTERN ALASKA

AQUATIC BED WETLANDS--WESTERN ALASKA

DEFINITION: The Aquatic Bed Wetlands class includes areas having a prevalence of vegetation that grows principally on or below the surface of the water for most of the growing season in most years (Cowardin et al. 1979). Aquatic beds existing beyond a depth of 2 m (6.6 ft) are classified as deepwater habitats and therefore will not be considered in this guide.

75. In the hierarchical classification system of NWI, the Aquatic Bed Wetlands can be categorized under each of the five major systems (Marine, Estuarine, Riverine, Lacustrine, and Palustrine). The class itself includes four subclasses: (a) Algal, (b) Aquatic Moss, (c) Rooted Vascular, and (d) Floating Vascular. To assist in field recognition, however, this guide will discuss Haline Aquatic Bed Wetlands (Marine and Estuarine systems) and Freshwater Aquatic Bed Wetlands (Riverine, Lacustrine, and Palustrine systems). Use of recognized subclasses will be retained where applicable.

Haline Aquatic Bed Wetlands--Western Alaska

76. Haline Aquatic Bed Wetlands are not extensive in western Alaska. Seagrass beds are scattered and have been reported at the mouths of many rivers on Nunivak Island, in protected bays in the Norton Sound-Seward Peninsula area, in Lopp and Ikpek Lagoons on the northwestern coast of the Seward Peninsula, and near Cape Newenham in both Nanak and Chagvan Bays. Seagrass beds appear to be rare in the Bering Sea mainland region, except along the Seward Peninsula, which apparently is the northern limit of eelgrass.

Vegetation

77. Growth form and physiognomy. Dense to open stands of submerged eelgrass and marine algae occur.

78. Species composition. Prevalent species include:

- a. Subclass: Algal. Various genera of marine algae.
- b. Subclass: Rooted Vascular. *Zostera marina* (Eelgrass).

79. Eelgrass is the only vascular plant species that occurs in intertidal and subtidal seagrass beds. Marine algae may also occur with the eelgrass.

Environmental conditions

80. Seagrass beds occur in the lower intertidal to subtidal areas, and the substrates usually are sandy. In brackish ponds, the salinity is reduced, but a few species usually do grow in them; the substrates in ponds are highly variable.

Field identification

81. The seagrass beds comprising the Haline Aquatic Bed Wetlands in the ocean are obvious, the seaward limit being that of rooted or attached plant growth not exceeding a depth of 2 m (6.6 ft). Although various types of marine algae occur here, Aquatic Bed Wetlands are usually recognized by the presence of eelgrass.

Freshwater Aquatic Bed Wetlands--Western Alaska

82. The freshwater community in western Alaska occurs in lakes, streams, and rivers, but especially in the abundant ponds. Some of these ponds contain no aquatic plants, while other ponds have an abundance of hydrophytes.

Vegetation

83. Growth form and physiognomy. Open to dense stands of aquatic plant species such as arctic buttercup and common marestalk occur.

84. Species composition. Prevalent species include:

- Hippuris vulgaris* (Common marestalk)
- Ranunculus hyperboreus* (Arctic buttercup)
- Ranunculus pallasii* (Pallas buttercup)

Common associated species include:

- Callitriche* spp. (Water-starwort)
- Carex aquatilis* (Water sedge)

Eriophorum angustifolium (Tall cotton-grass)

Menyanthes trifoliata (Buckbean)

Myriophyllum spicatum (Spike watermilfoil)

Potamogeton spp. (Pondweed)

Ranunculus gmelini (Gmelin's buttercup)

Sparganium hyperboreum (Northern bur-reed)

Zannichellia palustris (Horned pondweed)

85. The species composition of ponds is variable. Most species occur widely, and the species variation associated with adjacent ponds may be as great as that found in ponds separated by hundreds of kilometres.

86. Areas of standing open water, characterized by a minimal cover of largely aquatic species, usually occur in close association with the Freshwater Aquatic Bed Wetlands. Such areas of open water are either nonvegetated (except by algae) or have sparse hydrophyte stands, especially water sedge and marestalk. Other prevalent species associated with open-water areas are water-starwort, pondweed, and watermilfoil. However, the species present in open-water areas usually are similar to those of the Aquatic Bed Wetlands, differing only by extremely low cover values.

Environmental conditions

87. Clear water normally stands in the Freshwater Aquatic Bed Wetlands community. The soils are mineral; textures vary from sand to silt.

Field identification

88. The Freshwater Aquatic Bed Wetlands have standing water and usually a moderately dense to dense stand of aquatic species. At its outer limit, this wetland type often is adjacent to standing open water where the vegetative cover is sparse or absent. At the upper limit, rooted emergent species replace submersed species as dominants, and the area merges into an Emergent Wetland.

EMERGENT WETLANDS--WESTERN ALASKA

DEFINITION: The Emergent Wetlands class includes areas dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. These wetlands are usually dominated by perennial plants (Cowardin et al. 1979).

89. Within the Emergent Wetlands class, NWI includes two subclasses: (a) Persistent and (b) Nonpersistent, based on the duration of the standing vegetation through the nongrowing season. Because of the variability of persistence/nonpersistence from one geographic area to another, this guide will describe four common plant communities to assist in field recognition: (a) Haline Coastal Flats, (b) Haline Marshes, (c) Freshwater Flats, and (d) Freshwater Marshes. These plant communities are included for identification purposes and do not preclude the use of NWI classification, although each of these plant associations can be classified under this system.

Haline Coastal Flats--Western Alaska

90. Haline Coastal Flats border most of the ocean shore in western Alaska. They vary from gently sloping beaches to nearly barren rock faces where mountains descend directly into the sea.

Vegetation

91. Growth form and physiognomy. Sparsely vegetated stands of graminoids, often dunegrass, and forbs such as beachpea occur.

92. Species composition. Prevalent and common associated species include:

Cochlearia officinalis (Scurvy-grass)

Elymus mollis (Dunegrass)

Festuca rubra (Red fescue)

Honckenya peploides (Sea-beach sandwort)

Juncus spp. (Rush)

Lathyrus maritimus (Beachpea)

Mertensia maritima (Oysterleaf)

Potentilla egedii (Pacific silverweed)

Puccinellia spp. (Alkaligrass)

Primula borealis (Northern primrose)

Saussurea nuda (Saussurea)

Senecio psuedo-arnica (Groundsel)

Stellaria humifusa (Low chickweed)

93. Coastal Flats are commonly unvegetated in western Alaska. Some flats, however, have scattered individuals of the above species. Any combination of these species can be found, but probably dunegrass and sea-beach sandwort are the ones most commonly encountered.

Environmental conditions

94. Coastal Flats usually extend to near the lower tide limit and are inundated by every tide. The scraping of the flat each year by sea ice and the alternating removal and deposition of sand and gravel by storms are major factors limiting plant growth in these areas.

Field identification

95. The sparsely vegetated areas adjacent to the ocean are easily recognized as Haline Coastal Flats. Also included in this type are sparsely vegetated sea cliffs. These are included since they receive salt spray from the ocean that limits the species to those that are salt tolerant.

Haline Marshes--Western Alaska

96. Haline Marshes are scattered along the coast of western Alaska and extend far inland in a few places. For example, the storm tides flood the mainland for many miles inland over the low tundra plain near Scammon Bay on the Bering Sea.

Vegetation

97. Growth and form physiognomy. Dense stands of graminoids, particularly dunegrass and sedges, occur, usually with scattered forbs.

98. Species composition. Prevalent species include:

Carex lyngbyaei (Lyngbye's sedge)

Carex subspathacea (Hoppner sedge)

Elymus mollis (Dunegrass)

Common associated species include:

Angelica lucida (Angelica)

Arctagrostis latifolia (Polargrass)

Atriplex gmelini (Spearscale)

Carex glareosa (Clustered sedge)

Carex rariflora (Caric-sedge)

Chrysanthemum arcticum (Arctic daisy)

Deschampsia caespitosa (Tufted hairgrass)

Empetrum nigrum (Crowberry)

Eriophorum angustifolium (Tall cotton-grass)

Eriophorum russeolum (Russett cotton-grass)

Festuca rubra (Red fescue)

Lathyrus maritimus (Beachpea)

Ligusticum scoticum (Beach lovage)

Petasites frigidus (Arctic sweet coltsfoot)

Phippsia algida (Snowgrass)

Poa arctica (Arctic bluegrass)

Poa eminens (Large-flower speargrass)

Potentilla egedii (Pacific silverweed)

Puccinellia spp. (Alkaligrass)

Senecio pseudo-arnica (Groundsel)

Spiraea beauverdiana (Beauverd spiraea)

Stellaria humifusa (Low chickweed)

Tripleurospermum phaeocephalum (Arctic chamomile)

99. Most Haline Marshes in western Alaska have dunegrass, Lyngbye's sedge, or Hoppner sedge as prevalent species. Beachpea, tall cotton-grass, large-flower speargrass, and Pacific silverweed are the most common associated species. Because a large number of additional species grow in western Alaskan Haline Marshes, this is a difficult wetlands community to describe except in very general terms.

Environmental conditions

100. Haline Marshes may have either brackish or saline soils, and soils vary from gravelly to sandy and silty to moderately deep organic mucks. Dunegrass is the most abundant species on all soil types. Sandy soils have a few species besides dunegrass, but silty soils have a more diverse and less predictable species composition. Herbs such as groundsel and beachpea occur on gravelly soils. Clustered sedge, Pacific silverweed, large-flower speargrass, and dunegrass grow on peat soils.

Field identification

101. Since the species composition of some haline marshes is similar to that of Haline Coastal Flats, these wetlands must be distinguished according to the relative amounts of vegetative cover. Graminoids, particularly *Carex*, dominate most Haline Marshes, whereas herbs and shrubs are more common than graminoids in many adjacent communities. Several species found in the Haline Marsh, including Lyngbye's sedge and Hoppner sedge, are restricted to haline or fresh marshes at or near the coast. However, dunegrass occurs inland locally on the Seward Peninsula.

Freshwater Flats--Western Alaska

102. Freshwater Flats occur along some pond margins in western Alaska, but little information is available about them. Species that have been recorded on these mudflats include: reedgrass, swamp willow-herb, common maretail, arctic rush, chestnut rush, *Koenigia*, arctic dock, and marsh fleabane.

Freshwater Marshes--Western Alaska

103. Freshwater Marshes cover extensive areas in western Alaska. Included in this type are areas commonly called tundra. Some of the tundra areas, identified in this report as wet meadows, have mineral soils; others, identified as bog marshes, have peat soils. Many bog marshes occur in old lake basins that have accumulated organic matter

and where succession has progressed from open water to tundra. Little is known about rate of succession, but it appears to be highly variable. Also included in the Freshwater Marsh class are (a) pond and stream margins that are classified as the wet meadow type of marsh and (b) riparian areas and gravel bars that are discussed as Riparian Marsh.

Vegetation

104. Growth form and physiognomy. Dense stands of graminoids (mostly sedges) occur with forbs; stands of graminoids are scattered and trees are rare. Mosses, especially sphagnum moss, are rare to abundant.

105. Species composition. For the following subtypes, the following species are included:

a. Wet meadow subtype. Prevalent species include:

Arctophila fulva (Pendent grass)
Calamagrostis canadensis (Bluejoint)
Carex aquatilis (Water sedge)
Deschampsia caespitosa (Tufted hairgrass)
Eriophorum angustifolium (Tall cotton-grass)
Eriophorum russeolum (Russett cotton-grass)
Common associated species include:
Betula nana (Dwarf birch)
Carex spp. (Sedge, Caric-sedge)
Equisetum fluviatile (Swamp horsetail)
Hippuris vulgaris (Common maretail)
Poa spp. (Bluegrass)
Polemonium acutiflorum (Jacob's ladder)
Potentilla palustris (Marsh cinquefoil)
Primula tschuktschorum (Chukch primrose)
Rumex fenestratus (Western dock)
Valeriana capitata (Capitate valerian)

b. Riparian marsh subtype. Prevalent species include:

Arctophila fulva (Pendent grass)
Carex aquatilis (Water sedge)
Eriophorum angustifolium (Tall cotton-grass)
Eriophorum scheuchzeri (White cotton-grass)

Common associated species include:

Agrostis scabra (Ticklegrass)
Arctagrostis latifolia (Polargrass)
Artemisia tilesii (Wormwood)
Calamagrostis canadensis (Bluejoint)
Chrysosplenium tetrandrum (Northern water-carpet)
Deschampsia caespitosa (Tufted hairgrass)
Epilobium latifolium (Dwarf fireweed)
Equisetum arvense (Meadow horsetail)
Hedysarum alpinum (Alpine sweet-vetch)
Parnassia kotzebuei (Kotzebue grass-of-parnassus)
Poa arctica (Arctic bluegrass)
Salix spp. (Willow)
Senecio congestus (Marsh fleabane)
Stellaria crassifolia (Fleshy starwort)
Triglochin palustris (Marsh arrow-grass)
Wilhelmsia physodes (Wilhelmsia)

c. Bog marsh subtype. Prevalent species include:

Carex aquatilis (Water sedge)
Empetrum nigrum (Crowberry)
Eriophorum angustifolium (Tall cotton-grass)
Eriophorum russeolum (Russett cotton-grass)
Eriophorum scheuchzeri (White cotton-grass)
Sphagnum spp. (Sphagnum moss)

Common associated species include:

Betula nana (Dwarf birch)
Caltha palustris (Yellow marsh marigold)
Carex spp. (Sedge, Caric-sedge)
Chamaedaphne calyculata (Leatherleaf)
Drosera rotundifolia (Round-leaf sundew)
Dupontia fisheri (Dupontia)
Ledum palustre (Labrador-tea)
Menyanthes trifoliata (Buckbean)
Petasites frigidus (Arctic sweet coltsfoot)

Polemonium acutiflorum (Jacob's ladder)

Potentilla palustris (Marsh cinquefoil)

Rubus chamaemorus (Cloudberry)

Vaccinium uliginosum (Bog blueberry)

106. Tundra occurring on mineral soils is called wet meadow. Cotton-grass is one of the most common species in these areas; in the wettest sites, water sedge, capitate valerian, and Jacob's ladder are abundant. Willows also are common in these areas.

107. Wet meadows also occur along pond margins, and pendent grass, tall cotton-grass, and water sedge are the prevalent species. True aquatic plants, such as common maretail, often are scattered among the prevalent species in the understory. On alluvial soils around large lakes, such as on St. Matthew Island, tufted hairgrass may be the most common, or even the only, species present. Common maretail, sedges, reedgrass, swamp horsetail, and willows occur in old lake basins that have filled.

108. Riparian marshes occur along rivers and particularly on gravel bars. The prevalent species, which include pendent grass, water sedge, and tall cotton-grass, are primarily the same as those in the wet meadow. However, the associated species are quite different.

109. The prevalent species in the bog marsh, except for the ubiquitous water sedge and tall cotton-grass, differ from those in the other two types of marshes. For example, crowberry and sphagnum moss occur as prevalent species in bog marshes, but neither is prevalent in wet meadow or riparian marshes. Several of the associated species (such as labrador-tea, leatherleaf, and bog blueberry) are either restricted to or are at least much more common on peat soils than on mineral soils. Others of the secondary species, such as yellow marsh marigold and buckbean, grow in many other habitats.

110. Tall cotton-grass and water sedge are among the most common species in all three types of marsh. Most of the other species are more restricted in their environmental tolerances.

Environmental conditions

111. Freshwater Marshes may occur under a wide range of flooding

conditions. They may occur in permanently wet sites around pond margins, in seasonally flooded areas on floodplains, or in areas which are rarely flooded but have soils that are saturated for several months of the year.

Field identification

112. Freshwater Marshes can be distinguished from other wetlands on the basis of total cover, percent cover of woody species, and species composition. However, separation of wet meadows and bog marshes from nonwetlands can be very difficult.

SCRUB-SHRUB WETLANDS AND FORESTED
WETLANDS--WESTERN ALASKA

- DEFINITION: a. The Scrub-Shrub Wetlands class includes areas dominated by woody vegetation less than 6 m (20 ft) in height. The species include true shrubs, young trees, and trees or shrubs that are small or stunted because of environmental conditions. Scrub-Shrub Wetlands include many of the young trees and shrub species found within Forested Wetlands (Cowardin et al. 1979).
- b. The Forested Wetlands class includes areas dominated by woody vegetation equal to or greater than 6 m (20 ft) in height (Cowardin et al. 1979).

113. Within the Forested Wetlands class, NWI includes five subclasses: (a) Broad-leaved Deciduous, (b) Needle-leaved Deciduous, (c) Broad-leaved Evergreen, (d) Needle-leaved Evergreen, and (e) Dead. To assist in the field recognition of wetlands, however, this guide will deviate from the NWI classification system and describe two distinct wooded wetland associations: (a) Bog Swamp and (b) Riparian Swamp. These plant communities are included for identification purposes and do not preclude the use of NWI classification, although each of these plant associations can be classified under this system.

114. Wooded wetlands in western Alaska are mostly riparian; occasionally the woody cover on peat soils becomes prevalent, and the site is recognized as a bog swamp. If the woody cover is not prevalent, such a site on peat soils would be classified as an Emergent Wetland (fresh-water bog marsh).

Vegetation

115. Growth forms and physiognomy. Moderately dense stands of shrubs, mostly willows, to 4 m (13 ft) tall are found, with an open to dense understory of herbs.

116. Species composition. In the following subtypes, the following species are included:

- a. Riparian swamp subtype. Prevalent species include:

Salix spp. (Willow)

 Common associated species include:

Alnus crispa (American green alder)
Arctagrostis latifolia (Polargrass)
Calamagrostis canadensis (Bluejoint)
Equisetum spp. (Horsetail)
Picea glauca (White spruce)
Picea mariana (Black spruce)
Polemonium acutiflorum (Jacob's ladder)
Potentilla fruticosa (Shrubby cinquefoil)
Sanguisorba stipulata (Sitka burnet)

b. Bog swamp subtype. Prevalent and common associated species include:

Betula nana (Dwarf birch)
Empetrum nigrum (Crowberry)
Ledum palustre (Labrador-tea)
Picea glauca (White spruce)
Picea mariana (Black spruce)
Rubus chamaemorus (Cloudberry)
Vaccinium uliginosum (Bog blueberry)

117. Willows are prevalent in the riparian swamps; Alaska willow is possibly the most common, but many other species occur and they are difficult to distinguish. Another shrub species, American green alder, is often found, but it is not nearly as common as willows. These shrub species, including the willows, rarely reach tree size. Riparian swamps often have an open understory of herbs.

118. Bog swamps are nearly identical in species composition to freshwater (bog) marshes except that the woody cover is prevalent. The most commonly associated species are listed with the bog marsh (see paragraph 105c).

Environmental conditions

119. Riparian swamps are flooded seasonally by adjacent streams or rivers. Bog swamps also may be flooded seasonally, and they have saturated soils for several months each year.

Field identification

120. Riparian swamps are usually obvious as they directly border

streams and rivers and have the only tall woody species in the area. Bog swamps are much more difficult to distinguish because many of the species can grow in dry as well as wet habitats. The saturation or so-called "bogginess" of the soil sometimes can be used to indicate a wetland by comparing it with a more solid substrate characteristic of a nonwetland.

AQUATIC BED WETLANDS--INTERIOR ALASKA

DEFINITION: The Aquatic Bed Wetlands class includes areas having a prevalence of vegetation that grows principally on or below the surface of the water for most of the growing season in most years (Cowardin et al. 1979). Aquatic Beds existing beyond a depth of 2 m (6.6 ft) are classified deepwater habitats and therefore will not be considered in this guide.

121. In the hierarchical classification system of NWI, Aquatic Bed Wetlands in interior Alaska can be included under the Riverine, Laustrine, and Palustrine systems and the subclass Rooted Vascular. Additionally, these wetlands are all freshwater. These Freshwater Aquatic Bed Wetlands are found along the margins of streams, rivers, ponds, and lakes. However, this wetland class is relatively scarce in the interior when compared with the abundance of open-water areas.

Vegetation

122. Growth form and physiognomy. Moderately dense stands of rooted aquatic herbs, such as yellow pond-lily, occur.

123. Species composition. Prevalent species include:

Hippuris vulgaris (Common maretail)

Nuphar polysepalum (Yellow pond-lily)

Potamogeton spp. (Pondweed)

Common associated species include:

Callitriche verna (Vernal water-starwort)

Ranunculus spp. (Crowfoot)

124. Common maretail and yellow pond-lily are prevalent in the deeper areas of freshwater aquatic wetlands, but yellow pond-lily becomes less common in shallow water. Pondweeds are probably the second most common species in deep water, while vernal water-starwort and crowfoot are common in shallow water.

Environmental conditions

125. The Freshwater Aquatic Bed Wetlands are of limited extent in the interior of Alaska. This may be due to ice or changes in water level

and/or extremely low temperatures. The high turbidity of some aquatic environments in Alaska also excludes the submersed and floating-leaved aquatic species from some habitats.

Field identification

126. The freshwater Aquatic Bed Wetlands can be identified by the presence of submersed and floating-leaved species. The dominance of submersed species in freshwater sites distinguishes these sites from Emergent Wetlands, which are dominated by rooted, emersed species.

EMERGENT WETLANDS--INTERIOR ALASKA

DEFINITION: The Emergent Wetlands class includes areas dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. The vegetation is present for most of the growing season in most years. These wetlands are usually dominated by perennial plants (Cowardin et al. 1979).

127. Within the Emergent Wetlands class, NWI includes two subclasses: (a) Persistent and (b) Nonpersistent, based on the duration of the standing vegetation through the nongrowing season. Because of the variability of persistence/nonpersistence from one geographic area to another, this guide will describe two common plant communities to assist in field recognition: (a) Freshwater Flats and (b) Freshwater Marshes (including wet meadows, riparian marsh, and bog marsh). These plant communities are included for identification purposes and do not preclude the use of NWI classification, although each of these plant associations can be classified under this system.

Freshwater Flats--Interior Alaska

128. Freshwater Flats occur adjacent to streams, rivers, ponds, and lakes, but are relatively scarce considering the abundance of seemingly suitable areas in interior Alaska. Willow swamps are common along streams and rivers where Freshwater Flats might be expected.

Vegetation

129. Growth form and physiognomy. Scattered graminoids, such as water sedge, and forbs, such as dwarf fireweed, occur with occasional shrubs, such as soapberry.

130. Species composition. Prevalent and common associated species include:

- Carex aquatilis* (Water sedge)
- Epilobium latifolium* (Dwarf fireweed)
- Equisetum* spp. (Horsetail)
- Shepherdia canadensis* (Soapberry)

131. Freshwater Flats may be nearly devoid of plant life, or they

may have scattered individuals of the listed species. These habitats rarely have been described in the literature, and other species probably also occur.

Environmental conditions

132. Freshwater Flats are periodically flooded from snowmelts, usually during the spring. Soils, at least on flats around streams and rivers, are coarsely textured--either sands or gravels. The soils are usually silty on shores of ponds and lakes.

Field identification

133. Freshwater flats are conspicuous because of their sparse vegetative cover and location next to streams and ponds.

Freshwater Marshes--Interior Alaska

134. Freshwater Marshes are abundant and extensive in interior Alaska. They occur on a diversity of sites, including both riparian and nonriparian habitats, and on mineral as well as on organic soils. Those on organic soils are closely related to some of the wooded wetlands, with which they have many common species.

Vegetation

135. Growth form and physiognomy. Dense stands of graminoids such as water sedge and forbs such as arctic sweet coltsfoot occur often with mosses (commonly sphagnum) and with shrubs such as labrador-tea and trees, usually black spruce, scattered through the stand.

136. Species composition. Species found as prevalent or common associated species in the following subtypes are listed below:

a. Wet meadow subtype. Prevalent species include:

Arctagrostis latifolia (Polargrass)*

Carex aquatilis (Water sedge)

Carex bigelowii (Bigelow sedge)

Eriophorum vaginatum (Tussock cotton-grass)

Common associated species include:

* Primarily in alpine areas.

Artemisia arctica (Wormwood)
Calamagrostis canadensis (Bluejoint)
Carex lachenalii (Hare's-foot sedge)
Carex membranacea (Fragile sedge)
Carex podocarpa (Short-stalk sedge)
Eleocharis spp. (Spikerush)
Equisetum arvense (Meadow horsetail)
Eriophorum angustifolium (Tall cotton-grass)
Mertensia paniculata (Tall bluebell)
Myrica gale (Sweet gale)
Oxyria digyna (Mountain sorrel)
Pedicularis capitata (Capitate lousewort)
Petasites frigidus (Arctic sweet coltsfoot)
Picea glauca (White spruce)
Picea mariana (Black spruce)
Polemonium acutiflorum (Jacob's ladder)
Polygonum bistorta (Meadow bistort)
Salix polaris (Polar willow)
Valeriana capitata (Capitate valerian)

b. Riparian marsh subtype. Prevalent species include:

Carex aquatilis (Water sedge)
Equisetum arvense (Meadow horsetail)
Eriophorum spp. (Cotton-grass)

Common associated species include:

Artemisia arctica (Wormwood)
Calamagrostis canadensis (Bluejoint)
Picea glauca (White spruce)
Picea mariana (Black spruce)
Poa alpina (Alpine bluegrass)
Poa arctica (Arctic bluegrass)
Shepherdia canadensis (Soapberry)
Trisetum spicatum (Downy oatgrass)

c. Bog marsh subtype. Prevalent species include:

Calamagrostis neglecta (Narrow reedgrass)

Carex aquatilis (Water sedge)
Carex bigelowii (Bigelow sedge)
Eriophorum vaginatum (Tussock cotton-grass)
Picea mariana (Black spruce)
Sphagnum spp. (Sphagnum moss)
 Common associated species include:
Andromeda polifolia (Bog rosemary)
Betula glandulosa (Glandular birch)
Betula nana (Dwarf birch)
Chamaedaphne calyculata (Leatherleaf)
Empetrum nigrum (Crowberry)
Eriophorum angustifolium (Tall cotton-grass)
Kalmia polifolia (Bog laurel)
Larix laricina (Tamarack)
Ledum palustre (Labrador-tea)
Petasites frigidus (Arctic sweet coltsfoot)
Potentilla fruticosa (Shrubby cinquefoil)
Rubus chamaemorus (Cloudberry)
Vaccinium uliginosum (Bog blueberry)

137. Wet meadows are found from low to high elevations on mineral soils that are saturated for long periods of time. These sites are usually on slopes. Bigelow's sedge is commonly the prevalent species in alpine regions where soils are saturated. Species commonly growing with Bigelow's sedge include capitate lousewort, arctic sweet coltsfoot, meadow horsetail, polar willow, and meadow bistort. Mosses, other than sphagnum, are often abundant. Polargrass and meadow horsetail are prevalent in moist swales; associated species include wormwood, short-stalk sedge, tall bluebell, arctic sweet coltsfoot, Jacob's ladder, and capitate valerian. Snowmelt areas are abundant in the mountains, and the prevalent species are often hare's-foot sedge, tall cotton-grass, and mountain sorrel. Water sedge and meadow horsetail are predominant in moist lowlands, even in nonriparian wetlands.

138. Riparian marshes, including those adjacent to ponds, often have water sedge and meadow horsetail as prevalent species, as well as

cotton-grasses. Mosses, except sphagnum, are common.

139. Bog marshes are extremely abundant and are extensive in interior Alaska. They are found at all elevations on level sites as well as on slopes. Some are nearly covered by herbaceous species, while others have numerous shrubs and trees. Sphagnum is often present and may constitute the bulk of the organic soil, but many bog marshes have sedge peat. Bogs with prevalent herbaceous species are called "muskegs," but because this term has been applied to such a variety of sites including some that are forested, its meaning has become ambiguous. Herbaceous bogs usually have sphagnum moss and tussock cotton-grass as prevalent species. Many bogs in interior Alaska have shrubs or trees as well as a dense understory of herbs. These bogs are classified as Emergent Wetlands unless the woody species becomes prevalent, which is unusual. The shrubs are predominantly ericaceous, including bog-rosemary, leatherleaf, bog laurel, labrador-tea, and bog blueberry. All of these are extremely common as are crowberry, cloudberry, and the dwarf birch. Black spruce is abundant, while tamarack is less common.

Environmental conditions

140. Some wet meadows may be periodically inundated, such as in snowmelt areas, while others have saturated soils but rarely standing water. Riparian marshes along streams and rivers may be seasonally inundated, while those adjacent to ponds and lakes are flooded less often yet have saturated soils.

141. The distinction between wet meadows and bog marshes is based on whether the soil origin is mineral or organic. Although this is sometimes clear, many of the soils are either mixed or have a peat layer overlying a mineral soil. Vegetation can be used to separate them, since the species composition of wet meadows is significantly different from that found in bog marshes. The presence of heath shrubs is a particularly good indicator that the organic matter is exercising a controlling influence on the vegetation. Bog marshes seldom are inundated, but their soils are extremely wet, as evidenced by their spongy or boggy nature.

142. The process of bog formation is complex and will only be outlined here. Briefly, bogs can start as plant species become established

in a pond and gradually build up a peat layer; the pond gradually becomes shallower and smaller. Bogs also may start on terrestrial surfaces when mosses, particularly sphagnum, form a mat that holds moisture and the existing nonwetland vegetation is killed by flooding of the soils. This is called "paludification." Eventually the surface of the resulting bog may be raised as organic materials accumulate. The site will become drier, and the bog vegetation will be replaced by the plant community that was originally destroyed. The changes may be slow or rapid. This cycle has many variations, and more studies are needed before the pattern is adequately understood.

Field identification

143. Freshwater Marshes are readily distinguished from Aquatic Bed Wetlands and Freshwater Flats by physiognomic differences. They closely resemble Scrub-Shrub Wetlands and Forested Wetlands (bog swamps), with the sole difference being the amount of woody cover. A glance at a site is often insufficient to separate these types. Woody cover in interior Alaskan bogs is easily overestimated because of the tree density. For example, both black spruce and tamarack have very short branches and consequently little cover. Also, many of the shrubs are small and, although common, they are scattered through the community. Thus, many sites that first might appear to be swamps are actually marshes, using the classification presented here.

144. Freshwater Marshes, both wet meadows and bog marshes, can be exceedingly difficult to differentiate from nonwetlands. Many of the species of these marshes also grow on dry sites. The best field criteria, in many cases, are soils and topography. If the soil is spongy and especially if footprints fill with water when the soil is saturated, the site is probably a wetland. Ridges, even surrounded by marshes, are often drier and should not be classified as wetlands.

SCRUB-SHRUB WETLANDS AND FORESTED
WETLANDS--INTERIOR ALASKA

- DEFINITIONS: a. The Scrub-Shrub Wetlands class includes areas dominated by woody vegetation less than 6 m (20 ft) in height. The species include true shrubs, young trees, and trees or shrubs that are small or stunted because of environmental conditions. Scrub-Shrub Wetlands include many of the young tree and shrub species found within Forested Wetlands (Cowardin et al. 1979).
- b. The Forested Wetlands class includes areas dominated by woody vegetation equal to or greater than 6 m (20 ft) in height (Cowardin et al. 1979).

145. Within the Forested Wetlands class, NWI includes five subclasses: (a) Broad-leaved Deciduous, (b) Needle-leaved Deciduous, (c) Broad-leaved Evergreen, (d) Needle-leaved Evergreen, and (e) Dead. To assist in the field recognition of wetlands, however, this guide will deviate from the NWI classification system and describe two distinct wooded wetland associations: (a) Riparian Swamp and (b) Bog Swamp. These plant communities are included for identification purposes and do not preclude the use of NWI classification, although each of these plant associations can be classified under this system.

146. The two wooded wetland classes are common in interior Alaska along streams and rivers, but they are less common around ponds and lakes. On nonriparian sites they are scattered and closely associated with Emergent Wetlands (freshwater bog marshes).

Vegetation

147. Growth form and physiognomy. An open-to-dense understory of graminoids occurs in dense stands of trees, often willows.

148. Species composition. The following species are included for the following subtypes:

- a. Riparian swamp subtype. Prevalent species include:

Alnus spp. (Alder)

Populus balsamifera (Balsam poplar)

Salix alaxensis (Alaska willow)

Common associated species include:

Calamagrostis canadensis (Bluejoint)

Picea glauca (Black spruce)

Picea mariana (White spruce)

Salix spp. (Willow)

Shepherdia canadensis (Soapberry)

- b. Bog swamp subtype. Prevalent and common associated species include:

Andromeda polifolia (Bog rosemary)

Betula glandulosa (Glandular birch)

Betula nana (Dwarf birch)

Calamagrostis canadensis (Bluejoint)

Carex aquatilis (Water sedge)

Carex bigelowii (Bigelow's sedge)

Chamaedaphne calyculata (Leatherleaf)

Empetrum nigrum (Crowberry)

Eriophorum angustifolium (Tall cotton-grass)

Eriophorum vaginatum (Tussock cotton-grass)

Kalmia polifolia (Bog laurel)

Larix laricina (Tamarack)

Ledum palustre (Labrador-tea)

Petasites frigidus (Arctic sweet coltsfoot)

Picea mariana (White spruce)

Potentilla fruticosa (Shrubby cinquefoil)

Rubus chamaemorus (Cloudberry)

Sphagnum spp. (Sphagnum moss)

Vaccinium uliginosum (Bog blueberry)

149. Riparian swamps have alders and willows as the prevalent species. Relatively few species grow in the understory of these swamps since the trees are so dense.

150. Bog swamps differ from bog marshes only in having a greater amount of tree cover. The same species are found in both wetlands. The reader is referred to the discussion of freshwater bog marshes (paragraph 136c) for additional detail.

151. Occasionally, a few swamps occur that are not riparian and have peat soils. These have willows or occasionally sweet gale as the

prevalent species. Like other swamps, the soils are saturated.

Environmental conditions

152. Riparian swamps typically are flooded during the spring and summer by snowmelt waters. The soils range from peats to gravels. Bog swamps have organic soils and are characterized by saturated soils rather than by periodic inundation.

Field identification

153. Freshwater riparian swamps can be recognized by the thickets of alders and willows adjacent to standing or flowing waters. Bog swamps can be distinguished from freshwater bog marshes by their large amounts of woody cover. Separation of bog swamps from nonwetland forest is difficult because some species such as black spruce grow on dry slopes as well as in wetlands. The peat soils can help identify the bog swamps because the peat retains water and these areas remain wet. One field character that has been used as a guide is that if footprints in the peat soils fill with water when the soils are wet, the site is probably a wetland.

PART VI: REGIONAL WETLAND TYPES OF THE NORTH SLOPE

AQUATIC BED WETLANDS--NORTH SLOPE

DEFINITION: The Aquatic Bed Wetlands class includes areas having a prevalence of vegetation that grows principally on or below the surface of the water for most of the growing season in most years (Cowardin et al. 1979). Aquatic beds existing beyond a depth of 2 m (6.6 ft) are classified deepwater habitats and therefore will not be considered in this guide.

154. By the hierarchical classification system of NWI, Aquatic Bed Wetlands on the Alaska North Slope can be primarily included in the Riverine, Lacustrine, and Palustrine systems and the subclass Rooted Vascular. Additionally, these wetlands are all freshwater.

155. Freshwater Aquatic Bed Wetlands are uncommon on the North Slope. Although permanent water areas are abundant, they are frequently unvegetated. Along the shore, the species are usually rooted-emersed rather than freshwater aquatic species, and the site is classified as Emergent Wetlands.

Vegetation

156. Growth form and physiognomy. Aquatic plant species such as common maretail occur, with scattered rooted emersed herbs such as pendent grass.

157. Species composition. Prevalent and common associated species include:

Callitriche autumnalis (Northern water-starwort)

Hippuris vulgaris (Common maretail)

Myriophyllum spicatum (Spike watermilfoil)

Potamogeton spp. (Pondweed)

Ranunculus spp. (Crowfoot)

Sparganium hyperboreum (Northern bur-reed)

158. Relatively few aquatic plant species occur as far north as the Arctic; some geographic regions within the Arctic have none. The species that do occur are segregated into more or less distinct zones.

Pendent grass and northern bur-reed grow in water to 2 m (6.6 ft) deep, while common maretail, buckbean, and water crowfoot occur in the shallower areas. The other species in the preceding list also occur generally near the shore.

159. Since few aquatic plant species grow on the North Slope, a greater percent of each pond or lake has open water than in similar habitats in other parts of Alaska. The rivers that flow into the Beaufort Sea also add large areas to the open-water acreages.

Environmental conditions

160. Ice action, cold temperatures, and high turbidity limit aquatic plant species on the North Slope, both in abundance in any given stream or pond and in the total number of species present.

Field identification

161. Freshwater Aquatic Bed Wetlands are dominated by submersed plants in contrast to Emergent Wetlands, which are dominated by emerged species. Submersed species are readily distinguished from emerged species, but sometimes problems arise. For example, the species of *Ranunculus* typically are emerged, but some occasionally have floating or submersed leaves, in which case these species are considered submersed.

EMERGENT WETLANDS--NORTH SLOPE

DEFINITION: The Emergent Wetlands class includes areas dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. These wetlands are usually dominated by perennial plants (Cowardin et al. 1979).

162. Within the Emergent Wetlands class, NWI includes two subclasses: (a) Persistent and (b) Nonpersistent, based on the duration of the standing vegetation through the nongrowing season. Because of the variability of persistence/nonpersistence from one geographic area to another, this guide will describe four common plant communities to assist in field recognition: (a) Haline Coastal Flats, (b) Haline Marshes, (c) Freshwater Flats, and (d) Freshwater Marshes. These plant communities are included for identification purposes and do not preclude the use of NWI classification, although each of these plant associations can be classified under this system.

Haline Coastal Flats--North Slope

163. Haline Coastal Flats are extensive on the North Slope. Many of the ocean beaches are bare, while others are vegetated and normally have at least a narrow band of flat between the dense plant cover and the shore. The Haline Coastal Flat begins at the lower limit of the intertidal zone.

Vegetation

164. Growth form and physiognomy. Stands of scattered herbs, such as oysterleaf, occur.

165. Species composition. Prevalent and common associated species include:

- Carex* spp. (Sedge, Caric-sedge)
- Cochlearia officinalis* (Scurvy-grass)
- Elymus mollis* (Dunegrass)
- Honckenya peploides* (Sea-beach sandwort)
- Juncus biglumis* (Two-flowered rush)

Mertensia maritima (Oysterleaf)
Oxyria digyna (Mountain sorrel)*
Phippsia algida (Snowgrass)
Polygonum viviparum (Alpine bistort)*
Puccinellia phryganodes (Creeping alkaligrass)
Saxifraga rivularis (Brook saxifrage)*
Stellaria humifusa (Low chickweed)
Taraxacum spp. (Dandelion)*

166. Haline Coastal Flats on the North Slope are often bare due to the harsh environment of the Arctic shoreline. Dunegrass, scurvygrass, sea-beach sandwort, and oysterleaf are the most commonly occurring species. The coastline is mostly level, but cliffs descend to the ocean in some areas. Southwest of Barrow, the silty cliff faces have scattered two-flowered rush and alpine bistort.

Environmental conditions

167. The scouring of sea ice and inundation by storm tides may eliminate vegetation along the coast. The soils vary from coarse gravels to sands and silts.

Field identification

168. Haline Coastal Flats are characterized by sparse vegetative cover. Since flats adjacent to the ocean on the North Slope are largely barren, they are conspicuous.

Haline Marshes--North Slope

169. Haline Marshes are scattered near the coast of the Beaufort Sea.

Vegetation

170. Growth form and physiognomy. Moderately dense to dense stands of rooted, emersed herbs occur.

171. Species composition. Prevalent species include:
Carex subspathacea (Hoppner sedge)

* Coastal bluffs.

Carex ursina (Caric-sedge)
Elymus mollis (Dunegrass)
Honckenya peploides (Sea-beach sandwort)
Juncus arcticus (Arctic rush)
Mertensia maritima (Oysterleaf)
Primula spp. (Primrose)
Puccinellia phryganodes (Creeping alkaligrass)

Common associated species include:

Alopecurus alpinus (Mountain foxtail)
Arctophila fulva (Pendent grass)
Calamagrostis neglecta (Narrow reedgrass)
Cerastium beeringianum (Bering chickweed)
Cochlearia officinalis (Scurvy-grass)
Dupontia fisherii (Dupontia)
Poa arctica (Arctic bluegrass)
Sagina intermedia (Snow pearlwort)
Saxifraga rivularis (Brook saxifrage)
Stellaria humifusa (Low chickweed)

172. Haline Marshes on the North Slope occur in depressions on the lee of sand spits and on other sites protected from the full force of winds and ice scour. Relatively few species occur in these marshes. Sea-beach sandwort, oysterleaf, and creeping alkaligrass are probably the most abundant species. Caric-sedge grows in dense stands on wet gravels, dunegrass may also form thick stands, and willows may be scattered among the herbaceous species.

Environmental conditions

173. Haline Marshes are flooded by storm tides as well as by the daily tidal regime. Soil substrates range from silty to gravelly.

Field identification

174. Haline Marshes can be recognized by the dense plant cover and by their position on beaches. They usually occur adjacent to or surrounded by Coastal Flats that have a similar species composition, but Marshes have a greater percentage of vegetative cover.

Freshwater Flats--North Slope

175. Freshwater Flats on the North Slope are common on gravel bars in streams and rivers. The flats are less common around ponds and lakes.

Vegetation

176. Growth form and physiognomy. Sparse stands of scattered forbs occur, sometimes with graminoids and small trees such as willows and alders.

177. Species composition. Prevalent and common associated species include:

Alnus crispa (American green alder)

Artemisia spp. (Wormwood)

Dryas integrifolia (Dryas)

Salix alexensis (Alaska willow)

178. The species composition of Freshwater Flats is variable. Some of the flats resemble the more densely vegetated Scrub-Shrub and Forested Wetlands and are characterized by willows and alders. Other flats more closely resemble tundra.

Environmental conditions

179. Freshwater Flats usually are subjected to spring flooding and become exposed early. This seasonal cycle, as well as scouring by ice, restricts the vegetation to scattered plants. Soils are of a coarse texture and consist of either sands or gravels.

Field investigation

180. Sparse vegetation adjacent to areas of open water, either standing or flowing, is the key characteristic that identifies Freshwater Flats.

Freshwater Marshes--North Slope

181. Soils of the North Slope remain saturated due to (a) low precipitation and evapotranspiration rates and (b) soils which are

frozen for most of the year. The area is largely composed of Freshwater Marshes.*

182. Growth form and physiognomy. Dense stands of graminoids, particularly water sedge and tall cotton-grass, occur with forbs such as crowfoot.

183. Species composition. The following species are included for the specified subtypes:

a. Wet meadow and bog marsh subtypes. Prevalent species include:

Carex aquatilis (Water sedge)

Dupontia fisherii (Dupontia)**

Eriophorum angustifolium (Tall cotton-grass)**

Eriophorum vaginatum (Tussock cotton-grass)†

Common associated species include:

Alopecurus alpinus (Mountain foxtail)

Andromeda polifolia (Bog rosemary)

Arctophila fulva (Pendent grass)

Arctostaphylos alpina (Alpine bearberry)

Betula nana (Dwarf birch)

Caltha palustris (Yellow marsh marigold)

Cardamine pratensis (Bittercress)**

Carex spp. (Sedge, Caric-sedge)

Dryas integrifolia (Dryas)

Equisetum arvense (Meadow horsetail)

Eriophorum scheuchzeri (White cotton-grass)

Juncus castaneus (Chestnut rush)

Ledum palustre (Labrador-tea)

Pedicularis spp. (Lousewort)

Petasites frigidus (Arctic sweet coltsfoot)

Poa arctica (Arctic bluegrass)

Salix spp. (Willow)

* Higher areas may not be considered wetlands.

** Wet meadow.

† Bog marsh.

Sphagnum spp. (Sphagnum moss) and other mosses

Vaccinium uliginosum (Bog blueberry)

Vaccinium vitis-idaea (Mountain cranberry)

Valeriana capitata (Capitate valerian)

b. Riparian marsh subtype. Prevalent species include:

Arctophila fulva (Pendent grass)

Carex aquatilis (Water sedge)

Eriophorum angustifolium (Tall cotton-grass)

Menyanthes trifoliata (Buckbean)

Potentilla palustris (Marsh cinquefoil)

Common associated species include:

Alopecurus alpinus (Mountain foxtail)

Andromeda polifolia (Bog rosemary)

Caltha palustris (Yellow marsh marigold)

Carex bigelowii (Bigelow sedge)

Dupontia fisherii (Dupontia)

Equisetum arvense (Meadow horsetail)

Equisetum palustre (Marsh horsetail)

Eriophorum scheuchzeri (White cotton-grass)

Hippuris vulgaris (Common maretail)

Ranunculus hyperboreus (Arctic buttercup)

Ranunculus pallasii (Pallas buttercup)

Saxifraga hirculus (Yellow marsh-saxifrage)

184. There are three major variations of Freshwater Marshes:

(a) wet meadow, (b) bog marsh, and (c) riparian marsh. All three share some species, especially water sedge, tall cotton-grass, and dupontia. The wet meadow, which is found on mineral soils, and the bog marsh, found on organic or peat soils, are often quite similar in species composition because their soils intergrade. Riparian marsh, which includes all shoreline marshes regardless of whether or not the adjacent water is standing or flowing, is relatively distinct from the other two types of marshes.

185. Wet meadows commonly are encountered on the interfluves between major rivers where tussock cotton-grass is often the prevalent

species. Various sedges, especially water sedge and tall cotton-grass, and the forb yellow marsh marigold are among the usual associated species. Low willows also occur in these wet meadows. Bog marshes are similar, but usually have some species growing in them that rarely grow in nonorganic soils. Among these are labrador-tea, bog rosemary, bog blueberry, and mountain cranberry. Since many soils are intermediate between mineral and organic, the vegetational differences between wet meadows and bog marshes are often minimal. The soils in the centers or pans of frost polygons frequently are saturated and never peaty. Water sedge, dupontia, and tall cotton-grass are very often the most common species in these polygons, although many other species are also found in them. Pendent grass is usually present where the polygon centers are extremely wet.

186. Although riparian marshes share many of the wet meadow and bog marsh species, including some of those restricted to peat soils such as bog rosemary, the prevalent species are sometimes different. Pendent grass, for example, is much more common in riparian marshes than in meadows or bogs; moreover, riparian marshes also have several species, such as northern bur-reed, common maretail, and marsh horsetail, which rarely grow in wet meadow or bog marshes. These latter three species appear to be always associated with standing water.

Environmental conditions

187. The soils of marshes, which vary from mineral to mucks and deep peats, may be either alkaline or acidic. The riparian marshes are periodically flooded; some wet meadows and bog marshes are flooded during the spring thaw, while others have saturated soils but are seldom inundated.

Field identification

188. Freshwater Marshes can be distinguished relatively easily from other wetlands in northern Alaska, primarily on the basis of total cover and whether the dominant species are emersed or submersed. It is, however, extraordinarily difficult to distinguish Freshwater Marshes from nonwetlands in some cases. The physiognomy does not differ between marshes and most nonwetlands, nor does the species composition always

change. Freshwater Marshes differ from nonwetlands in that the soils are saturated. This sometimes can be determined in the field by observation of microtopography.

SCRUB-SHRUB WETLANDS AND FORESTED
WETLANDS--NORTH SLOPE

- DEFINITION: a. The Scrub-Shrub Wetlands class includes areas dominated by woody vegetation less than 6 m (20 ft) in height. The species include true shrubs, young trees, and trees or shrubs that are small or stunted because of environmental conditions. Scrub-Shrub Wetlands include many of the young tree and shrub species found within Forested Wetlands (Cowardin et al. 1979).
- b. The Forested Wetlands class includes areas dominated by woody vegetation equal to or greater than 6 m (20 ft) in height (Cowardin et al. 1979).

189. Within the Forested Wetlands class, NWI includes five subclasses: (a) Broad-leaved Deciduous, (b) Needle-leaved Deciduous, (c) Broad-leaved Evergreen, (d) Needle-leaved Evergreen, and (e) Dead. For the purposes of this guide, however, class and subclass distinctions will not be made for Forested Wetlands on the North Slope.

190. Wooded wetlands are restricted to riparian areas and stream terraces. They occur primarily in the foothills of the Brooks Range, but not in the coastal plain or in the higher elevations of the mountains.

Vegetation

191. Growth form and physiognomy. Moderately dense to dense stands of trees, mostly willows, occur with a variable understory.

192. Species composition. Prevalent species include:

Alnus crispa (American green alder)*

Salix spp. (Willow)

Common associated species include:

Aconitum delphinifolium (Monkshood)

Carex aquatilis (Water sedge)

Delphinium brachycentrum (Northern larkspur)

Dupontia fisherii (Dupontia)

Petasites frigidus (Arctic sweet coltsfoot)

Polemonium acutiflorum (Jacob's ladder)

* Only locally dominant.

Rubus chamaemorus (Cloudberry)

Sphagnum spp. (Sphagnum moss)

193. Alaska willow is most often the prevalent species. It is a pioneer species on gravel bars and, if not washed away by floods, it will form thickets. Several other species of willow also grow in the foothills of the Brooks Range; American green alder is present in the foothills, particularly on the more sheltered sites and occasionally with balsam poplar. The herb cover is high in the young willow stands but is reduced as the willow thickets age and become more dense. Many herbs found in the wooded wetlands also occur in the Emergent Wetlands (Riparian Freshwater Marsh).

Environmental conditions

194. Wooded wetlands on gravel bars and streambanks are seasonally inundated in the spring by snowmelt. Although the soils are saturated, they are not flooded on terraces. North Slope wooded wetlands occur on the relatively protected sites in the foothills of the Brooks Range.

Field identification

195. Because nonwetland forests do not occur in the North Slope region, identification of wooded wetlands is simplified. When woody cover of willows or alders is prevalent, the site is usually a wetland. Willows do occur rarely on dry ridges, but these ridges can be distinguished from moist sites simply by field observation of the topography.

PART VII: REGIONAL WETLAND TYPES OF THE ALEUTIAN ISLANDS

AQUATIC BED WETLANDS--ALEUTIAN ISLANDS

DEFINITION: The Aquatic Bed Wetlands class includes areas having a prevalence of vegetation that grows principally on or below the surface of the water for most of the growing season in most years (Cowardin et al. 1979). Aquatic beds existing beyond a depth of 2 m (6.6 ft) are classified as deepwater habitats and therefore will not be considered in this guide.

196. In the hierarchical classification system of NWI, the Aquatic Bed Wetlands can be categorized under each of the five major systems (Marine, Estuarine, Riverine, Lacustrine, and Palustrine). The class itself includes four subclasses: (a) Algal, (b) Aquatic Moss, (c) Rooted Vascular, and (d) Floating Vascular. To assist in field recognition, however, this guide will discuss Haline Aquatic Bed Wetlands (Marine and Estuarine systems) and Freshwater Aquatic Bed Wetlands (Riverine, Lacustrine, and Palustrine systems). Use of recognized subclasses will be retained where applicable.

Haline Aquatic Bed Wetlands--Aleutian Islands

197. Not all of the Aleutian Islands are surrounded by the Haline Aquatic Bed Wetlands, as might be expected. The western Aleutians, beyond Atka and Adak Islands, apparently lack the protected bays necessary for eelgrass growth. In contrast, Izembek Lagoon on the Alaska Peninsula supports the largest single stand of eelgrass known within the region.

Vegetation

198. Growth form and physiognomy. Marine algae, submersed graminoids, and eelgrass occur in open to very dense stands.

199. Species composition. Prevalent and common associated species include:

a. Subclass: Algal.

Alaria spp. (Brown algae)

Fucus spp. (Rockweed)

Ulva spp. (Sea-lettuce)

b. Subclass: Rooted Vascular.

Zostera marina (Eelgrass)

200. Marine algae, including rockweed, sea-lettuce, and other brown algae often occur, sometimes mixed with eelgrass.

Environmental conditions

201. Bays and points protected from the full force of the wind and waves support most of the eelgrass beds.

Field identification

202. Haline Aquatic Bed Wetlands can be identified by their landscape position below the intertidal zone and by the presence of eelgrass.

Freshwater Aquatic Bed Wetlands--Aleutian Islands

203. Freshwater Aquatic Bed Wetlands are common in the Aleutian Islands along pond and streambanks.

Vegetation

204. Growth form and physiognomy. Moderately dense to very dense stands of aquatic forbs such as common marestalk occur.

205. Species composition. Prevalent and common associated species include:

Hippuris vulgaris (Common marestalk)

Isoetes spp. (Quillwort)

Myriophyllum spicatum (Spike watermilfoil)

Potamogeton spp. (Pondweed)

Ranunculus trichophyllus (Water crowfoot)

Sparganium hyperboreum (Northern bur-reed)

206. Succession in the Freshwater Aquatic Bed Wetlands is toward the drier Emergent Wetlands (Freshwater Marsh). At a particular site, the rate of change may be exceedingly slow.

Environmental conditions

207. The Freshwater Bed Wetlands occur in areas with permanently standing water.

Field identification

208. The distinguishing feature of the Freshwater Aquatic Bed Wetlands is that the cover of submersed aquatic plants is extensive. The adjacent areas of open water have very little cover of aquatic plants; the adjacent Emergent Wetland is dominated by emerged species.

DEFINITION: The Emergent Wetlands class includes areas dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. These wetlands are usually dominated by perennial plants (Cowardin et al. 1979).

209. Within the Emergent Wetlands class, NWI includes two subclasses: (a) Persistent and (b) Nonpersistent, based on the duration of the standing vegetation through the nongrowing season. Because of the variability of persistence/nonpersistence from one geographic area to another, this guide will describe four common plant communities to assist in field recognition: (a) Haline Coastal Flats, (b) Haline Marshes, (c) Freshwater Flats, and (d) Freshwater Marshes. These plant communities are included for identification purposes and do not preclude the use of NWI classification, although each of these plant associations can be classified under this system.

Haline Coastal Flats--Aleutian Islands

210. Haline Coastal Flats are common in the lower intertidal zone of the Aleutian Islands. The mountains reach nearly to the sea, especially on the south sides of many of the islands, and Haline Coastal Flats are here defined to include sea cliffs and bluffs whose vegetation is strongly affected by regular inundation or by salt spray.

Vegetation

211. Growth form and physiognomy. Low scattered herbs such as beachpea and mosses occur.

212. Species composition. Prevalent and common associated species include:

Cochlearia officinalis (Scurvy-grass)

Draba hyperborea (Rockcress)

Elymus mollis (Dunegrass)

Festuca rubra (Red fescue)

Honckenya peploides (Sea-beach sandwort)

Lathyrus maritimus (Beachpea)
Mertensia maritima (Oysterleaf)
Potentilla spp. (Silverweed)
Saxifraga bracteata (Brook saxifrage)
Senecio pseudo-arnica (Groundsel)
Zostera marina (Eelgrass)*
Mosses

213. Seaward of the Haline Marshes, the narrow intertidal zone may have scattered individuals of any of the herbaceous species listed above. Silverweed, brook saxifrage, rockcress, and a variety of mosses grow in crevices along the seacoast and tolerate occasional inundation by very high tides or salt spray. Eelgrass, which is prevalent in the Haline Aquatic Bed Wetlands community, may be scattered at the lower limit of the Haline Coastal Flats.

Environmental conditions

214. The Haline Coastal Flats occur primarily in the sandy intertidal zone, except for occurrences on sea cliffs and bluffs. Even though these cliffs and bluffs are only rarely inundated, salt spray from the ocean can have a marked influence on their vegetation type.

Field identification

215. Haline Coastal Flats are readily identified as stands of sparse vegetative cover adjacent to the ocean.

Haline Marshes--Aleutian Islands

216. As in any archipelago, the relative amount of shoreline in the Aleutian Islands is high compared to the total area. Haline Marshes might, therefore, be expected to be extensive. However, the rugged topography--i.e., mountains rising out of the sea with little or no beach or flat--greatly restricts the amount of Haline Marshes.

Vegetation

217. Growth form and physiognomy. Dense stands of graminoids

* Seldom dominant.

such as dunegrass, occur with scattered forbs (e.g., groundsel) and occasional mosses.

218. Species composition. Prevalent species include:

Elymus mollis (Dunegrass)

Honckenya peploides (Sea-beach sandwort)

Senecio pseudo-arnica (Groundsel)

Mosses

Common associated species include:

Carex lyngbyaei (Lyngbye's sedge)

Festuca rubra (Red fescue)

Mertensia maritima (Oysterleaf)

Poa eminens (Large-flower spargrass)

219. Dunegrass is prevalent in most Haline Marshes in the Aleutians, but sea-beach sandwort and groundsel are abundant along some coastlines. Groundsel grows so densely in places that walking through some stands is difficult. The associated species usually are found scattered through the dunegrass marshes, with oysterleaf growing near the lower edge.

Environmental conditions

220. The Haline Marshes occur in the intertidal zone and are at least occasionally flooded by high tides. The mineral soils range from sandy to pebbly, while organic soils are derived from sedges or grasses.

Field identification

221. The Haline Marshes usually are recognized easily because of the dense cover of grasses adjacent to the ocean.

Freshwater Flats--Aleutian Islands

222. Freshwater Flats can be expected to occur around some pond margins in the Aleutian Islands, but their extent is extremely limited. No adequate descriptive information is available about Freshwater Flats on the Aleutian Islands.

Freshwater Marshes--Aleutian Islands

223. Freshwater Marshes are abundant in the Aleutians and range from narrow banks of sedges along stream margins to extensive stands of herbs and shrubs scattered above a surface mat of mosses.*

Vegetation

224. Growth form and physiognomy. Open-to-dense stands of herbaceous vascular plant species such as sedges occur, sometimes with a moss or lichen layer beneath; shrubs, if present, are scattered.

225. Species composition. Prevalent species include:

Carex anthoxanthea (Caric-sedge)

Carex lyngbyaei (Lyngbye's sedge)

Carex pluriflora (Many-flowered sedge)

Empetrum nigrum (Crowberry)

Eriophorum russeolum (Russett cotton-grass)

Sphagnum spp. (Sphagnum moss)

Common associated species include:

Alopecurus aequalis (Short-awn foxtail)

Athyrium filix-femina (Lady fern)

Calamagrostis nutkaensis (Pacific reedgrass)

Caltha palustris (Yellow marsh marigold)

Carex rariflora (Caric-sedge)

Cladonia pacifica (Reindeer moss)

Claytonia sibirica (Spring beauty)

Dryopteris dilatata (Spinulose shield-fern)

Erigeron peregrinus (Fleabane)

Geum calthifolium (Caltha-leaf avens)

Heracleum lanatum (Cow parsnip)

Iris setosa (Wild iris)

Juncus spp. (Rush)

* Areas containing mosses or lichens as the prevalent species and sustaining less than 30 percent areal coverage of emergents, shrubs, or trees are more properly classified as Moss-Lichen Wetlands (Cowardin et al. 1979).

Leptarrhena pyrolifolia (Leatherleaved-saxifrage)
Linnaea borealis (Twin-flower)
Plantago macrocarpa (Seashore plantain)
Platanthera dilatata (White bog-orchid)
Platanthera tipuloides (Bog-orchid)
Polygonum viviparum (Alpine bistort)
Saxifraga hirculus (Yellow marsh-saxifrage)
Sparganium hyperboreum (Northern bur-reed)
Streptopus amplexifolius (Cucumber-root)
Veratrum album (European white hellebore)
Veronica americana (Speedwell)

226. The Freshwater Marsh community may be composed of cucumber-root, twin-flower, various sedges, spinulose shield-fern, and lady fern adjacent to streams, while European white hellebore and speedwell occur along streams in the western Aleutians. Along streams that are deeply cut into the slopes, lady fern, Lyngbye's sedge, cow parsnip, rush, and spinulose shield-fern grow in the densely shaded stream sides and conspicuously contrast with the sedge-reindeer moss nonwetlands. Streams that drain snowbanks may have a variety of mosses, yellow marsh-saxifrage, and leatherleaved-saxifrage adjacent to them. Yellow marsh marigold and spring beauty grow in areas where moving water limits freezing.

227. Ephemeral pools frequently have rushes, short-awn foxtail, northern bur-reed, and yellow marsh marigold as prevalent species. Pond margins may be covered entirely with Lyngbye's sedge, but other sedges (including many-flowered sedge), seashore russett cotton-grass, and rush may also be common. Seashore plantain usually grows in slightly drier areas.

228. All of the above areas occur on predominantly mineral soils, but it is sometimes difficult to distinguish mineral from organic or peat soils. Because the soils tend to intergrade and some species such as Lyngbye's sedge are prevalent on both types of substrates, no major distinction is made here. Generally, mosses, lichens, and shrubs occur in greater abundance on peat soils than on mineral soils. The most common

moss in bogs is sphagnum, and reindeer moss is the most abundant lichen. Heath shrubs or subshrubs, particularly crowberry and blueberry, occur in some marshes. Russett cotton-grass and Pacific reedgrass occur with these species. These sites often are referred to as tundra.

Environmental conditions

229. The environmental conditions in Freshwater Marshes are highly variable. Many marshes occur on peat soils, but others occur on mineral soils. Many have saturated soils most of the time, others are inundated for most of the year, and some are only seasonally wet.

Field identification

230. Separation of the Freshwater Marsh from other wetlands is relatively easy; it can be done objectively based on total cover in the case of Freshwater Flats and on the amount of woody cover in the case of wooded wetlands. Freshwater Aquatic Bed Wetlands, which are occasionally adjacent to Freshwater Emergent Wetlands (Marsh), are dominated by submersed species.

231. Separation from nonwetlands is quite difficult; not only do many species grow in both wet and dry areas, identification can also be difficult, as in the species of sedge. Sometimes secondary species can help, but even then quantitative sampling often will be necessary to distinguish wetland from nonwetland areas.

SCRUB-SHRUB WETLANDS AND FORESTED
WETLANDS--ALEUTIAN ISLANDS

- DEFINITIONS: a. The Scrub-Shrub Wetlands class includes areas dominated by woody vegetation less than 6 m (20 ft) in height. The species include true shrubs, young trees, and trees or shrubs that are small or stunted because of environmental conditions. Scrub-Shrub Wetlands include many of the young tree and shrub species found within Forested Wetlands (Cowardin et al. 1979).
- b. The Forested Wetlands class includes areas dominated by woody vegetation equal to or greater than 6 m (20 ft) in height (Cowardin et al. 1979).

232. Within the Forested Wetlands class, NWI includes five subclasses: (a) Broad-leaved Deciduous, (b) Needle-leaved Deciduous, (c) Broad-leaved Evergreen, (d) Needle-leaved Evergreen, and (e) Dead. To assist in the field recognition of these wetlands, however, classes and subclasses will not be discussed individually.

233. Wooded wetlands are not common in the Aleutians. They resemble Emergent Wetlands (Freshwater Marshes) and differ primarily in the relative abundance of shrubs. Riparian swamps are rare, and there is little information about them; consequently, they are not described further here.

Vegetation

234. Growth form and physiognomy. Moderately dense to dense stands of shrubs such as bog blueberry occur, usually with abundant herbs typical of Freshwater Marshes. Sometimes mosses occur in the lowest level of the understudy.

235. Species composition. Prevalent and common associated species include:

Empetrum nigrum (Crowberry)

Rubus chamaemorus (Cloudberry)

Salix spp. (Willow)

Sphagnum spp. (Sphagnum moss)

Vaccinium uliginosum (Bog blueberry)

Vaccinium vitis-idaea (Mountain cranberry)

236. Wooded wetlands are neither abundant nor well studied, and

it is not possible to provide a more complete list of species. Except for sphagnum moss, all of the species listed above are shrubs or subshrubs, such as crowberry. Of these shrubs, only willow could possibly reach tree height and thus lend itself to be classified as a Forested Wetlands species.

237. The riparian or streamside wooded wetlands are poorly surveyed, possibly because they are not common. Alaska willow and Barclay's willow are probably the most common species in these wetlands.

238. Other wooded wetlands in the Aleutians occur mostly on peat soils and are normally called bogs. Except for the two riparian species of willow, the listed species (paragraph 235) grow in bogs, although most are not restricted to them. The understory of grasses and forbs is similar to Freshwater Marshes with peat soils.

Environmental conditions

239. The soils of wooded wetlands are saturated for several months annually, except in dry years. Riparian swamps, which may be seasonally inundated, typically occur on mineral soils, while the other wooded wetlands occur on organic substrates.

Field identification

240. Wooded wetlands are easily recognized in the Aleutians since they are the only wetlands with a dominance of woody cover and since nonwetlands with woody cover are rare. Nonwetlands are likely to have significant woody cover only in rock outcrops on exposed slopes in tundra.

References

- Breckon, G. J., and Barbour, M. G. 1974. "Review of North American Pacific Coast Beach Vegetation," Madrono, Vol 22, pp 33-360.
- Cowardin, L. M., Carter, V., Golet, F. C., and LaRoe, E. T. 1979. Classification of Wetlands and Deep-Water Habitats of the United States, U. S. Department of Interior, U. S. Fish and Wildlife Service.
- Decker, H. F. 1966. "Plants," pp 73-95, In Goldthwait, R. P., et al., "Soil Development and Ecological Succession in a Deglaciated Area of Muir Inlet, Southeast Alaska," Institute of Polar Studies Report No. 20, Ohio State University Research Foundation., Columbus.
- Federal Register. 1977. "Title 33, Navigable Waters," Chapter II, Regulatory Programs of the Corps of Engineers, Vol 42, No. 138, pp 37,128-37,144, Tuesday, July 19, 1977, U. S. Army Corps of Engineers, Washington, D. C.
- Hult n, E. 1968. Flora of Alaska and Neighboring Territories, Stanford University Press, Stanford, Calif.
- Johnson, A. W., et al. 1966. "Vegetation and Flora of the Cape Thompson-Ogotoruk Creek Area, Alaska," pp 277-354, In Wilimovsky, N. J., and J. N. Wolfe, eds., "Environment of the Cape Thompson Region, Alaska," U. S. Atomic Energy Commission, Division of Technical Information, PNE-481.
- Johnson, P. R., and Hartman, C. W. 1969. Environmental Atlas of Alaska, Institute of Arctic Environmental Engineering, Institute of Water Resources, U. S. Geological Survey Professional Paper 443.
- Orth, D. J. 1967. Dictionary of Alaska Place Names, U. S. Geological Survey Professional Paper 567.
- Watson, C. E. 1959. Climates of the States: Alaska, U. S. Weather Bureau Climatology of the United States, 60-49.

Selected Bibliography

- Amundsen, C. C. 1872. "Amchitka Bioenvironmental Program: Plant Ecology of Amchitka Island, Final Report," Battelle, Columbus Laboratories, under AEC Prime, Contract No. AT (26-1)-171. 27 p.
- Amundsen, C. C., and Clebsch, E. E. C. 1971. "Dynamics of the Terrestrial Ecosystem Vegetation of Amchitka Island, Alaska," Bioscience, Vol 21, pp 619-623.
- Andersson, M. 1873. "Birds of Nuvagapak Point, Northeastern Alaska," Arctic, Vol 26(3), pp 186-197.

- Bank, T. P., II. 1951. "Botanical and Ethnobotanical Studies in the Aleutian Islands, I. Aleutian Vegetation and Aleut Culture," Michigan Acad. Sci., Arts, and Letters Paper 37, pp 13-30.
- Bliss, L. C., and Cantlon, J. E. 1957. "Succession on River Alluvium in Northern Alaska," Amer. Midl. Nat., Vol 58, pp 425-469.
- Bos, G. N. 1967. "Range Types and Their Utilization by Muskox on Nunivak Island, Alaska: a Reconnaissance Study," University of Alaska M.S. Thesis. 124 p.
- Brandt, H. 1943. Alaska Bird Trails, The Bird Research Foundation, Cleveland, Ohio. 464 p.
- Britton, M. E. 1967. "Vegetation of the Arctic Tundra," pp 67-130, In Hansen, H. P., ed., Arctic Biology, 2nd ed, Oregon State University Press, Corvallis.
- Brown, J., Pitelka, F. A., and Coulombe, H. H. 1970. "A Work Model of the Barrow Ecosystem," pp 41-43, In Fuller, W. A., and P. G. Kevan, eds., Proceedings of the Conference on Productivity and Conservation in Northern Circumpolar Lands, International Union for Conservation of Nature and National Resources, Morges, Switzerland.
- Burns, J. J. 1964. "The Ecology, Economics, and Management of Mink in the Yukon-Kuskokwim Delta, Alaska," University of Alaska M.S. Thesis. 114 p.
- Cantlon, J. E. 1961. "Plant Cover in Relation to Macro-, Meso-, and Microrelief; Final Report," Arctic Institute of North American and Arctic Research Laboratory Grant ONR-208, 212. 76 p.
- Childs, H. E., Jr. 1969. "Birds and Mammals of the Pitmegea River Region, Cape Sabine, Northwestern Alaska," Biol Pap. Univ. Alaska No. 10. 76 p.
- Churchill, E. D. 1955. "Phytosociological and Environmental Characteristics of Some Plant Communities in the Umiat Region of Alaska," Ecology, Vol 36(4), pp 606-627.
- Clebsch, E. E. C. 1957. "The Summer Season Climatic and Vegetational Gradient Between Point Barrow and Meade River, Alaska," University of Tennessee M.S. Thesis. 60 p.
- Cooper, W. S. 1931. "A Third Expedition to Glacier Bay, Alaska," Ecology, Vol 12, pp 61-95.
- _____. 1936. "The Strand and Dune Flora of the Pacific Coast of North America: a Geographic Study," pp 141-184, In Essays in Geobotany, University of California Press, Berkeley.
- _____. 1939. "A Fourth Expedition to Glacier Bay, Alaska," Ecology, Vol 20, pp 130-155.
- _____. 1942. "Vegetation of the Prince William Sound Region, Alaska, with a Brief Excursion into Post-Pleistocene Climatic History," Ecol. Monogr., Vol 12, pp 1-22.

- Craig, P. C., and McCart, P. J. 1975. "Classification of Stream Types in Beaufort Sea Drainages Between Prudhoe Bay and the MacKenzie Delta, N.W.T., Canada," Arctic and Alpine Research, Vol 7, pp 183-198.
- Crow, J. H. 1968. "Plant Ecology of the Copper River Delta, Alaska," Washington State University Ph. D. Thesis. 120 p.
- Dachnowski-Stokes, A. P. 1941. "Peat Resources in Alaska," U. S. Department of Agriculture Technical Bulletin No. 769. 84 p.
- Dean, F. C., and Chesemore, D. L. 1974. "Studies of Birds and Mammals in the Baird and Schwatka Mountains, Alaska," Biol. Pap. University of Alaska No. 15. 80 p.
- Dennis, J. 1969. "Growth of Tundra Vegetation in Relation to Arctic Microenvironments at Barrow, Alaska," Duke University Ph. D. Thesis. 289 p.
- Drew, J. V., and Shanks, R. E. 1965. "Landscape Relationships of Soils and Vegetation in the Forest-Tundra Ecotone, Upper Firth River Valley, Alaska-Canada," Ecol. Monogr., Vol 35, pp 285-306.
- Druiry, W. H., Jr. 1956. "Bog Flats and Physiographic Processes in the Upper Kuskokwim River Region, Alaska," Harvard University Contrib. Gray Herb. 178. 130 p.
- Fay, F. H., and Cade, T. J. 1959. "An Ecological Analysis of the Avifauna of St. Lawrence Island, Alaska," University of California Publ. Zool., Vol 63, pp 73-150.
- Griggs, R. F. 1936. "The Vegetation of the Katmai District," Ecology, Vol 17, pp 380-417.
- Hakala, J. B. 1952. "The Life History and General Ecology of the Beaver (Castor canadensis Kuhl) in Interior Alaska," University of Alaska M.S. Thesis. 181 p.
- Hanson, H. C. 1950. "Vegetation and Soil Profiles in Some Solifluction and Mound Areas in Alaska," Ecology, Vol 31, pp 606-630.
- _____. 1951. "Characteristics of Some Grassland, Marsh, and Other Plant Communities in Western Alaska," Ecol. Monogr., Vol 21, pp 317-378.
- _____. 1953. "Vegetation Types in Northwestern Alaska and Comparisons with Communities in Other Arctic Regions," Ecology, Vol 34, pp 111-140.
- _____. 1958. "Analysis of Nelchina Caribou Range," U. S. Department of the Interior Fish and Wildlife Service, Federal Aid in Wildlife Job Completion Report, Job 6, W-3-R-12, Juneau, Alaska. 68 p.
- Harris, A. S., et al. 1974. "The Forest Ecosystem of Southeast Alaska, I. The Setting," U. S. Department of Agriculture Forest Service General Technical Report PNW-12, Portland. 40 p.
- Harvill, A. M. 1948. "A Phytogeographic Study of Alaskan Mosses," University of Michigan Ph.D. Thesis. 337 p.

- Heilman, P. E. 1966. "Change in Distribution and Availability of Nitrogen with Forest Succession in Interior Alaska," Ecology, Vol 47, pp 825-831.
- Heinselman, M. L. 1963. "Forest Sites, Bog Processes, and Peatland Types in the Glacial Lake Agassiz Region, Minnesota," Ecol. Monogr., Vol 133, pp 327-374.
- Heusser, C. J. 1960. "Late-Pleistocene Environments of North Pacific North America," American Geographical Society Special Publication No. 35. 308 p.
- Hopkins, D. M., and Sigafoos, R. S. 1951. "Frost Action and Vegetation Patterns on Seward Peninsula, Alaska," U. S. Geological Survey Bulletin 974-C: 51-100.
- Hultén, E. 1960. Flora of the Aleutian Islands. 2nd ed. J. Cramer, Weinheim. 376 p.
- _____. 1962. "Flora and Vegetation of Scammon Bay, Bering Sea Coast, Alaska," Svensk. Bot. Tidsk., Vol 56, pp 36-54.
- _____. 1966. "Contributions to the Knowledge of Flora and Vegetation of the Southwestern Alaskan Mainland," Svensk. Bot. Tidsk., Vol 61, pp 175-189.
- _____. 1973. "Supplement to Flora of Alaska and Neighboring Territories, a Study in the Flora of Alaska and the Transberingian Connection," Bot. Not., Vol 126, pp 459-512.
- Isleib, M. E., and Kessel, B. 1973. "Birds of the North Gulf Coast-Prince William Sound Region, Alaska," Biol. Pap. University of Alaska No. 14. 149 p.
- Johnson, P. L., and Tieszen, L. L. 1973. "Vegetative Research in Arctic Alaska," pp 169-198, In Britton, M. E., ed., "Alaskan Arctic Tundra," Arctic Inst. North America Tech. Paper No. 25.
- Johnson, P. L., and Vogel, T. C. 1966. "Vegetation of the Yukon Flats Region, Alaska," U. S. Army Materiel Command, CRREL Res. Rep. 209. 53 p.
- Kessel, B., and Cade, T. J. 1958. "Birds of the Colville River, Northern Alaska," Biol. Pap. University of Alaska No. 2. 83 p.
- Kessel, B., and Schaller, G. B. 1960. "Birds of the Upper Sheenjek Valley, Northeastern Alaska," Biol. Pap. University of Alaska No. 4. 59 p.
- Klein, D. R. 1958. "Saint Matthew Island Reindeer-Range Studies," U. S. Department of the Interior Fish and Wildlife Service, Federal Aid in Wildlife Job Completion Report, Project W-3-R-12, Work Plan B, Job No. 6, Juneau, Alaska. 39 p.
- _____. 1965. "Ecology of Deer Range in Alaska," Ecol. Monogr., Vol 35, pp 259-284.
- Koranda, J. J. 1960. "The Plant Ecology of the Franklin Bluffs Area, Alaska," University of Tennessee Ph.D. Thesis. 234 p.

- Koranda, J. J. 1973. "The North Slope, Its Physiography, Fauna, and Its Flora," Alaska Geographic, Vol 1, pp 6-37.
- Koranda, J. J., and Evans, C. D. 1975. "A Discussion of Sites Recommended as Potential Natural Landmarks in the Arctic Lowland Natural Region, Northern Alaska," Tundra Biome Center, University of Alaska, Fairbanks. 189 p.
- Lawrence, D. B. 1958. "Glaciers and Vegetation in Southeastern Alaska," Am. Sci., Vol 46, pp 89-122.
- Lutz, H. J., and Caporaso, A. P. 1958. "Indicators of Forest Land Classes in Airphoto Interpretation of the Alaska Interior," U. S. Forest Service, Alaska For. Res. Cent. Stn. Pap. 10. 31 p.
- McRoy, C. P. 1968. "The Distribution and Biogeography of Zostera marina (eelgrass) in Alaska," Pacific Sci., Vol 22, pp 507-513.
- Meehan, W. R. 1974. "The Forest Ecosystem in Southeast Alaska, 4. Wildlife Habitats," U. S. Department of Agriculture Forest Service General Technical Report PNW-16, Portland. 32 p.
- Melchior, H. R. 1973. "Biological Survey of the Kobuk Sand Dunes, Chukchi-Imuruk Biological Survey Interior Report," Manuscript, Cooperative Park Studies Unit, University of Alaska, Fairbanks. 14 p.
- Melchior, J. R., and Racine, C. H. 1974. "Kobuk National Monument Biological Survey, Second Interim Report," Manuscript, Cooperative Park Studies Unit, University of Alaska, Fairbanks. 14 p.
- Merriam, C. H. 1892. "Plants of the Pribilof Islands, Bering Sea," Proc. Biol. Soc. Wash., Vol 7, pp 133-150.
- Moore, P. D., and Bellamy, D. J. 1974. Peatlands. Springer-Verlag, New York. 221 p.
- Neiland, B. J. 1971. "The Forest-Bog Complex of Southeast Alaska," Vegetation, Vol 22, pp 1-64.
- Neiland, B. J., and Hok, J. R. 1975. "Vegetation of the Prudhoe Bay Region," pp 73-78, In Brown, J., ed., "Ecological Investigations of the Tundra Biome in the Prudhoe Bay Region, Alaska," Biol. Pap. University of Alaska Special Report No. 2.
- Palmer, L. J. 1942. "Major Vegetative Types of Southeastern Alaska," U. S. Department of the Interior Fish and Wildlife Service Report, Juneau, Alaska. 16 p.
- Palmer, L. J., and Rouse, C. H. 1945. "Study of the Alaska Tundra with Reference to Its Reactions to Reindeer and Other Grazing," U. S. Department of the Interior Fish and Wildlife Service, Research Report 10. 48 p.
- Pegau, R. E. 1968. "Reindeer Range Appraisal in Alaska," University of Alaska M.S. Thesis. 130 p.
- Porsild, A. E. 1939. "Contributions to the Flora of Alaska," Rhodora, Vol 41, pp 141-301.

- Porter, S. C. 1966. "Pleistocene Geology of Anaktuvuk Pass, Central Brooks Range, Alaska," Arctic Inst. North America Tech. Pap. No. 18. 100 p.
- Potter, L. D. 1972. "Plant Ecology of the Walakpa Bay Area, Alaska," Arctic, Vol 25, pp 115-130.
- Racine, C. H. 1974. "Vegetation of the Chukchi-Imuruk Area, Chukchi-Imuruk Biological Survey," Manuscript, Cooperative Park Studies Unit, University of Alaska, Fairbanks.
- Rausch, R. L., and Rausch, V. R. 1968. "On the Biology and Systematic Position of Microtus abbreviatus Miller, a Vole Endemic to the St. Matthew Island, Bering Sea," Z. f. Säugetierkunde, Vol 33, pp 65-99.
- Rigg, G. B. 1937. "Some Raised Bogs of Southeastern Alaska with Notes of Flat Bogs and Muskeg," Am. J. Bot., Vol 24, pp 194-198.
- Schamel, D. L. 1974. "The Breeding Biology of the Pacific Eider (Somateria mollissima v-nigra Bonaparte) on a Barrier Island in the Beaufort Sea, Alaska," University of Alaska M.S. Thesis. 95 p.
- Scott, R. W. 1972. "Ecology and Phytogeography of Alpine Vegetation in the Southeastern Wrangell Mountains, Alaska," University of Michigan Ph.D. Thesis. 314 p.
- _____. 1974a. "Soils and Patterned Ground in the Chitistone Pass Region of Alaska," pp 279-282, In Bushnell, V. C., and M. G. Marcus, eds., Icefield Ranges Research Project, Scientific Results, Vol 4. Am. Geogr. Soc.
- _____. 1974b. "Alpine Plant Communities of the Southeastern Wrangell Mountains, Alaska," pp 283-306, In Bushnell, V. C., and M. G. Marcus, eds., Icefield Ranges Research Project, Scientific Results, Vol 4. Am. Geogr. Soc.
- _____. 1974c. "The Effect of Snow Duration on Alpine Plant Community Composition and Distribution," pp 307-318, In Bushnell, V. C., and M. G. Marcus, eds., Icefield Ranges Research Project, Scientific Results, Vol 4. Am. Geogr. Soc.
- _____. 1974d. "The Vegetation of Chitistone, Skolai, and Frederika Valleys, Alaska," pp 331-337, In Bushnell, V. C., and M. G. Marcus, eds., Icefield Ranges Research Project, Scientific Results, Vol 4. Am. Geogr. Soc.
- Sellman, P. V., and Brown, J. 1973. "Stratigraphy and Diagenesis of Perennially Frozen Sediments in the Barrow Region, Alaska," pp 171-181, In "Permafrost: The North American Contribution to the Second International Conference," Nat. Acad. Sci., Washington.
- Shacklette, H. T. 1961. "Substrate Relationships of Some Bryophyte Communities on Latouche Island, Alaska," Bryologist, Vol 64, pp 1-16.
- _____. 1965a. "A Leafy Liverwort Hydrosere on Yakobi Island, Alaska," Ecology, Vol 46, pp 377-378.

- Shacklette, H. T. 1965b. "Bryophytes Associated with Mineral Deposits and Solutions in Alaska," U. S. Geol. Surv. Bull. 1198-C. 17 p.
- Shacklette, H. T., et al. 1969. "Vegetation of Amchitka Island, Aleutian Islands, Alaska," U. S. Geol. Surv. Prof. Pap. 648. 66 p.
- Smith, D. K. 1974. "Floristic, Ecologic, and Phytogeographic Studies of the Bryophytes in the Tundra Around Barrow, Alaska," University of Tennessee Ph.D. Thesis. 191 p.
- Soil Conservation Service. 1975. "Soil Taxonomy; A Basic System of Soil Classification for Making and Interpreting Soil Surveys," U. S. Department of Agriculture Handbook No. 436, U. S. Government Printing Office, Washington, D. C. 754 p.
- Spetzman, L. A. 1951. "Plant Geography and Ecology of the Arctic Slope of Alaska," University of Minnesota M.S. Thesis. 186 p.
- _____. 1959. "Vegetation of the Arctic Slope of Alaska," U. S. Geol. Surv. Prof. Pap. 302-B. 58 p.
- Stephens, F. R., and Billings, R. F. 1967. "Plant Communities of a Tide-Influenced Meadow on Chichagof Island, Alaska," Northwest Sci., Vol 41, pp 178-183.
- Stephens, F. R., Gass, C. R., and Billings, R. F. 1970. "The Muskegs of Southeast Alaska and Their Diminished Extent," Northwest Sci., Vol 44, pp 123-130.
- Stevens, M. E. 1965. "Relation of Vegetation to Some Soils in Southeastern Alaska," pp 167-180, In Youngberg, C. T., ed., Forest-Soil Relationships in North America, Oregon State University Press, Corvallis.
- Streveler, G. P., and Paige, B. B. 1971. "The Natural History of Glacier Bay National Monument, Alaska," U. S. Department of the Interior, National Park Service, Glacier Bay National Monument. 89 p.
- Streveler, G. P., et al. 1973. Dixon Harbor Biological Survey, Final Report on the Summer Phase of 1973 Research, National Park Service Glacier Bay. 241 p.
- Taylor, R. F. 1932. "The Successional Trend and Its Relation to Second-Growth Forests in Southeastern Alaska," Ecology, Vol 13, pp 318-391.
- Tedrow, J. C. F. 1973. "Pedologic Investigations in Northern Alaska," pp 93-108, In Britton, M. E., ed., "Alaskan Arctic Tundra," Arctic Instr. North America Technical Paper No. 25.
- Thomas, J. H. 1951. "A Collection of Plants from Point Lay, Alaska," Contrib. Dudley Herb., Vol 4, pp 53-56.
- _____. 1957. "The Vascular Flora of Middleton Island, Alaska," Contrib. Dudley Herb., Vol 5, pp 39-56.
- Ugolini, F. C., and Walters, J. 1974. "Pedological Survey of the Noatak River Basin," pp 86-156, In Young, S. B., ed., The Environment of the Noatak River Basin, Alaska, Center for Northern Studies, Wolcott, Vermont.

- Viereck, L. A. 1962. "Alaska Wildlife Investigations, Sheep and Goat Investigation, Range Survey," Job Completion Report, Research Project Segment, Federal Aid in Wildlife Restoration, Project No. W-6-R-3, Work Plan E, Job No. 2-a. 21 p.
- _____. 1963. "Alaska Wildlife Investigations, Sheep Investigations, Surveys of Range Ecology," Work Plan Segment Report, Federal Aid in Wildlife Restoration, Project No. W-6-R-4, Work Plan E, Job No. 2-a.
- _____. 1970. "Soil Temperatures in River Bottom Stands in Interior Alaska," pp 223-233, In "Ecology of the Subarctic Regions," Proceedings of the Helsinki Symposium, UNESCO.
- _____. 1973a. "Wildfire in the Taiga of Alaska," Quat. Research, Vol 3, pp 465-495.
- _____. 1973b. "Ecological Effects of River Flooding and Forest Fires on Permafrost in the Taiga of Alaska," pp 60-67, In "Permafrost: The North American Contribution to the Second International Conference," Nat. Acad. Sci., Washington, D. C.
- Viereck, L. A., and Little, E. L., Jr. 1972. "Alaska Trees and Shrubs," U. S. Department of Agriculture, Forest Service, Agriculture Handbook No. 410. 265 p.
- _____. 1975. "Atlas of United States Trees, Vol 2. Alaska Trees and Common Shrubs," U. S. Department of Agriculture, Forest Service Misc. Publ. No. 1293. 19 p, 105 maps.
- Wahrhaftig, C. 1965. "Physiographic Divisions of Alaska," U. S. Geol. Surv. Prof. Pap. 482. 52 p.
- Walker, E. H. 1945. "Plants of the Aleutian Islands," pp 63-71, In Collins, H. B., Jr., A. H. Clark, and E. H. Walker, "The Aleutian Islands: Their People and Natural History," Smithsonian Inst. War Background Studies 21, Publ. 3775.
- Webber, P. J., and Walker, D. A. 1975. "Vegetation and Landscape Analysis at Prudhoe Bay, Alaska: A Vegetation Map of the Tundra Biome Study Area," pp 81-91, In Brown, J., ed., "Ecological Investigations of the Tundra Biome in the Prudhoe Bay Region, Alaska," Biol. Pap. University of Alaska Special Report No. 2.
- Wiggins, I. L. 1951. "The Distribution of Vascular Plants on Polygonal Ground Near Point Barrow, Alaska," Contrib. Dudley Herb., Vol 4, pp 41-56.
- Wiggins, I. L., and MacVicar, D. G. 1958. "Notes on the Plants in the Vicinity of Chandler Lake, Alaska," Contrib. Dudley Herb., Vol 5, pp 69-95.
- Wiggins, I. L., and Thomas, J. H. 1962. "A Flora of the Alaskan Arctic Slope," Arctic Inst. North America Special Publication No. 4, University of Toronto Press, Toronto. 425 p.

Williamson, F. S. L., and Peyton, L. J. 1962. "Faunal Relationships of Birds in the Iliamna Lake Area, Alaska," Biol. Pap. University of Alaska No. 5. 73 p.

Worley, I. A. 1972. "The Bryo-geography of Southeastern Alaska," University of British Columbia Ph.D. Thesis. 715 p.

Young, S. B. 1971. "The Vascular Flora of St. Lawrence Island with Special Reference to Floristic Zonation in the Arctic Regions," Harvard University Contrib. Gray Herb. 201. 115 p.

_____. 1974. "Vegetation of the Noatak Valley, Alaska," pp 58-84, In Young, S. B., ed., "The Environment of the Noatak River Basin, Alaska," Center for Northern Studies, Wolcott, Vermont.

Zach, L. 1950. "A Northern Climax, Forest or Muskeg?" Ecology, Vol 31, pp 304-306..

APPENDIX A: GLOSSARY

Alpine Soils: a great soil group of the intrazonal order, comprised of dark soils of grassy meadows at altitudes above the timberline.

Bog: a wetland usually occurring in a depression; often a lake with poor drainage. Generally characterized by extensive peat deposits, acidic water, floating sedge or sphagnum mats, and heath shrubs and often by the presence of conifers such as black spruce and various cedars.

Biota: the flora and fauna of a region.

Chroma: the relative purity, strength, or saturation of a color; directly related to the dominance of the determining wavelength of the light and inversely related to grayness; one of the three variables of color. See Munsell Color System, hue, value, and color.

Cline: gradual variation in a characteristic of a species, usually correlated with geography or topography.

Common Associated Species: species which occur in recognizable assemblages because they have either similar biotic processes or needs; also, species may be linked by some form of biological interdependence. These species are not the prevalent species in an area.

Deposit: material left in a new position by a natural transporting agent such as water, wind, ice, or gravity, or by the activity of man.

Dominant: species which by their activity, behavior, or number have considerable influence or control upon the character of the community; a species which "controls" its habitat and food web.

Ecology: a branch of science concerned with the interrelationship of organisms to one another and their environment.

Ecosystem: system of exchanges of materials and energy between living things and their physical environment. The biotic community and the nonliving environment functioning together as a system.

Ecotypes: ecological variants adapted to local conditions.

Emergent Vegetation: various aquatic plants usually rooted in shallow water and having most of their vegetative growth above water, such as cattails and bulrushes.

Environment: all the external conditions which surround living things, such as soil, water, and air.

Ericaceous: belonging to the generally acidophytic species of the family Ericaceae including heaths, rhododendrons, and azaleas.

Estuary: a semienclosed coastal body of water which has a free connection with the open sea. Estuaries are strongly affected by tidal action and the mixing of seawater with freshwater from land drainage. Examples are river mouths, coastal bays, tidal marshes, and bodies of water behind barrier beaches.

Forb: species of herbaceous plants which are not grasses, sedges, or rushes.

Free-Floating Vegetation: plants that are in contact with water and/or air, but not soil.

Frost-Polygon: patterns within the earth caused as the surface freezes; the fine soil material and clays, which hold more moisture, expand while freezing and then contract when they thaw. This action tends to push the larger material upward and outward from the mass to form the patterned surface.

Gleyed: a condition of soil indicating that the presence of water in the soil has altered it and is manifested by the presence of bluish or greenish colors through the soil mass or in mottles (spots or streaks).

Graminoid: referring to grasses or grasslike plants (including the grasses, sedges, rushes, etc.).

Groundwater: water below the surface of the ground whose pressure is greater than atmospheric.

Growing Season: the period and/or number of days between the last freeze in the spring and the first frost in the fall for the freeze threshold temperature of the crop or other designated temperature threshold.

Habitat: place where a plant or animal species naturally lives and grows; its immediate surroundings.

Haline: containing a dominance of ocean salt.

Halophyte: any plant species capable of tolerating salinity levels of more than 0.5 ppt (o/oo).

Heath: a plant of the genus *Erica*, a low evergreen shrub characteristic of the tundra.

Herb: a nonwoody plant species.

Hydric Soil: soil that is wet long enough to periodically produce anaerobic conditions, thereby influencing the growth of plants.

Hydrology: a science dealing with the properties, distribution, and circulation of water.

Hydrophyte: a plant growing in water or in characteristically wet soil.

Hyperhaline: having a salinity greater than 40 ‰, due to ocean-derived salts.

Indicator(s): herein used to signify an event, entity, or condition that typically characterizes a prescribed environment or situation. Indicators determine or help to determine whether certain stated circumstances exist.

Intertidal Zone: in coastal areas, the region between levels of high tide and low tide.

Inundation: a condition created by the rise and spread of water over a land surface.

Lacustrine: pertaining to a lake.

Marine: pertaining to the open ocean overlying the continental shelf and its associated high-energy coastline. Marine habitats are exposed to the waves and currents of the open ocean, and the water regimes are determined primarily by the ebb and flow of oceanic tides.

Maritime: associated with the sea.

Marsh: a wetland dominated by herbaceous or nonwoody plants, often developing in shallow ponds or depressions, river margins, tidal areas, and estuaries. Marshes may contain either salt water or fresh water. Vegetation is dominated by grasses and sedges.

Mineral Soil: soil composed of predominantly mineral rather than organic materials.

Morphological Adaptation: a peculiarity of structure and form of a species that results in its being better suited to survival in a given environment.

Mottling: spots or blotches of different color or shades of color interspersed with the dominant color.

Nonwetlands: nonaquatic lowlands and uplands that are seldom inundated, or which have saturated soils for only brief periods during the growing season, and which normally support a prevalence of vegetation typically adapted for life in aerobic soil conditions.

Organic Soil: a soil which contains a high percentage (>15 percent) of organic matter throughout the solum.

Paludification: a process in which mosses, particularly sphagnum, form a mat that holds moisture on the soils of terrestrial surfaces, thereby resulting in the death of existing species.

Palustrine: pertaining to all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is less than 0.5 o/oo.

Peat: Partly decayed organic matter formed in boggy areas where lack of oxygen and/or high acidity limits decomposition.

Peatland: lands in which the soils contain more than 50 percent organic matter.

Perennial: a woody or herbaceous plant living from year to year, normally not dying after flowering once.

Periodically: herein used to characterize the detectable regular or irregular occurrence of saturated soil conditions or inundation resulting from ponding from groundwater and/or rainwater, overland flow, or stream flooding that occur(s) with hours, days, weeks, months, or even years between events.

Permafrost: a permanently frozen material underlying the solum; a perennially frozen soil horizon.

Persistent Emergent: emergent hydrophytes that normally remain standing at least until the beginning of the next growing season.

Physiognomy: a descriptive concept based on the external appearance of vegetation (e.g., forest, prairie, marsh, etc.).

Physiological Adaptation: a peculiarity of the basic physical and chemical activities within cells and tissues of a species that results in it being better suited to survival in a given environment.

Prevalent Plant Species: the perennial plant species within all or any given vegetation strata having an estimated relative areal cover, density, basal area, biomass, abundance, dominance value, or importance value of >50 percent.

Riparian: pertaining to vegetation of a riverbank or streamside.

Riverine: pertaining to wetlands and deepwater habitats contained within a channel, except: (1) wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens and (2) habitats with water containing ocean-derived salts of 0.5 o/oo.

Root Zone: the portion of a soil profile that is penetrated or can be penetrated by plant roots.

Saline: containing various dissolved salts derived from nonoceanic sources in concentrations greater than 5 o/oo.

Saturated Soil Conditions: situations in which all voids between soil particles are filled with liquid.

Scouring: the movement of rocks and other debris across the land by glaciers, rivers, or storm tides.

Soil: upper layer of the earth's crust consisting of disintegrated rock with an admixture of organic matter and soluble salts in which living organisms may be found.

Stand: a group of plants in a given area.

Submergent Anchored Vegetation: plant species that grow entirely underwater and are attached to the substrate.

Subtidal: pertaining to the zone below the tidal zone where the substrate is permanently inundated by tidal water.

Succession: the gradual, usually orderly, and sometimes predictable sequence of plant communities occupying a given area with the passage of time.

Swamp: a wetland type in which the dominant vegetation consists of trees (greater than 40 percent cover) and which is inundated by tidal or nontidal salt water or fresh water.

Tidal: referring to the alternate rise and fall of waters along the coast or of those waters having coastal influence.

Tidal Flats: areas of nearly flat, barren mud periodically covered by tidal waters. Normally these materials have an excess of soluble salt.

Topography: the relative position and elevations of the natural or man-made features of an area that describe the configuration of its surface.

Tundra: a treeless plain, either wetland or "dry," found between the northern limits of trees and the region of perpetual ice and snow in the far north, or above treeline in the high mountains.

Typical: exhibiting the essential characteristic of a group of organisms; e.g., a typical plant species.

Under Normal Circumstances: used in the definition of wetlands to describe areas that have not been substantially altered by man's activities such as removal of original vegetation or draining.

Vascular Plant Species: any of the many species of plants that have specialized conducting and supporting tissues, as well as differentiation into the structures known as roots, stems, and leaves (e.g., trees, shrubs, and grasses, etc.).

Vegetation: the plant life that occupies a given area. Plant life can range in form from single-celled organisms such as algae, to multicellular forms such as trees.

Wetland Soils: soils in which the root zone is saturated permanently or periodically during the growing season of the prevalent vegetation.

APPENDIX B: COMMON AND SCIENTIFIC NAMES OF PLANTS OF ALASKA

Common/Scientific Names*

- Alaska cedar
Chamaecyparis nootkatensis (Lamb.) Spach.
- Alaska moss-health
Cassiope stellariana (Pall.) DC.
- Alaska willow
Salix alaxensis (Anderss.) Cov.
- Alder
Alnus spp.
- Alkali-grass
Puccinellia spp.
- Alpine bearberry
Arctostaphylos alpina (L.) Spreng.
- Alpine bistort
Polygonum viviparum L.
- Alpine bluegrass
Poa alpina L.
- Alpine sweet-vetch
Hedysarum alpinum L.
- American green alder
Alnus crispa (Ait.) Pursh
- Angelica
Angelica lucida L.
- Aquatic moss
Fontinalis antipyretica
- Arctic bluegrass
Poa arctica R. Br.
- Arctic buttercup
Ranunculus hyperboreus Tottb.
- Arctic chamomile
Tripleurospermum phaeocephalum (Kupr.) Pobed.
- Arctic daisy
Chrysanthemum arcticum L.
- Arctic dock
Rumex arcticus Trautv.
- Arctic rush
Juncus arcticus Willd.
- Arctic sweet coltsfoot
Petasites frigidus (L.) Franch.
- Balsam poplar
Populus balsamifera L.
- Barclay willow
Salix barclayi Anderss.

* Plants are listed in alphabetical order by scientific name beginning on page B9.

Beach lovage
Ligusticum scoticum L.
 Beachpea
Lathyrus maritimus L.
 Beach Strawberry
Fragaria chiloensis (L.) Duchesne
 Beauverd spiraea
Spiraea beauverdiana Schneid.
 Bering Chickweed
Cerastium beeringianum Cham. and Schlecht.
 Bering hairgrass
Deschampsia beringensis Hult.
 Bigelow sedge
Carex bigelowii Torr.
 Black cottonwood
Populus trichocarpa Torr. and Gray
 Black spruce
Picea mariana (Mill.) B. S. P.
 Blueberry
Vaccinium spp.
 Bluegrass
Poa spp.
 Bluejoint
Calamagrostis canadensis (Michx.) Beauv.
 Bog blueberry
Vaccinium uliginosum L.
 Bog laurel
Kalmia polifolia Wang.
 Bog-orchid
Platanthera tipuloides (L. f.) Lindl.
 Bog rosemary
Andromeda polifolia L.
 Broadleaf marsh marigold
Caltha biflora DC.
 Brook saxifrage
Saxifraga bracteata D. Don
 Brook saxifrage
Saxifraga rivularis L.
 Brown alga
Alaria spp.
 Buckbean
Menyanthes trifoliata L.
 Bunchberry
Cornus canadensis L.
 Caltha-leaf avens
Geum calthifolium Menzies
 Capitata lousewort
Pedicularis capitata Adams
 Capitata valerian
Valeriana capitata Pall.

Caric-sedge
 Carex anthoxanthea Presl
 Caric-sedge
 Carex rariflora (Wahlenb.) J. E. Sm.
 Caric-sedge
 Carex saxatilis L.
 Caric-sedge
 Carex sitchensis Prescott
 Caric-sedge
 Carex spp.
 Caric-sedge
 Carex ursina Dew.
 Chestnut rush
 Juncus castaneus Sm.
 Chukch primrose
 Primula tschuktschorum Kjellm.
 Cloudberry
 Rubus chamaemorus L.
 Clustered sedge
 Carex glareosa Wahlenb.
 Common maretail
 Hippuris vulgaris L.
 Cotton-grass
 Eriophorum spp.
 Cow parsnip
 Heracleum lanatum Michx.
 Creeping alkaligrass
 Puccinellia phryganodes (Trin.) Scribn. and Merr.
 Creeping spikerush
 Eleocharis palustris (L.) Roem. and Schult.
 Crowberry
 Empetrum nigrum L.
 Crowfoot
 Ranunculus spp.
 Cucumber-root
 Streptopus amplexifolius (L.) DC.
 Dandelion
 Taraxacum spp.
 Deer cabbage
 Fauria crista-galli (Menzies) Makino
 Ditch-grass
 Ruppia spiralis L.
 Downy oatgrass
 Trisetum spicatum (L.) Richter
 Dryas
 Dryas integrifolia Vahl
 Dunegrass
 Elymus mollis Trin.
 Dupontia
 Dupontia fischerii R. Br.

Dwarf birch
 Betula nana L.
 Dwarf fireweed
 Epilobium latifolium L.
 Dwarf water-lily
 Nymphaea tetragona Georgi
 Eelgrass
 Zostera marina L.
 European white hellebore
 Veratrum album L.
 Filiform pondweed
 Potamogeton filiformis Pers.
 Fleabane
 Erigeron peregrinus (Pursh) Greene
 Fleshy starwort
 Stellaria crassifolia Ehrh.
 Fragile sedge
 Carex membranacea Hook.
 Glandular birch
 Betula glandulosa Michx.
 Gmelin's buttercup
 Ranunculus gmelini DC.
 Goosetongue
 Plantago maritima L.
 Groundsel
 Senecio pseudo-arnica Less.
 Hairgrass
 Deschampsia spp.
 Hare's-foot sedge
 Carex lachenalii Schkuhr
 Hemlock
 Tsuga spp.
 Highbush cranberry
 Viburnum edule (Michx.) Raf.
 Hoppner sedge
 Carex subspathacea Wormsk.
 Horned pondweed
 Zannichellia palustris L.
 Horsetails
 Equisetum spp.
 Jacob's ladder
 Polemonium actifolium Willd.
 Koenigia
 Koenigia islandica L.
 Kotzebue grass-of-parnassus
 Parnassia kotzebuei Cham. and Schlecht.
 Labrador-tea
 Ledum palustre L.
 Lady fern
 Athyrium filix-femina (L.) Roth

Large-flower speargrass
Poa eminens Presl
 Leatherleaf
Chamaedaphne calyculata (L.) Moench
 Leatherleaved saxifrage
Leptarrhena pyrolifolia (D. Don) Ser.
 Lodgepole pine
Pinus contorta Dougl.
 Lousewort
Pedicularis spp.
 Low chickweed
Stellaria humifusa Rottb.
 Lyngbye's sedge
Carex lyngbyaei Hornem.
 Many-flowered sedge
Carex pluriflora Hult.
 Maritime arrow-grass
Triglochin maritima L.
 Marsh arrow-grass
Triglochin palustris L.
 Marsh cinquefoil
Potentilla palustris (L.) Scop.
 Marsh fleabane
Senecio congestus (R. Br.) DC.
 Marsh horsetail
Equisetum palustre L.
 Meadow barley
Hordeum brachyantherum Nevski
 Meadow bistort
Polygonum bistorta L.
 Meadow horsetail
Equisetum arvense L.
 Monkshood
Aconitum delphinifolium DC.
 Mountain cranberry
Vaccinium vitis-idaea L.
 Mountain foxtail
Alopecurus alpinus Sm.
 Mountain hemlock
Tsuga mertensiana (Bong.) Sarg.
 Mountain sorrel
Oxyria digyna (L.) Hill
 Narrow reedgrass
Calamagrostis neglecta (Ehrh.) Gaertn.
 Northern bur-reed
Sparganium hyperboreum Laest.
 Northern larkspur
Delphinium brachycentrum Ledeb.
 Northern primrose
Primula borealis Duby

Northern water-carpet
Chrysosplenium tetrandrum (Lund) T. Fries
 Northern water-starwort
Callitriche autumnalis L.
 Oregon rush
Juncus oreganus S. Wats.
 Oysterleaf
Mertensia maritima (L.) S. F. Gray
 Pacific alkaligrass
Puccinellia nutkaensis (Presl) Fern. and Weatherb.
 Pacific reedgrass
Calamagrostis nutkaensis (Presl) Steud.
 Pacific silverweed
Potentilla egedii Wormsk.
 Pallas buttercup
Ranunculus pallasii Schlecht.
 Pendent grass
Arctophila fulva (Trin.) Anderss.
 Polar willow
Salix polaris Wahlenb.
 Polargrass
Arctagrostis latifolia (R. Br.) Griseb.
 Pondweed
Potamogeton spp.
 Primrose
Primula spp.
 Quillwort
Isoetes spp.
 Red fescue
Festuca rubra L.
 Red-osier dogwood
Cornus stolonifera Michx.
 Reedgrass
Calamagrostis sp.
 Reindeer moss
Cladonia pacifica Ahti
 Rockcress
Draba hyperborea (L.) Beauv.
 Rockweed
Fucus spp.
 Round-leaf sundew
Drosera rotundifolia L.
 Rush
Juncus spp.
 Russett cotton-grass
Eriophorum russeolum E. Fries
 Salmonberry
Rubus spectabilis Pursh
 Saussurea
Saussurea nuda Ledeb.

Scouler's surfgrass
Phyllospadix scouleri Hook.
 Scurvy-grass
Cochlearia officinalis L.
 Sea-beach sandwort
Honckenya peploides (L.) Ehrh.
 Sea blite
Suaeda depressa (Pursh) S. Sats.
 Sea lettuce
Ulva spp.
 Sea milkwort
Glaux maritima L.
 Seashore plantain
Plantago macrocarpa Cham. and Schlecht.
 Sedge
Carex spp.
 Shore sedge
Carex limosa L.
 Short-awn foxtail
Alopecurus aequalis Sobol.
 Short-stalk sedge
Carex podocarpa C. B. Clarke
 Showy sedge
Carex spectabilis Dew.
 Shrubby cinquefoil
Potentilla fruticosa L.
 Silverweed
Potentilla egedii Wormsk.
 Silverweed
Potentilla spp.
 Sitka burnet
Sanguisorba stipulata Raf.
 Skunk cabbage
Lysichiton americanum Hult. and St. John
 Snow pearlwort
Sagina intermedia Fenzl.
 Snowgrass
Phippsia algida (Soland.) R. Br.
 Soapberry
Shepherdia canadensis (L.) Nutt.
 Spearscale
Atriplex gmelini C. A. Mey.
 Speedwell
Veronica americana Schwein.
 Sphagnum moss
Sphagnum spp.
 Spike watermilfoil
Myriophyllum spicatum L.
 Spikerush
Eleocharis spp.

Spinulose shield-fern
Dryopteris dilatata (Hoffm.) Gray

Spring beauty
Claytonia sibirica L.

Spruce
Picea spp.

Stonewort
Chara spp.

Swamp cranberry
Oxycoccus microcarpus Turez.

Swamp horsetail
Equisetum fluviatile L.

Swamp willow herb
Epilobium palustre L.

Sweet gale
Myrica gale L.

Tall bluebell
Mertensia paniculata (Ait.) G. Don

Tall cotton-grass
Eriophorum angustifolium Honck.

Tamarack
Larix laricina (Du Roi) K. Koch

Ticklegrass
Agrostis scabra Willd.

Tufted hairgrass
Deschampsia caespitosa (L.) Beauv.

Tussock cotton-grass
Eriophorum vaginatum L.

Twin-flower
Linnaea borealis L.

Two-flowered rush
Juncus biglumis L.

Variegated scouring rush
Equisetum variegatum Schleich.

Variegated sedge
Carex stylosa C. A. Mey.

Vernal water-starwort
Callitriche verna L.

Water crowfoot
Ranunculus trichophyllus Chaix.

Watermilfoil
Myriophyllum spp.

Water sedge
Carex aquatilis Wahlenb.

Water-starwort
Callitriche spp.

Western dock
Rumex fenestratus Greene

Western hemlock
Tsuga heterophylla (Raf.) Sarg.

White beaked sedge
Rhynchospora alba (L.) M. Vahl
 White bog-orchid
Platanthera dilatata (Pursh) Lindl.
 White cotton-grass
Eriophorum scheuchzeri Hoppe
 Wild Iris
Iris setosa Pall.
 Wilhelmsia
Wilhelmsia physodes (Fisch.) McNeill
 Willow
Salix spp.
 Wormwood
Artemisia spp.
 Wormwood
Artemisia arctica Less.
 Wormwood
Artemisia tilesii Ledeb.
 Yarrow
Achillea borealis Bong.
 Yellow marsh marigold
Caltha palustris L.
 Yellow marsh-saxifrage
Saxifraga hirculus L.
 Yellow pond-lily
Nuphar polysepalum Engelm.

Scientific/Common Names

Achillea borealis Bong.
 Yarrow
Aconitum delphinifolium DC.
 Monkshood
Agrostis scabra Willd.
 Ticklegrass
Alaria spp.
 Brown alga
Alnus crispa (Ait.) Pursh
 American green alder
Alnus spp.
 Alder
Alopecurus aequalis Sobol.
 Short-awn foxtail
Alopecurus alpinus Sm.
 Mountain foxtail
Andromeda polifolia L.
 Bog rosemary
Angelica lucida L.
 Angelica

Arctagrostis latifolia (R. Br.) Griseb.
 Polargrass
Arctophila fulva (Trin.) Rupr. ex Anderss.
 Pendent grass
Arctostaphylos alpina (L.) Spreng.
 Alpine bearberry
Artemisia arctica Less.
 Wormwood
Artemisia spp.
 Wormwood
Artemisia tilesii Ledeb.
 Wormwood
Athyrium filix-femina (L.) Roth
 Lady fern
Atriplex gmelini C. A. Mey.
 Spearscale
Betula glandulosa Michx.
 Glandular birch
Betula nana L.
 Dwarf birch
Calamagrostis canadensis (Michx.) Beauv.
 Bluejoint
Calamagrostis neglecta (Ehrh.) Gaertn.
 Narrow reedgrass
Calamagrostis nutkaensis (Presl) Steud.
 Pacific reedgrass
Calamagrostis spp.
 Reedgrass
Callitriche autumnalis L.
 Northern water-starwort
Callitriche spp.
 Water-starwort
Callitriche verna L.
 Vernal water-starwort
Caltha biflora DC.
 Broadleaf marsh marigold
Caltha palustris L.
 Yellow marsh marigold
Cardamine pratensis L.
 Bittercress
Carex anthoxanthea Presl
 Caric-sedge
Carex aquatilis Wahlenb.
 Water sedge
Carex bigelowii Torr.
 Bigelow sedge
Carex glareosa Wahlenb.
 Clustered sedge
Carex lachenalii Schkuhr
 Hare's-foot sedge

Carex limosa L.
 Shore sedge
Carex lyngbyaei Hornem.
 Lyngbye's sedge
Carex membranacea Hook.
 Fragile sedge
Carex pluriflora Hult.
 Many-flowered sedge
Carex podocarpa C. B. Clarke
 Short-stalk sedge
Carex rariflora (Wahlenb.) J. E. Sm.
 Caric-sedge
Carex saxatilis L.
 Caric-sedge
Carex sitchensis Prescott
 Caric-sedge
Carex spectabilis Dew.
 Showy sedge
Carex spp.
 Sedge
Carex spp.
 Caric-sedge
Carex stylosa C. A. Mey.
 Variegated sedge
Carex subspathacea Wormsk.
 Hoppner sedge
Carex ursina Dew.
 Caric-sedge
Cassiope stellariana (Pall.) DC.
 Alaska moss-heath
Cerastium beeringianum Cham. and Schlecht.
 Bering chickweed
Chamaecyparis nootkatensis (Lamb.) Spach.
 Alaska cedar
Chamaedaphne calyculata (L.) Moench
 Leatherleaf
Chara spp.
 Stonewort
Chrysanthemum arcticum L.
 Arctic daisy
Chrysosplenium tetrandrum (Lund) T. Fries
 Northern water-carpet
Cladonia pacifica Ahti
 Reindeer moss
Claytonia sibirica L.
 Spring beauty
Cochlearia officinalis L.
 Scurvy-grass
Cornus canadensis L.
 Bunchberry

Cornus stolonifera Michx.
 Red-osier dogwood
Delphinium brachycentrum Ledeb.
 Northern larkspur
Deschampsia beringensis Hult.
 Bering hairgrass
Deschampsia caespitosa (L.) Beauv.
 Tufted hairgrass
Deschampsia spp.
 Hairgrass
Draba hyperborea (L.) Beauv.
 Rockcress
Drosera rotundifolia L.
 Round-leaf sundew
Dryas integrifolia Vahl
 Dryas
Dryopteris dilatata (Hoffm.) Gray
 Spinulose shield-fern
Dupontia fischerii R. Br.
 Dupontia
Eleocharis palustris (L.) Roem, and Schult.
 Creeping spikerush
Eleocharis spp.
 Spikerush
Elymus mollis Trin.
 Dunegrass
Empetrum nigrum L.
 Crowberry
Epilobium latifolium L.
 Dwarf fireweed
Epilobium palustre L.
 Swamp willow herb
Equisetum arvense L.
 Meadow horsetail
Equisetum fluviatile L.
 Swamp horsetail
Equisetum palustre L.
 Marsh horsetail
Equisetum spp.
 Horsetails
Equisetum variegatum Schleigh.
 Variegated scouring rush
Erigeron peregrinus (Pursh) Greene
 Fleabane
Eriophorum angustifolium Honck.
 Tall cotton-grass
Eriophorum russeolum E. Fries
 Russett cotton-grass
Eriophorum scheuchzeri Hoppe
 White cotton-grass

Eriophorum spp.
 Cotton-grass
Eriophorum vaginatum L.
 Tussock cotton-grass
Fauria crista-galli (Menzies) Makino
 Deer cabbage
Festuca rubra L.
 Red fescue
Fontinalis antipyretica
 Aquatic moss
Fragaria chiloensis (L.) Duchesne
 Beach strawberry
Fucus spp.
 Rockweed
Geum calthifolium Menzies
 Caltha-leaf avens
Glaux maritima L.
 Sea milkwort
Hedysarum alpinum L.
 Alpine sweet-vetch
Heracleum lanatum Michx.
 Cow parsnip
Hippuris vulgaris L.
 Common maretail
Honckenya peploides (L.) Ehrh.
 Sea-beach sandwort
Hordeum brachyantherum Nevski
 Meadow barley
Iris setosa Pall.
 Wild Iris
Isoetes spp.
 Quillwort
Juncus arcticus Willd.
 Arctic rush
Juncus biglumis L.
 Two-flowered rush
Juncus castaneus Sm.
 Chestnut rush
Juncus oreganus S. Wats.
 Oregon rush
Juncus spp.
 Rush
Kalmia polifolia Wang.
 Bog laurel
Koenigia islandica L.
 Koenigia
Larix laricina (Du Roi) K. Koch
 Tamarack
Lathyrus maritimus L.
 Beachpea

Ledum palustre L.
 Labrador-tea
Leptarrhena pyrolifolia (D. Don) Ser.
 Leatherleaved-saxifrage
Ligusticum scoticum L.
 Beach lovage
Linnaea borealis L.
 Twin-flower
Lysichiton americanum Hult. and St. John
 Skunk cabbage
Menyanthes trifoliata L.
 Buckbean
Mertensia maritima (L.) S. F. Gray
 Oysterleaf
Mertensia paniculata (Ait.) G. Don
 Tall Bluebell
Myrica gale L.
 Sweet gale
Myriophyllum spicatum L.
 Spike watermilfoil
Myriophyllum spp.
 Watermilfoil
Nuphar polysepalum Engelm.
 Yellow pond-lily
Nymphaea tetragona Georgi
 Dwarf water-lily
Oxycoccus microcarpus Turez.
 Swamp cranberry
Oxyria digyna (L.) Hill
 Mountain sorrel
Parnassia kotzebuei Cham. and Schlecht.
 Kotzebue grass-of-parnassus
Pedicularis capitata Adams
 Capitata lousewort
Pedicularis spp.
 Lousewort
Petasites frigidus (L.) Franch.
 Arctic sweet coltsfoot
Phippsia algida (Soland.) R. Br.
 Snowgrass
Phyllospadix scouleri Hook.
 Scouler's surfgrass
Picea mariana (Mill.) B. S. P.
 Black spruce
Picea spp.
 Spruce
Pinus contorta Dougl.
 Lodgepole pine
Plantago macrocarpa Cham. and Schlecht.
 Seashore plantain

Plantago maritima L.
 Goosetongue
Platanthera dilatata (Pursh) Lindl.
 White bog-orchid
Platanthera tipuloides (L. f.) Lindl.
 Bog-orchid
Poa alpina L.
 Alpine bluegrass
Poa arctica R. Br.
 Arctic bluegrass
Poa eminens Presl
 Large-flower speargrass
Poa spp.
 Bluegrass
Polemonium acutifolium Willd.
 Jacob's ladder
Polygonum bistorta L.
 Meadow bistort
Polygonum viviparum L.
 Alpine bistort
Populus balsamifera L.
 Balsam poplar
Populus trichocarpa Torr. and Gray
 Black cottonwood
Potamogeton filiformis Pers.
 Filiform pondweed
Potamogeton spp.
 Pondweed
Potentilla egedii Wormsk.
 Pacific silverweed
Potentilla fruticosa L.
 Shrubby cinquefoil
Potentilla palustris (L.) Scop.
 Marsh cinquefoil
Potentilla spp.
 Silverweed
Primula borealis Duby
 Northern primrose
Primula spp.
 Primrose
Primula tschuktschorum Kjellm.
 Chukch primrose
Puccinellia nutkaensis (Presl) Fern. and Weatherb.
 Pacific alkaligrass
Puccinellia phryganodes (Trin.) Scribn. and Merr.
 Creeping alkaligrass
Puccinellia spp.
 Alkaligrass
Ranunculus gmelini DC.
 Gmelin's buttercup

Ranunculus hyperboreus Rottb.
 Arctic buttercup
Ranunculus pallasii Schlecht.
 Pallas buttercup
Ranunculus spp.
 Crowfoot
Ranunculus trichophyllus Chaix.
 Water crowfoot
Rhynchospora alba (L.) M. Vahl
 White beaked sedge
Rubus chamaemorus L.
 Cloudberry
Rubus spectabilis Pursh
 Salmonberry
Rumex arcticus Trautv.
 Arctic dock
Rumex fenestratus Greene
 Western dock
Ruppia spiralis L.
 Ditch-grass
Sagina intermedia Fenzl.
 Snow pearlwort
Salix alaxensis (Anderss.) Cov.
 Alaska willow
Salix barclayi Anderss.
 Barclay willow
Salix polaris Wahlenb.
 Polar willow
Salix spp.
 Willow
Sanguisorba stipulata Raf.
 Sitka burnet
Saussurea nuda Ledeb.
 Saussurea
Saxifraga bracteata D. Don
 Brook saxifrage
Saxifraga hirculus L.
 Yellow marsh-saxifrage
Saxifraga rivularis L.
 Brook saxifrage
Senecio congestus (R. Br.) DC.
 Marsh fleabane
Senecio pseudo-arnica Less.
 Groundsel
Shepherdia canadensis (L.) Nutt.
 Soapberry
Sparganium hyperboreum Laest.
 Northern bur-reed
Sphagnum spp.
 Sphagnum moss

Spiraea beauverdiana Schneid.
 Beauverd spiraea
Stellaria crassifolia Ehrh.
 Fleshy starwort
Stellaria humifusa Rottb.
 Low chickweed
Streptopus amplexifolius (L.) DC.
 Cucumber-root
Suaeda depressa (Pursh) S. Sats.
 Sea blite
Taraxacum spp.
 Dandelion
Triglochin maritima L.
 Maritime arrow-grass
Triglochin palustris L.
 Marsh arrow-grass
Tripleurospermum phaeocephalum (Kupr.) Pobed.
 Arctic chamomile
Trisetum spicatum (L.) Richter
 Downy oatgrass
Tsuga heterophylla (Raf.) Sarg.
 Western hemlock
Tsuga mertensiana (Bong.) Sarg.
 Mountain hemlock
Tsuga spp.
 Hemlock
Ulva spp.
 Sea-lettuce
Vaccinium spp.
 Blueberry
Vaccinium uliginosum L.
 Bog blueberry
Vaccinium vitis-idaea L.
 Mountain cranberry
Valeriana capitata Pall.
 Capitate valerian
Veratrum album L.
 European white hellebore
Veronica americana Schwein.
 Speedwell
Viburnum edule (Michx.) Raf.
 Highbush cranberry
Wilhelmsia physodes (Fisch.) McNeill
 Wilhelmsia
Zannichellia palustris L.
 Horned pondweed
Zostera marina L.
 Eelgrass