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A Preliminary Classification System for Vegetation of Alaska

By Leslie A. Viereck and C.T. Dyrness



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Abstract

A hierarchical system, with five levels of resolution, is proposed for classifying Alaska vegetation. The system, which is agglomerative, starts with 415 known Alaska plant communities which are listed and referenced. At the broadest level of resolution the system contains five formations – forest, tundra, shrubland, herbaceous vegetation, and aquatic vegetation.

Keywords: Classification (vegetation), communities (plant), Alaska.

Leslie A. Viereck is plant ecologist and C. T. Dyrness is program leader at the Institute of Northern Forestry, Pacific Northwest Forest and Range Experiment Station, USDA Forest Service.

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Preface

The first draft of this classification was produced at the Alaskan Rangeland Workshop in Anchorage in February 1976; it had four levels of resolution. In June 1976 it was revised, and the second draft, with five levels, was sent out for review. The committee that worked on these early drafts included, in addition to the authors, William Gabriel (Bureau of Land Management, Anchorage), Samuel Rieger (Soil Conservation Service, Anchorage), William Mitchell (University of Alaska, Palmer), and David Murray (University of Alaska, Fairbanks).

Many others contributed significantly to the classification. Paul Alaback (Oregon State University, Corvallis) and Bonita Neiland (University of Alaska, Fairbanks) provided information on the coastal southeast Alaska forest types. Allen Batten and David Murray (University of Alaska, Fairbanks) provided a literature review and much of the background information on the tundra types. In addition, Mr. Batten reviewed many of the vegetation descriptions and determined the synonymy of many vegetation types. Peter Scorup (University of Alaska, Palmer), Kenneth Winterberger (USDA Forest Service, Pacific Northwest Forest and Range Experiment Station, Anchorage), Paula Krebs (Bureau of Land Management, Anchorage) and Patrick Webber (University of Colorado, Boulder) provided valuable insight on the use of classification in mapping vegetation in tundra and forested areas. Richard Driscoll (USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado) provided very helpful review comments.

We also acknowledge the encouragement to develop this classification by the Federal and State agencies involved in inventory and mapping of vegetation in Alaska.

Introduction

It has become increasingly apparent that a unified statewide system for classifying vegetation in Alaska is needed. Over the years, so many individuals, agencies, and institutions have described and mapped the vegetation that there are many approaches to naming vegetation units currently in use. The lack of uniformity in the approach makes correlation of information between different areas and workers difficult, if not impossible. A generally acceptable hierarchical system that accommodates all major plant groupings in the State is needed. If the levels in the hierarchy are carefully chosen, the classification system should be useful for statewide application as well as for detailed work in localized areas.

This suggested classification will be revised as new information becomes available. Although it reflects input from many biologists, feedback from users will be helpful for later revisions. The goal is a system that can be applied at all levels of resolution and in all areas of the State.

Review of Vegetation Classification Work in Alaska

Interest in vegetation science in Alaska has traditionally been oriented toward the tundra areas. Far more information is available for tundra vegetation than for either taiga or coastal forests. The emphasis is still on tundra, but more effort is now spent on vegetation work in taiga. Following is a brief summary of some available sources of information for use in constructing a statewide vegetation classification system; it will give a general idea of some of the past major vegetation classification efforts in Alaska.

COASTAL FORESTS

Little work has been done in Alaska coastal forests to describe and classify vegetation. A good source of general information on vegetation in southeast Alaska is a report by Palmer (1942) for the Fish and Wildlife Service.¹ Palmer, however, only lists two forest types and six other types for the whole southeastern area. There are detailed descriptions of the vegetation of some coastal areas, such as Coronation and Wornkofski Islands (Klein 1965), Prince William Sound (Cooper 1942), and Glacier Bay. Glacier Bay has also been the subject of numerous studies of plant succession after deglaciation (Cooper 1924, 1939; Lawrence 1958; Crocker and Major 1955). Neiland (1971) described bog vegetation but did not separate distinct vegetation types.

Because of this lack of information, our classification may need considerable additions to accommodate coastal forest communities, especially at the plant community level. Many of the vegetation units in the present system were suggested by scientists currently working in southeast Alaska and are based on work not yet published.

¹ For the reader's convenience in using this publication, unpublished references are listed with published references in "References."

ALEUTIAN ISLANDS

Amchitka Island has been the focal point for studies of vegetation of the Aleutian Islands. Early work by Hulten (1960) and Tatewaki and Kobayashi (1934), however, gave some general descriptions of Aleutian Island vegetation, Amundsen (1972) described ten plant community types on Amchitka Island; a more detailed description of the vegetation was given by Shacklette et al. (1969) – they listed 15 habitats with 41 plant communities using the system presented by Fosberg (1967).

Our classification system may be incomplete for plant communities of the Aleutian Islands because of the paucity of information for those islands, with the exception of Amchitka Island.

ALPINE TUNDRA

Although considerable information is available on arctic tundra in Alaska, little information is available on alpine plant communities. Palmer (1942) and Viereck (1962a, 1962b, 1963) described plant communities in the Alaska Range; Scott (1972), the Wrangell Mountains; Dean (1964), the Baird and Schwatka Mountains; and Anderson (1972), the Tanana-Yukon upland at Eagle Summit.

Murray and Batten (1977) summarized information on alpine plant communities and incorporated them into a provisional classification. Their plant communities were used as the starting point for our tundra classification.

ARCTIC TUNDRA

It is impossible to review all the considerable work on classification and description of vegetation in the Alaska arctic tundra. Notable studies include those of Spetzman (1959), Britton (1967), Johnson et al. (1966), and Johnson and Tiezen (1973). Both Spetzman (1959) and Britton (1967) made general vegetation descriptions throughout the arctic tundra area north of the crest of the Brooks Range. At Cape Thompson, Johnson et al. (1966) described and mapped 13 types and arranged the types along gradients of moisture, soil texture, and slope.

Johnson and Tiezen (1973) reviewed the vegetation work in arctic Alaska and listed 42 community types in ten physiographic habitats. They did not describe the community types but did correlate eight major types with soil texture, drainage, soil type, and level of permafrost. The 42 community types represent a mix of habitats and general vegetation physiognomy and plant groups.

Hettinger and Janz (1974) described vegetation and soils in northeastern Alaska; they identified and described 67 vegetation types and correlated them with terrain and soil features. Koranda and Evans (1975) classified the vegetation between the foothills of the Brooks Range and the Arctic Ocean, partially on the basis of physiography or topographic feature, but gave little information on species composition. Webber and Walker (1975) described 12 vegetation types which were mapped in the Prudhoe Bay area. Murray and Batten (1977) listed all arctic tundra communities that have been described in the literature; their work is the basis of our proposed classification of Alaska tundra vegetation.

INTERIOR ALASKA FORESTS (TAIGA)

Little information and few quantitative analyses are available for vegetation of the taiga of Alaska. The work accomplished seldom included attempts to classify communities. Two notable exceptions are Hettinger and Janz (1974), who developed a classification for the north-eastern corner of the State, and Hanson (1953), who classified taiga communities in north-western Alaska.

Viereck (1975), after reviewing available information on taiga communities, developed a classification that followed the system developed by Fosberg (1967) for the International Biological Program. Whenever possible, Viereck made his classification compatible with Reid's (1974) for an adjacent area in Canada. Viereck showed relative positions of all vegetation types along hypothetical moisture and temperature gradients. All interior Alaska forest communities in our classification are based on Viereck's (1975) work. Because of our incomplete knowledge of taiga types, many additional communities will undoubtedly be added in the future.

ENTIRE STATE OF ALASKA

All statewide vegetation classifications we know of were developed for use with large-scale vegetation maps. Spetzman's (1963) map, at a scale of 1:2,500,000, is the basis of subsequent vegetation maps of Alaska. Map units shown are four forest types (coastal western hemlock-Sitka spruce, bottomland spruce-poplar, upland spruce-hardwood, and lowland spruce-hardwood); three tundra types (moist, wet, and alpine); two shrub types (high brush and low brush); and muskeg-bog. A slightly modified version of this map was published at the same scale in 1973 by the Joint Federal-State Land Use Planning Commission for Alaska.

The National Atlas of the USA contained a map of the potential vegetation of Alaska constructed by Kuchler (1969) at a scale of 1:7,500,000. The vegetation units are similar to Spetzman's (1963), although many names were changed. In the taiga, Kuchler combined the upland units into one unit termed spruce-birch forests; the low mixed type he renamed black spruce forest; and the wet, moist, and alpine tundra of Spetzman he renamed water sedge tundra, cotton sedge tundra, and dryas meadows and barrens, respectively. Kuchler also recognized that vegetation of the Aleutian Islands differs from that of northern and western Alaska by identifying two distinct types: Aleutian meadows and Aleutian heath and barrens.

Viereck and Little (1972) published a map of the vegetation of Alaska, only slightly modified from Spetzman's map. They provided an extensive description of the mapped units, as well as a further division and description of additional vegetation units.

Proposed Classification System

In keeping with recent national trends, we have devised a "pure" classification system, that is, it is based, as much as possible, on the characteristics of the vegetation itself. Although many systems have combined vegetation, soils, landform, and climate, a single component classification has distinct advantages. Because only vegetation is classified, a logical, consistent hierarchical system can be developed. In the ideal hierarchical system, each unit is exclusive of all others, and when one class at any level is known, all levels above it are automatically known. Such a system should be as objective as possible. Boundaries of the types should be fixed and spelled out so that marginal situations can be consistently categorized by all users. Actually, it is virtually impossible to be entirely objective in determining classes and class boundaries, but objectivity should be the aim.

By restricting our classification to vegetation, we do not imply that information on other portions of the ecosystem (for example, soils and landforms) is not important; in many applications this information is as important as knowledge of the vegetation. By keeping the classification pure, we attempt to provide the greatest flexibility and a more universal applicability. As Davis and Henderson (1976) stated, "an integrated system predetermines the way components are combined, makes a value judgment about which are important and which are not, and thus limits its application to only those situations it was specifically designed for."

In local areas, many land managers will prefer at least a partially integrated system. A manager might, for example, refer to "wet sedge-grass tundra on alluvial fans." A generally accepted hierarchical classification for soils exists, and one for landforms could easily be devised. It should be stressed, however, that combinations of units from various classifications would change from place to place, as would their significance for management limitations. Hence, a combined approach, using elements from different classifications, should be for strictly local application.

Bailey et al. (1978) summarized the types and characteristics of resource classification systems. They noted that the most basic system is a taxonomic classification that is independent of place. For maximum usefulness, a classification should be based on many characteristics. Our classification is based on all the plants at any location – the relative abundance of individual plant species. It is well to keep in mind that our proposed system is a taxonomic classification designed to serve many needs. In this respect, it is a natural rather than an artificial classification designed to meet a narrowly defined need (Bailey et al. 1978).

Our classification has been developed by aggregation, with plant communities as the basic elements. We started with known communities, grouping them into broader classes based on similarity of composition by species. Some plant communities we have listed have been described in great detail, others in only a sketchy manner. In all cases, however, we attempted to list at least one reference for each community. Generally, the communities are named for dominant species in principal layers (tree, tall shrub, low shrub, herb). In some cases, however, species with high indicator value are also listed.

This system is designed to classify existing vegetation, not potential vegetation. A classification for potential vegetation must be built on a solid background of knowledge of successional relationships of all vegetation types. Since the successional status of many plant communities in Alaska is, as yet, unknown, we concentrated on existing vegetation. The successional relationships of the vegetation units are important and will be included in future detailed descriptions when information is available.

The proposed system has four formations for terrestrial vegetation – forest, tundra, shrubland, and herbaceous vegetation – and one formation for aquatic vegetation; these formations constitute level I. At the finest level of resolution (level V) units are discrete plant communities, with levels II, III, and IV intermediate in resolution. The scope of the system is shown by the number of units: level II contains 15 units; level III, 39; level IV, 126; and level V, 415.

FOREST

The level II classes for forest are conifer, deciduous, and mixed. A conifer forest is one in which over 75-percent of total tree cover is contributed by coniferous species. Similarly, a deciduous forest has over 75-percent of the tree cover in deciduous tree species. In a mixed stand, neither conifers nor deciduous species have clear dominance; both contribute 25 to 75 percent of the total canopy cover.

The classes in level III are based on amounts of tree canopy cover and are those suggested by Fosberg (1967) – closed, open, and woodland. Closed stands have from 60- to 100-percent crown canopy. Crown cover is best determined from aerial photographs. Open stands have from 25- to 60-percent crown canopy cover. Woodland has only scattered trees and a canopy cover of 10 to 25 percent. Areas with less than 10-percent tree cover are not classed as forest.

TUNDRA

The level II classes for tundra are sedge-grass tundra, herbaceous tundra, tussock tundra, shrub tundra, and mat and cushion tundra. These are generally recognized classes, and many of these terms are already in use. By herbaceous we mean nongrasslike, nonwoody plants – sometimes referred to as forbs. We have narrowed the classification under tundra by listing many grass types as herbaceous vegetation and many of the shrub types as shrubland.

We assigned grass meadows, except those in the arctic, to the herbaceous vegetation formation. Under this approach, all grass communities in the Aleutian Islands and Kodiak Island and in south-central Alaska are classified as grassland rather than tundra. Common grass species, such as *Calamagrostis canadensis* and *Elymus arenarius*, are restricted to the herbaceous vegetation formation. Grasses in sedge-grass tundra are, on the other hand, mostly typical arctic species; e.g., *Arctagrostis latifolia* and *Poa arctica*.

The separation between shrubland and shrub tundra is more difficult to define. Although the ericaceous shrubs (e.g., *Empetrum nigrum* and *Vaccinium uliginosum*) are mainly confined to shrub tundra, other shrub species (such as *Salix planifolia*) are conspicuous elements in both shrubland and shrub tundra. Until more data are gathered, the separation cannot be made simply on the basis of floristics. The classification at present should be partially based on location; for example, stands of ericaceous shrubs and low willows north of the Brooks Range are best classified as shrub tundra, whereas an equivalent vegetation type in lowlands south of the Brooks Range are classified as shrubland. Stands classed as shrub tundra, however, would include sizable amounts of typically tundra sedges, herbs, and mosses – species not occurring in shrubland stands.

Mat and cushion tundra is differentiated from shrub tundra mostly on the basis of height. Mat and cushion is made up of prostrate shrubs (most commonly dryas) which rarely surpass 20 centimeters (about 8 inches) in height. Closed mat and cushion stands have more than 75-percent cover in prostrate shrubs and other species. Open mat and cushion occurs on less productive sites and generally has only 50- to 75-percent plant cover.

SHRUBLAND

Most shrubland communities are dominated by willow, alder, or birch; therefore, level III and IV classes are mainly based on these genera. Tall shrubs are generally over 1.5 meters (about 5 feet) in height; low shrubs, less than 1.5 meters. Under level IV, closed shrub stands have a shrub canopy cover greater than 75 percent, whereas canopy cover in open shrub stands ranges from 25 to 75 percent.

HERBACEOUS VEGETATION

The major classes of herbaceous vegetation at level II are tall grass, midgrass, and sedge-grass. Tall grass, as defined by Fosberg (1967), is made up of graminoid plants which are over 1 meter (3.3 feet) tall when fully developed. For our purposes, midgrass includes all grass stands with a maximum height of less than 1 meter.

The major grass species in tall grass communities are *Calamagrostis canadensis* and *Elymus arenarius*. *Calamagrostis canadensis* on dry sites is also included under midgrass because of its shorter stature in these less productive areas. Another midgrass species characteristic of dry sites is *Festuca altaica*.

The herbaceous sedge-grass includes both freshwater and saline marshes where woody plants are virtually absent. The freshwater marshes that include a substantial component of shrubs are classified as shrubland.

AQUATIC VEGETATION

This category covers all plant life in permanent bodies of water, whether they be streams, lakes, or ocean. This category has not been developed in the present classification, and much work remains to be done.

DOCUMENTED PLANT COMMUNITIES (LEVEL V)

Under level V we list the plant communities and references known to us. We have standardized the community names by listing only the most significant species. Species in community names separated by hyphens are in the same layer; a slash between species indicates a change in layer (tree layer to shrub, shrub to herb layer, etc.). Some references listed for the communities give complete descriptions; others mention only the community name.

In many cases, elements of higher levels can easily be combined with community names for greater clarity. For example, a *Picea mariana/Sphagnum-Cladonia* community is listed under both open black spruce, and black spruce woodland. In actual practice, these communities should be referred to as open *Picea mariana/Sphagnum-Cladonia* and woodland *Picea mariana/Sphagnum-Cladonia*, respectively. This not only differentiates between the two communities but also provides more information in the community name.

The provisional classification follows. Nomenclature is standardized to Hulten (1968) for herbaceous vascular plants, Viereck and Little (1972) for woody plants, Crum et al. (1973) for mosses, Hale and Culberson (1970) for lichens, and Worley (1970) for hepatics.

Preliminary Classification for Alaska Vegetation

Level I	Level II	Level III	Level IV	Level V
1. Forest	A. Conifer forest	(1) Closed conifer forest	a. Sitka spruce – occupies wet sites in southeastern Alaska, primarily alluvial flood plains; occurs as a narrow coastal band in south-central Alaska and occupies much of the forested area on Afognak Island. b. Sitka spruce-western hemlock – occurs on moist sites throughout southeastern Alaska and in a narrow coastal band in south-central Alaska. c. Western hemlock-Sitka spruce-(western redcedar) – is a widespread forest type in southeastern Alaska. It also occurs in a narrow coastal band in south-central Alaska. South of 57°N, it usually contains western redcedar. d. Western hemlock-western redcedar – occurs in low producing, poorly drained ecosystems in southeastern Alaska. e. Mountain hemlock – occurs near timberline, normally on saturated soils. This type covers considerable land area both on the mainland and on the major islands of southeastern Alaska. It also occurs as a narrow subalpine band in south-central Alaska. f. Western hemlock-mountain hemlock – in southeastern Alaska, is transitional between the subalpine mountain hemlock zone and the Sitka spruce-western hemlock zone. g. Silver fir – has a limited distribution in southern portions of southeastern Alaska. h. Subalpine fir – occurs in scattered locations near treeline in southeastern Alaska. i. Black spruce – generally occurs on poorly drained organic soils, often underlain by permafrost. It has wide distribution in interior, western, southwestern, northwestern, and south-central Alaska. j. Black spruce-white spruce – occurs in interior Alaska near the northern and western limits of trees. It also occurs on terraces and at the base of south-facing slopes.	<i>Picea sitchensis</i>/<i>Oplopanax horridum</i>-<i>Rubus spectabilis</i>/<i>Cornus canadensis</i> (Alaback 1980, Neiland 1971, Stephens et al. 1969) <i>Picea sitchensis</i>-<i>Tsuga heterophylla</i>/<i>Lysichiton americanum</i>/<i>Sphagnum</i> spp. (Alaback 1980, Neiland 1971, Stephens et al. 1969) <i>Picea sitchensis</i>-<i>Tsuga heterophylla</i>/<i>Vaccinium ovalifolium</i>-<i>V. alaskensis</i>-<i>Menziesia ferruginea</i> (Neiland 1971, Stephens et al. 1969) <i>Picea sitchensis</i>-<i>Tsuga heterophylla</i>/<i>Moneses uniflora</i>-<i>Tiarella trifoliata</i>/<i>Mnium</i> spp. (Neiland 1971, Stephens et al. 1969) <i>Tsuga heterophylla</i>-<i>Picea sitchensis</i>-(<i>Thuja plicata</i>)/<i>Vaccinium ovalifolium</i>-<i>V. alaskensis</i>/<i>Rhytidiadelphus loreus</i> (Alaback 1980, Neiland 1971, Stephens et al. 1969) <i>Tsuga heterophylla</i>-<i>Picea sitchensis</i>-(<i>Thuja plicata</i>)/<i>Lysichiton americanum</i>/<i>Sphagnum recurvum</i> (Neiland 1971) <i>Tsuga heterophylla</i>-<i>Thuja plicata</i>/<i>Vaccinium ovalifolium</i>-<i>Lysichiton americanum</i> (Alaback 1980, Stephens et al. 1969) <i>Tsuga mertensiana</i>/<i>Vaccinium ovalifolium</i> <i>Cladothamnus pyrolaeiflorus</i> (Alaback 1980, Stephens et al. 1969) <i>Tsuga heterophylla</i>-<i>T. mertensiana</i>/<i>Vaccinium ovalifolium</i>-<i>V. alaskensis</i>/<i>Rubus pedatus</i>/<i>Rhytidiadelphus loreus</i> (Neiland 1971) <i>Abies amabilis</i>-<i>Tsuga heterophylla</i> (Juday et al. 1979) <i>Abies lasiocarpa</i>-<i>Tsuga mertensiana</i> (Harris 1965, Worley and Jaques 1973) <i>Picea mariana</i>feathermoss (Drury 1956, Lutz 1956, Neiland and Viereck 1977, Viereck 1975) <i>Picea mariana</i>/<i>Rosa acicularis</i>/<i>Peltigera</i> (Foote 1976, LaRoi 1967) <i>Picea mariana</i>-<i>P. glauca</i>feathermoss (Foote 1976; LaRoi 1967; Neiland and Viereck 1977; Viereck 1970a, 1975)

	k. White spruce – is widespread in south-central and interior Alaska and extends to the limits of tree growth along rivers draining the Brooks Range. It generally occupies sites with well-drained, permafrost-free soils.	<i>Picea glauca</i>/feathermoss (Buckley and Libby 1957; Drury 1956; Viereck 1970a, 1975) <i>Picea glauca</i>/<i>Viburnum edule</i>/<i>Equisetum arvense</i> (Foote 1976) <i>Picea glauca</i>/<i>Linnaea borealis</i>-<i>Equisetum sylvaticum</i> (Foote 1976)
(2) Open conifer forest	a. Shore pine-western hemlock-(western redcedar-Alaska yellow-cedar) (western redcedar south of 57° N) – is limited in southeastern Alaska and generally found on boggy, poorly drained sites that are locally termed muskegs and bogs. b. Sitka spruce – occurs in coastal areas in south-central and southeastern Alaska, often on alluvial deposits and glacial moraines and outwash, and adjacent to coastal wetlands. c. Mountain hemlock – forms a transition between the continuous closed stands of mountain hemlock and the alpine tundra zone in southeastern Alaska. d. Black spruce-white spruce – occurs mostly near treeline in interior, southwestern, western, northwestern, and south-central Alaska. e. White spruce – is similar to the closed white spruce type but with more shrub cover because of the more open tree canopy. Found commonly on well-drained sites and near treeline in interior, southwest, northwest, and south-central Alaska. f. Black spruce – is extremely common on poorly drained, cold sites in interior and south-central Alaska. g. Black spruce-tamarack – is found on wet lowland sites with shallow permafrost. It is restricted to interior Alaska.	<i>Pinus contorta</i>-<i>Tsuga heterophylla</i>-(<i>Thuja plicata</i>-<i>Chamaecyparis nootkatensis</i>)/<i>Vaccinium ovalifolium</i> <i>V. alaskensis</i>-<i>Ledum groenlandicum</i>/<i>Sphagnum squarrosum</i> (Neiland 1971) <i>Picea sitchensis</i>/<i>Alnus sinuata</i>/<i>Calamagrostis canadensis</i> (Viereck 1979, Worley 1977) <i>Picea sitchensis</i>/<i>Alnus tenuifolia</i> <i>Tsuga mertensiana</i>/<i>Cassiope</i> spp.-<i>Vaccinium ovalifolium</i>-<i>Fauria crista-galli</i> (Alaback 1980, Jaques 1973) <i>Picea mariana</i>-<i>P. glauca</i>/<i>Betula glandulosa</i> (Viereck 1979) <i>Picea glauca</i>/<i>Betula glandulosa</i>/<i>Hylocomium splendens</i> (Hettinger and Janz 1974; Viereck 1970b, 1975, 1979; Williamson and Peyton 1962) <i>Picea glauca</i>/<i>Betula glandulosa</i>/<i>Sphagnum</i> (Hettinger and Janz 1974; Viereck 1970b, 1975, 1979; Williamson and Peyton 1962) <i>Picea glauca</i>/<i>Betula glandulosa</i>/<i>Cladonia</i> (Racine and Anderson 1979, Viereck 1979) <i>Picea glauca</i>/<i>Alnus tenuifolia</i> <i>Picea mariana</i>/<i>Vaccinium</i>/feathermoss (Drury 1956; Foote 1976; Lutz 1956; Viereck 1975, 1979) <i>Picea mariana</i>/feathermoss-<i>Cladonia</i> (Foote 1976; Viereck 1975, 1979) <i>Picea mariana</i>/<i>Sphagnum</i>-<i>Cladonia</i> (Neiland and Viereck 1977) <i>Picea mariana</i>-<i>Larix laricina</i>

Preliminary Classification for Alaska Vegetation (Continued)

Level I	Level II	Level III	Level IV	Level V
1. Forest (continued)	A. Conifer forest (continued)	(3) Conifer woodland	a. Shore pine-(Alaska yellow-cedar) — is found only in southeastern Alaska and is generally on boggy, poorly drained sites. b. Black spruce — is found on wet, boggy sites where it often grades into a sphagnum bog, and on dry upland sites where lichens are frequently important in the understory. It is common in interior, south-central, southwest, and northwest Alaska. c. Black spruce-white spruce — occurs in interior, south-central, southwest, and northwest Alaska, especially near the northern, western, and altitudinal limit of trees. d. White spruce — is a very open, woodland type especially common at the northern limits of tree growth and at elevational tree lines.	<i>Pinus contorta</i>-(<i>Chamaecyparis nootkatensis</i>)/<i>Empetrum nigrum</i>-<i>Ledum groenlandicum</i>/<i>Carex pluriflora</i>/<i>Sphagnum fuscum</i> (Neiland 1971) <i>Pinus contorta</i>-(<i>Chamaecyparis nootkatensis</i>)/<i>Vaccinium uliginosum</i>/<i>Trichophorum cespitosum</i>/<i>Sphagnum compactum</i>-<i>S. tenellum</i>-lichens (Neiland 1971) <i>Pinus contorta</i>-(<i>Chamaecyparis nootkatensis</i>)/<i>Carex livida</i>-<i>Eriophorum angustifolium</i>/<i>Sphagnum lindbergii</i>-<i>S. papillosum</i> (Neiland 1971) <i>Pinus contorta</i>-(<i>Chamaecyparis nootkatensis</i>)/<i>Drosera anglica</i>-<i>Rhynchospora alba</i>/<i>Sphagnum lindbergii</i>-<i>S. tenellum</i> (Neiland 1971) <i>Pinus contorta</i>/<i>Kalmia polifolia</i>/<i>Eriophorum angustifolium</i>-<i>Carex pluriflora</i>-<i>Tofieldia occidentalis</i>-<i>Fauria crista galli</i>/<i>Sphagnum lindbergii</i>-<i>S. compactum</i> (Neiland 1971) <i>Pinus contorta</i>/<i>Carex livida</i>-<i>C. phyllomanica</i>-<i>Rubus arcticus</i>-<i>Platanthera dilatata</i>/<i>Sphagnum papillosum</i>-<i>S. recurvum</i> (Neiland 1971) <i>Picea mariana</i>/<i>Vaccinium</i>-<i>Salix</i> (Racine 1976) <i>Picea mariana</i>/<i>Sphagnum</i>-<i>Cladonia</i> (Viereck 1975, 1979) <i>Picea mariana</i>/<i>Cladonia</i> (Foote 1976; Racine 1976; Viereck 1975, 1979) <i>Picea mariana</i>-<i>P. glauca</i>/<i>Betula glandulosa</i>/feathermoss (Viereck 1979) <i>Picea glauca</i>-<i>P. mariana</i>/lichen (Foote 1976) <i>Picea glauca</i>/<i>Betula glandulosa</i>/feathermoss-<i>Cladonia</i> (Hettinger and Janz 1974; Racine 1975; Viereck 1975, 1979; Williamson and Peyton 1962) <i>Picea glauca</i>/<i>Dryas</i>-moss (Viereck 1979) <i>Picea glauca</i>/<i>Cladonia</i> (Racine 1976) <i>Picea glauca</i>/<i>Salix lanata</i>/<i>Cladonia</i> (LaPerriere 1979)
	B. Deciduous forest	(1) Closed deciduous forest	a. Red alder — occupies moist sites and disturbed areas in southeastern Alaska. b. Black cottonwood — is generally found along streams in southeastern and south-central Alaska. c. Balsam poplar — occurs most frequently on river flood plains in interior, south-central, and southwestern Alaska, although there are several isolated clumps on the north slope of the Brooks Range.	<i>Alnus rubra</i> (del Moral and Watson 1978) <i>Populus trichocarpa</i> <i>Populus balsamifera</i>/<i>Alnus tenuifolia</i>/<i>Calamagrostis canadensis</i> (Buckley and Libby 1957; Drury 1956; Hettinger and Janz 1974; Lutz 1956; Neiland and Viereck 1977; Racine 1976; Viereck 1970a, 1975) <i>Populus balsamifera</i>/<i>Salix barclayi</i>/<i>Heracleum lanatum</i> (Viereck 1970b) <i>Populus balsamifera</i>/<i>Salix</i>-<i>Alnus</i>/herb (Viereck 1979)

		d. Paper birch — occurs on a variety of upland sites, both with and without permafrost, in interior and south-central Alaska.	<i>Betula papyrifera</i> / <i>Alnus crispa</i> / <i>Calamagrostis</i> (Buckley and Libby 1957; Lutz 1956; Viereck 1975) <i>Betula papyrifera</i> / <i>Viburnum</i> (Foote 1976) <i>Betula papyrifera</i> / <i>Alnus-Salix</i> (Racine 1976)
		e. Aspen — occurs on warm, well-drained upland soils in interior and south-central Alaska.	<i>Populus tremuloides</i> / <i>Viburnum edule</i> / <i>Linnaea borealis</i> (Foote 1976) <i>Populus tremuloides</i> / <i>Salix</i> spp./ <i>Arctostaphylos uva-ursi</i> (Hettinger and Janz 1974; Viereck 1975)
		f. Birch-aspen — is found on moderately warm sites in interior and south-central Alaska and is generally replaced by white spruce.	<i>Betula papyrifera</i> - <i>Populus tremuloides</i>
	(2) Open deciduous forest	a. Paper birch — occurs on dry to moist sites in interior, south-central, and western Alaska. On drier sites, lichens are important in the understory; on moist sites, shrubs are dominant.	<i>Betula papyrifera</i> / <i>Cladonia</i> (Racine 1976) <i>Betula papyrifera</i> / <i>Betula glandulosa</i> / <i>Hylocomium</i> (Hanson 1953; Hettinger and Janz 1974; Viereck 1975, 1979) <i>Betula papyrifera</i> / <i>Viburnum edule</i> / <i>Calamagrostis</i> (Foote 1976)
		b. Aspen — occurs primarily on extremely dry sites on steep south slopes in interior and south-central Alaska.	<i>Populus tremuloides</i> / <i>Arctostaphylos uva-ursi</i>
		c. Balsam poplar — occurs as open clumps near tree line in interior, south-central, southwestern, and northwestern Alaska and as isolated groves on the north slope of the Brooks Range.	<i>Populus balsamifera</i> / <i>Salix</i> - <i>Alnus</i> / <i>Calamagrostis</i> (Racine and Anderson 1979; Viereck 1979)
	(3) Deciduous woodland	a. Paper birch — occurs on dry sites, such as old sand dunes and coarse gravel deposits, in northwest Alaska and the northern portion of interior Alaska.	<i>Betula papyrifera</i> / <i>Cladonia</i> (Racine 1976)
C. Mixed conifer and deciduous forest	(1) Closed mixed forest	a. Spruce-birch — tends to occur on cool, wet sites when black spruce is present in the mixture; white spruce favors warmer, drier sites. The type is found primarily in interior and south-central Alaska and, to a lesser extent, in north-west and southwest Alaska.	<i>Picea glauca</i> - <i>Betula papyrifera</i> / <i>Alnus crispa</i> / <i>Calamagrostis canadensis</i> (Buckley and Libby 1957; Hettinger and Janz 1974; Lutz 1956; Viereck 1975) <i>Picea mariana</i> - <i>Betula papyrifera</i> / <i>Ledum</i> <i>Betula papyrifera</i> - <i>Picea glauca</i> - <i>P. mariana</i> / <i>Calamagrostis</i> (Foote 1976)
		b. Aspen-spruce — is an intermediate successional stage, with spruce as the eventual climax. Aspen generally occurs with white spruce on warm, well-drained sites. The type is most common in interior and south-central Alaska.	<i>Populus tremuloides</i> - <i>Picea glauca</i> / <i>Arctostaphylos uva-ursi</i> (Buckley and Libby 1957; Lutz 1956; Viereck 1975) <i>Populus tremuloides</i> - <i>Picea mariana</i> / <i>Ledum</i> (Viereck 1975) <i>Populus tremuloides</i> - <i>Picea mariana</i> / <i>Cornus canadensis</i> (Foote 1976)
		c. Poplar-spruce — is an intermediate successional stage leading to white spruce climax on flood plain sites in interior, south-central, southwestern, and northwestern Alaska.	<i>Populus balsamifera</i> - <i>Picea glauca</i> / <i>Alnus/Equisetum</i>

Preliminary Classification for Alaska Vegetation (Continued)

Level I	Level II	Level III	Level IV	Level V
1. Forest (continued)	C. Mixed conifer and deciduous forest (continued)	(2) Open mixed forest	a. Spruce-birch – occurs on a variety of upland sites in interior, south-central, southwestern, and northwestern Alaska.	<i>Picea glauca</i> - <i>Betula papyrifera</i> / <i>Calamagrostis</i> - <i>Hylocomium</i> (Hettinger and Janz 1974; Viereck 1975) <i>Picea glauca</i> - <i>Betula papyrifera</i> / <i>Alnus crispa</i> / <i>Sphagnum</i> (Viereck 1975) <i>Picea glauca</i> - <i>Betula papyrifera</i> / <i>Salix planifolia</i> / <i>Sphagnum</i> (Viereck 1970b) <i>Picea mariana</i> - <i>Betula papyrifera</i> / <i>Cladonia</i>
2. Tundra	A. Sedge-grass tundra	(1) Wet sedge-grass	a. Wet sedge meadow – is found in very wet areas, generally underlain by permafrost, in every part of the State except southeast but is especially characteristic of the arctic coastal plain. b. Wet sedge-grass meadow – is largely confined to the arctic coastal plain in very wet areas underlain by shallow permafrost.	<i>Carex aquatilis</i> (Churchill 1955; Clebsch 1957; Fries 1977; George et al. 1977; Komarkova and Webber 1978, 1980; Scott 1974; Spetzman 1959; Webber 1978; Webber et al. 1978; White et al. 1975; Young 1971) <i>Carex aquatilis</i> - <i>Eriophorum angustifolium</i> (Batten 1977; Childs 1969; Hopkins and Sigafos 1951; Johnson et al. 1966; Kessel and Schaller 1960; Pegau 1968; Racine 1977; Racine and Young 1978; Webber and Walker 1975; Webber et al. 1978; Young 1974; Young and Racine 1978) <i>Carex aquatilis</i> - <i>C. rotundata</i> (George et al. 1977; Hanson 1953; Pegau and Hemming 1972) <i>Carex aquatilis</i> - <i>C. chordorrhiza</i> - <i>C. limosa</i> - <i>C. microglochin</i> - <i>Eriophorum scheuchzeri</i> - <i>E. angustifolium</i> (Drew and Shanks 1965) <i>Eriophorum angustifolium</i> (White et al. 1975) <i>Eriophorum angustifolium</i> - <i>Carex chordorrhiza</i> (Webber et al. 1978) <i>Eriophorum angustifolium</i> - <i>Carex aquatilis</i> - <i>C. lachenalii</i> (Klein 1958; Rausch and Rausch 1968) <i>Eriophorum angustifolium</i> - <i>Carex bigelowii</i> (Anderson 1974; Hanson 1950; Koranda 1960; Viereck 1963) <i>Carex bigelowii</i> - <i>C. rariflora</i> - <i>C. saxatilis</i> (Hettinger and Janz 1974) <i>Carex chordorrhiza</i> (Batten 1977; Spetzman 1959) <i>Carex rariflora</i> (Batten 1977; Hanson 1951; Spetzman 1959) <i>Carex aquatilis</i> - <i>Dupontia fischeri</i> (Potter 1972; Webber and Walker 1975; Webber et al. 1978; White et al. 1975; Wiggins 1951) <i>Dupontia fischeri</i> - <i>Eriophorum angustifolium</i> (Dennis 1969; Webber 1978) <i>Dupontia fischeri</i> - <i>Eriophorum scheuchzeri</i> (Spetzman 1959) <i>Dupontia fischeri</i> - <i>Carex aquatilis</i> - <i>Eriophorum scheuchzeri</i> - <i>E. angustifolium</i> (Clebsch 1957; Dennis 1969; Potter 1972; Wiggins 1951) <i>Eriophorum angustifolium</i> - <i>Carex glareosa</i> - <i>Deschampsia caespitosa</i> - <i>Dupontia fischeri</i> - <i>Arctagrostis latifolia</i> (Johnson et al. 1966)

	c. Wet sedge-herb meadow — is usually of minor extent, such as on streamsides and pond margins.	<i>Carex aquatilis</i> - <i>Potentilla palustris</i> (Bliss and Cantlon 1957; Webber et al. 1978) <i>Carex aquatilis</i> - <i>Menyanthes trifoliata</i> (Webber et al. 1978) <i>Carex aquatilis</i> - <i>C. membranacea</i> - <i>Petasites frigidus</i> (Scott 1974) <i>Carex nigricans</i> - <i>Eriophorum angustifolium</i> - <i>Fauria crista-galli</i> - <i>Trichophorum caespitosum</i> (Jaques 1973)
(2) Mesic sedge-grass	a. Mesic sedge-grass meadow — is usually of minor extent.	<i>Carex aquatilis</i> - <i>Poa arctica</i> (Clebsch 1957; Webber 1978) <i>Carex microchaeta</i> - <i>Poa arctica</i> (Batten 1977) <i>Carex podocarpa</i> - <i>Arctagrostis latifolia</i> (Scott 1974)
	b. Mesic sedge-herb meadow — is usually of minor extent; probably most common in south-central and southeastern Alaska	<i>Carex macrochaeta</i> - <i>Geranium erianthum</i> - <i>Erigeron peregrinus</i> - <i>Lupinus nootkatensis</i> (Hjeljord 1971)
	c. Arctic grass-herb meadow — occurs in small, limited areas, mainly reported from the arctic slope but probably more widespread.	<i>Epilobium latifolium</i> - <i>Mertensia paniculata</i> - <i>Arctagrostis latifolia</i> (Anderson 1974) <i>Bromus pumpellianus</i> - <i>Trisetum spicatum</i> - <i>Bupleurum triradiatum</i> (Koranda 1960) <i>Luzula confusa</i> - <i>Poa arctica</i> - <i>Petasites frigidus</i> (Wiggins 1951)
(3) Sedge-shrub	a. Sedge-willow — is widely distributed in tundra areas throughout Alaska, except the south-central and south-eastern parts; probably most abundant from the Brooks Range northward.	<i>Carex aquatilis</i> - <i>Salix planifolia</i> (Childs 1969; Clebsch 1957; Dennis 1969; Hanson 1951; Hettinger and Janz 1974; Webber et al. 1978) <i>Carex aquatilis</i> - <i>Salix lanata</i> (Scott 1974; Spetzman 1959) <i>Carex aquatilis</i> - <i>Alnus crispa</i> - <i>Salix</i> spp. (Bliss and Cantlon 1957) <i>Carex bigelowii</i> - <i>Salix planifolia</i> (Hettinger and Janz 1974; Johnson et al. 1966; Koranda 1960) <i>Carex bigelowii</i> - <i>Salix reticulata</i> - <i>S. planifolia</i> (Batten 1977; Hettinger and Janz 1974) <i>Carex bigelowii</i> - <i>Salix reticulata</i> (Hettinger and Janz 1974) <i>Eriophorum angustifolium</i> - <i>Salix planifolia</i> (Fries 1977) <i>Carex bigelowii</i> - <i>C. membranacea</i> - <i>Salix polaris</i> - <i>Equisetum arvense</i> (Hanson 1950) <i>Carex nesophila</i> - <i>Salix rotundifolia</i> - <i>S. reticulata</i> (Klein 1958) <i>Carex microchaeta</i> - <i>Salix planifolia</i> - <i>S. reticulata</i> (Batten 1977)
	b. Sedge-birch — occurs in northern and western interior Alaska.	<i>Carex bigelowii</i> - <i>Betula nana</i> (Webber et al. 1978) <i>Carex bigelowii</i> - <i>C. aquatilis</i> - <i>Betula nana</i> (Hettinger and Janz 1974)
(4) Sedge-mat and cushion	a. Sedge-dryas — is widely distributed in tundra areas throughout the State, with the exception of south-central and southeastern Alaska.	<i>Carex aquatilis</i> - <i>Dryas integrifolia</i> (Webber and Walker 1975; Webber et al. 1978) <i>Carex bigelowii</i> - <i>Dryas integrifolia</i> (Childs 1969; Hettinger and Janz 1974; Webber et al. 1978) <i>Carex bigelowii</i> - <i>Dryas octopetala</i> - <i>Salix reticulata</i> (Anderson 1974; Scott 1974; Webber et al. 1978) <i>Kobresia simpliciuscula</i> - <i>Dryas integrifolia</i> (Webber et al. 1978)
	b. Sedge-bearberry — is only reported from the Seward Peninsula and northeastern interior Alaska but is probably present in other areas, such as the Alaska Range.	<i>Carex membranacea</i> - <i>Arctostaphylos rubra</i> (Hettinger and Janz 1974) <i>Carex bigelowii</i> - <i>Arctostaphylos alpina</i> - <i>Loiseleuria procumbens</i> - <i>Diapensia lapponica</i> (Racine and Anderson 1979)

Preliminary Classification for Alaska Vegetation (Continued)

Level I	Level II	Level III	Level IV	Level V
2. Tundra (continued)	B. Herbaceous tundra	(1) Low elevation herbaceous tundra	a. Seral herbs – are especially common north of the Brooks Range but are encountered in small areas throughout most of the State.	<i>Epilobium latifolium</i> (Scott 1974; Webber et al. 1978) <i>Epilobium latifolium-Artemisia tilesii</i> (Batten 1977; Bliss and Cantlon 1957; Johnson et al. 1966; Spetzman 1959) <i>Epilobium latifolium-Crepis nana</i> (Young 1974) <i>Hedysarum alpinum-Artemisia arctica</i> (Webber et al. 1978) <i>Cochlearia officinalis-Oxyria digyna-Saxifraga rivularis</i> (Potter 1972) <i>Cochlearia officinalis-Phippsia algida-Stellaria humifusa</i> (Webber 1978) <i>Wilhelmsia physodes-Artemisia arctica-Chrysanthemum arcticum</i> (Thomas 1951) <i>Equisetum variegatum</i> (Young 1974)
		(2) Alpine herbaceous tundra	a. Herb-sedge (snowbed) – includes a wide variety of types in mountainous areas throughout the State.	<i>Cetraria delisei-Oxyria digyna-Koenigia islandica-Saxifraga rivularis</i> (Johnson et al. 1966) <i>Carex lachenalii-Oxyria digyna-Claytonia sarmentosa</i> (Scott 1974) <i>Racomitrium canescens-Dicranoweisia cirrata-Oxyria digyna</i> (Scott 1974) <i>Anthelia julacea-Scapania paludosa-Saxifraga hirculus-Leptarrhena pyrolifolia</i> (Shacklette et al. 1969) <i>Rubus arcticus-Sedum rosea-Polygonum bistorta-Saxifraga hirculus</i> (Racine and Young 1978) <i>Carex nigricans</i> (Jaques 1973)
			b. Alpine herbs – occur primarily as sparse vegetation on talus and blockfields, and in some well-vegetated herbaceous meadows in alpine valleys.	<i>Saxifraga tricuspidata-Draba caesia</i> (Batten 1977; Johnson et al. 1966) <i>Saxifraga oppositifolia</i> (Griggs 1936) <i>Saxifraga oppositifolia-Epilobium latifolium</i> (Viereck 1963) <i>Saxifraga tricuspidata-Artemisia arctica</i> (Webber et al. 1978) <i>Potentilla hyparctica-Cerastium aleuticum-Draba aleutica</i> (Shacklette et al. 1969) <i>Artemisia arctica-Potentilla hyparctica-Hierochloa alpina</i> (Heusser 1954, 1960) <i>Diapensia lapponica-Saxifraga bronchialis-Sibbaldia procumbens-Trisetum spicatum</i> (Griggs 1936) <i>Saxifraga</i> spp.- <i>Festuca brachyphylla-Poa glauca-Luzula confusa-Minuertia</i> spp. (Spetzman 1959) <i>Oxyria digyna-Saxifraga punctata-Sedum rosea-Primula tschuktschorum</i> (Fries 1977) <i>Luetkea pectinata-Cassiope stelleriana-Cladonia</i> spp.- <i>Lycopodium alpinum</i> (Hanson 1951) <i>Fauria crista-galli-Caltha biflora</i> (Klein 1965) <i>Achillea borealis-Arnica unalaschcensis-Claytonia sibirica-Geum calthifolium</i> (Shacklette et al. 1969) <i>Polygonum viviparum-Campanula lasiocarpa-Primula cuneifolia-Cardamine umbellata</i> (Bank 1951)

C. Tussock tundra	(1) Sedge tussock	a. Eriophorum tussock – nearly pure eriophorum tussock vegetation with no important associated species is relatively rare but has been reported from a few localities on the arctic slope	<i>Eriophorum vaginatum</i> (Johnson et al. 1966, Komarkova and Webber 1978)
	(2) Sedge tussock-shrub	a. Sedge tussock-willow – is mostly restricted to north of the Brooks Range on poorly drained level to gently sloping surfaces. b. Sedge tussock-ericaceous shrub – is scattered in northern and western interior Alaska. c. Sedge tussock-mixed shrub – is widely distributed throughout the Seward Peninsula and interior and northern Alaska.	<i>Eriophorum vaginatum</i>-<i>Salix planifolia</i>-<i>Carex bigelowii</i>/<i>Hylocomium splendens</i> (Hettinger and Janz 1974) <i>Eriophorum vaginatum</i>-<i>Salix planifolia</i>-<i>S. lanata</i> (Koranda 1960) <i>Eriophorum vaginatum</i>-<i>Carex bigelowii</i>-<i>Ledum palustre</i>-<i>Vaccinium vitis-idaea</i> (Childs 1969; Dean and Cheseomore 1974; Hanson 1950) <i>Eriophorum vaginatum</i>-<i>Betula nana</i>-<i>Ledum palustre</i>-<i>Vaccinium</i> spp. (Clebsch 1957; Drew and Shanks 1965; Hanson 1953; Pegau 1968; Ugolini and Walters 1974; Young and Racine 1978) <i>Eriophorum vaginatum</i>-<i>Betula nana</i>-<i>Salix planifolia</i>-<i>Ledum palustre</i>-<i>Vaccinium</i> spp. (Johnson et al. 1966; Koranda 1960; Young 1974) <i>Eriophorum vaginatum</i>-<i>Betula nana</i>-<i>Salix lanata</i>-<i>Ledum palustre</i>-<i>Vaccinium</i> spp. (Webber et al. 1978) <i>Eriophorum vaginatum</i>-<i>Betula nana</i>-<i>Ledum palustre</i>-<i>Vaccinium</i> spp.-<i>Carex bigelowii</i> (Churchill 1955; Hopkins and Sigafoos 1951; Racine 1977; Viereck 1966; Young and Racine 1977) <i>Eriophorum vaginatum</i>-<i>Betula nana</i>-<i>Salix planifolia</i>-<i>Ledum palustre</i>-<i>Vaccinium</i> spp.-<i>Carex bigelowii</i> (Spetzman 1959; Webber et al. 1978) <i>Eriophorum vaginatum</i>-<i>Betula nana</i> (Batten 1977; Kessel and Schaller 1960; Komarkova and Webber 1980; Webber et al. 1978) <i>Carex bigelowii</i>-<i>Betula nana</i>-<i>Salix planifolia</i>-<i>Ledum palustre</i>-<i>Vaccinium</i> spp. (Racine and Anderson 1979; Racine and Young 1978)
D. Shrub tundra	(1) Willow	a. Willow-sedge – is largely concentrated north of the Brooks Range, where it occurs in the foothills and the arctic coastal plain b. Willow-grass – may not be a very widespread type; it has only been described from the arctic coastal plain.	<i>Salix planifolia</i>-<i>Carex aquatilis</i> (Komárková and Webber 1978, 1980) <i>Salix lanata</i>-<i>Carex aquatilis</i> (Webber and Walker 1975; Webber et al. 1978) <i>Salix lanata</i>-<i>Carex vaginata</i>/<i>Hylocomium splendens</i> (Hettinger and Janz 1974) <i>Salix planifolia</i>/<i>S. rotundifolia</i>-<i>S. phlebophylla</i>-<i>Petasites frigidus</i>-<i>Poa arctica</i>-<i>Luzula confusa</i> (Clebsch 1957)

Preliminary Classification for Alaska Vegetation (Continued)

Level I	Level II	Level III	Level IV	Level V
2. Tundra (continued)	D. Shrub tundra (continued)	(2) Birch and ericaceous shrubs	a. Birch and ericaceous shrubs-sedge – is common in interior and northern Alaska. b. Birch and ericaceous shrubs-grass – may not be a very widespread type. c. Birch and ericaceous shrubs-sphagnum – is widespread throughout northern and western Alaska. d. Crowberry – is characteristic of southern Alaska and the Aleutian Islands. e. Ericaceous shrubs – are abundant in most areas of the State except north of the Brooks Range.	<i>Betula nana</i>-<i>Ledum palustre</i>-<i>Vaccinium</i> spp.-<i>Carex bigelowii</i> (Bliss and Cantlon 1957; Churchill 1955; Hanson 1950, 1951) <i>Betula nana</i>-<i>Ledum palustre</i>-<i>Vaccinium</i> spp.-<i>Empetrum nigrum</i>-<i>Eriophorum vaginatum</i>-<i>Carex bigelowii</i>-<i>Arctagrostis latifolia</i> (Churchill 1955) <i>Betula nana</i>-<i>Ledum palustre</i>-<i>Vaccinium vitis-idaea</i>-<i>Empetrum nigrum</i>-<i>Arctagrostis latifolia</i>-<i>Hierochloa alpina</i> (Churchill 1955) <i>Betula nana</i>-<i>Ledum palustre</i>-<i>Vaccinium vitis-idaea</i>-<i>Arctagrostis latifolia</i> (Churchill 1955) <i>Betula nana</i>-<i>Ledum palustre</i>-<i>Vaccinium</i> spp.-<i>Rubus chamaemorus</i>/<i>Sphagnum</i> spp. (Drew and Shanks 1965; Fries 1977; Hanson 1953; Pegau and Hemming 1972; Webber et al. 1978; Young and Racine 1977) <i>Betula nana</i>-<i>Ledum palustre</i>-<i>Vaccinium vitis-idaea</i>-<i>Empetrum nigrum</i>-<i>Sphagnum</i> spp.-<i>Hylocomium</i> sp. (Young and Racine 1978; Palmer and Rouse 1945) <i>Empetrum nigrum</i>-<i>Cassiope stelleriana</i>-<i>Phyllodoce aleutica</i>-<i>Vaccinium</i> spp. (Cooper 1942; Heusser 1960) <i>Empetrum nigrum</i>-<i>Vaccinium</i> spp.-<i>Ledum palustre</i>-<i>Betula nana</i> (Griggs 1936; Racine and Young 1978) <i>Empetrum nigrum</i>-<i>Lycopodium</i> spp./<i>Brachythecium albicans</i>-<i>Cladonia</i> spp. (Bank 1951) <i>Empetrum nigrum</i>-<i>Carex pluriflora</i>-<i>C. macrochaeta</i>/<i>Cladonia</i> spp. (Bank 1951; Everett 1971; Hulten 1960; Shacklette et al. 1969) <i>Empetrum nigrum</i>-<i>Cassiope lycopodioides</i>-<i>Carex circinnata</i>/mosses (Byrd and Woolington 1977) <i>Empetrum nigrum</i>-<i>Arctostaphylos alpina</i> (Fries 1977) <i>Empetrum nigrum</i>-<i>Vaccinium uliginosum</i> (Hulten 1962) <i>Ledum palustre</i>-<i>Vaccinium</i> spp.-<i>Arctostaphylos alpina</i>-<i>Cassiope tetragona</i> (Johnson et al. 1966; Pegau and Hemming 1972) <i>Vaccinium</i> spp.-<i>Ledum palustre</i>-<i>Empetrum nigrum</i>-<i>Arctostaphylos alpina</i>/lichens (Hettinger and Janz 1974) <i>Vaccinium vitis-idaea</i>-<i>Empetrum nigrum</i>/<i>Cladonia</i> spp. (Racine and Anderson 1979) <i>Vaccinium uliginosum</i>-<i>Diapensia lapponica</i>-<i>Phyllodoce coerulea</i>-<i>Salix Polaroides</i>-<i>S. arctica</i> (Fries 1977) <i>Phyllodoce aleutica</i>-<i>Vaccinium</i> spp.-<i>Cassiope stelleriana</i>-<i>Empetrum nigrum</i> (Isleib and Kessel 1973; Palmer 1942) <i>Phyllodoce aleutica</i>-<i>Cassiope stelleriana</i> (Heusser 1960) <i>Phyllodoce aleutica</i>-<i>Cassiope</i> spp.-<i>Vaccinium</i> spp. (Klein 1965, Ward 1957) <i>Cassiope mertensiana</i>-<i>C. stelleriana</i>-<i>Empetrum nigrum</i> (Heusser 1954, 1960) <i>Phyllodoce aleutica</i>-<i>Cassiope mertensiana</i> (Jaques 1973)

		f. Undifferentiated understory — is a common type found in all areas of the State.	<i>Betula nana</i>-<i>Ledum palustre</i>-<i>Vaccinium</i> spp. (Batten 1977; Koranda 1960; Ugolini and Walters 1974; Webber et al. 1978; Williamson and Peyton 1962) <i>Betula nana</i>-<i>Vaccinium</i> spp.-<i>Empetrum nigrum</i> (Hulten 1966) <i>Betula nana</i>-<i>Ledum palustre</i>-<i>Empetrum nigrum</i>/<i>Cladonia</i> spp.-<i>Stereocaulon</i> spp. (Young and Racine 1978)
	(3) Mixed shrub	a. Mixed shrub-grass — may be a relatively rare type. b. Undifferentiated understory — is apparently a common type found in all tundra areas of the State.	<i>Salix glauca</i>-<i>Arctostaphylos rubra</i>-<i>Vaccinium uliginosum</i>-<i>Arctagrostis latifolia</i> (Hettinger and Janz 1974) <i>Betula nana</i>-<i>Ledum palustre</i>-<i>Vaccinium</i> spp.-<i>Salix planifolia</i> (Hanson 1953; Johnson et al. 1966; Koranda 1960) <i>Betula nana</i>-<i>Ledum palustre</i>-<i>Vaccinium</i> spp.-<i>Salix planifolia</i>/<i>Cladonia</i> spp.-<i>Cetraria</i> spp. (Hanson 1953; Pegau 1968) <i>Betula nana</i>-<i>Arctostaphylos alpina</i>-<i>Salix arctica</i>-<i>Dryas integrifolia</i> (Drew and Shanks 1965) <i>Betula nana</i>-<i>Vaccinium uliginosum</i>-<i>Salix reticulata</i>-<i>Dryas integrifolia</i>-<i>Cassiope tetragona</i> (Hettinger and Janz 1974) <i>Salix glauca</i>-<i>Dryas octopetala</i>-<i>Betula nana</i> (Hettinger and Janz 1974)
E. Mat and cushion tundra	(1) Open mat and cushion	a. Snowbed — occurs in alpine draws and on lee slopes where snow accumulates. b. <i>Dryas</i>-lichen — is widespread in northern and western Alaska. c. <i>Dryas</i>-herb — is common on dry exposed sites throughout the State.	<i>Luetkea pectinata</i>-<i>Phyllodoce aleutica</i>-<i>Cassiope</i> spp. (Racine and Young 1978; Streveler et al. 1973) <i>Salix rotundifolia</i> (Klein 1958; Komarkova and Webber 1978; White et al. 1975) <i>Salix rotundifolia</i>-<i>Oxyria digyna</i> (Anderson 1974) <i>Dryas octopetala</i>-lichens (Anderson 1974; Childs 1969; George et al. 1977; Hanson 1951; Spetzman 1959) <i>Dryas integrifolia</i>-lichens (Drew and Shanks 1965; Hanson 1951; Komarkova and Webber 1978; Webber and Walker 1975) <i>Dryas octopetala</i>-lichens-<i>Oxytropis nigrescens</i>-<i>Salix phlebophylla</i>-<i>Carex microchaeta</i> (Johnson et al. 1966) <i>Dryas octopetala</i>-<i>Stereocaulon tomentosum</i> (Scott 1974) <i>Dryas octopetala</i>-<i>Cetraria cucullata</i>-other lichens-<i>Rhacomitrium lanuginosum</i> (Scott 1974) <i>Dryas octopetala</i>-<i>Empetrum nigrum</i>-<i>Salix arctica</i>-<i>Cetraria</i> spp.-<i>Cladonia</i> spp. (Young and Racine 1978) <i>Dryas octopetala</i>-<i>Minuartia</i> spp.-<i>Saxifraga</i> spp. (Hettinger and Janz 1974; Nodler et al. 1978) <i>Dryas octopetala</i>-<i>Astragalus</i> spp.-<i>Hedysarum alpinum</i> (Hanson 1953; Johnson et al. 1966) <i>Dryas integrifolia</i>-<i>Oxytropis nigrescens</i>-<i>Carex rupestris</i> (Koranda 1960; Webber and Walker 1975) <i>Dryas integrifolia</i>-<i>Lupinus arcticus</i> (Churchill 1955) <i>Dryas integrifolia</i>-<i>Hedysarum alpinum</i>-<i>Festuca rubra</i> (Hanson 1951) <i>Dryas drummondii</i>-<i>D. integrifolia</i>-<i>Astragalus</i> spp.-<i>Oxytropis campestris</i>-<i>Hedysarum mackenzii</i> (Viereck 1966)

Preliminary Classification for Alaska Vegetation (Continued)

Level I	Level II	Level III	Level IV	Level V
2. Tundra (continued)	E. Mat and cushion tundra (continued)	(1) Open mat and cushion (continued)	d. Dryas-sedge – is common on dry exposed sites throughout the State.	<i>Dryas octopetala</i> - <i>Carex microchaeta</i> (Webber et al. 1978) <i>Dryas octopetala</i> - <i>Carex misandra</i> - <i>C. bigelowii</i> (Hanson 1951) <i>Dryas octopetala</i> - <i>Carex glacialis</i> (Gjaerevoll 1954) <i>Dryas octopetala</i> - <i>Carex nardina</i> - <i>C. vaginata</i> -lichen (George et al. 1977) <i>Dryas integrifolia</i> - <i>Carex scirpoidea</i> - <i>Kobresia simpliciuscula</i> (Koranda 1960)
			e. Willow – generally occurs on stony soils, from south-central Alaska north and west.	<i>Salix rotundifolia</i> (Webber 1978) <i>Salix ovalifolia</i> (Webber et al. 1978; White et al. 1975) <i>Salix reticulata</i> - <i>Carex microchaeta</i> - <i>Rhacomitrium lanuginosum</i> (Hettinger and Janz 1974) <i>Salix reticulata</i> - <i>Carex saxatilis</i> (Hettinger and Janz 1974) <i>Salix rotundifolia</i> - <i>Potentilla vahlana</i> - <i>Saxifraga oppositifolia</i> (Racine and Anderson 1979) <i>Salix polaris</i> - <i>Cetraria islandica</i> - <i>Cladina rangiferina</i> (Scott 1974) <i>Salix arctica</i> - <i>Carex nesophila</i> - <i>Cladina alpestris</i> - <i>Cetraria cucullata</i> (Klein 1958) <i>Salix arctica</i> - <i>S. rotundifolia</i> - <i>Empetrum nigrum</i> (Shacklette et al. 1969) <i>Salix rotundifolia</i> - <i>S. ovalifolia</i> - <i>Cassiope lycopodioides</i> - <i>Empetrum nigrum</i> (Shacklette et al. 1969)
			f. Ericaceous shrubs – occur in shallow, stony soils in the mountains or at low elevations.	<i>Vaccinium vitis-idaea</i> - <i>Salix phlebophylla</i> - <i>Arctostaphylos alpina</i> (Anderson 1974) <i>Ledum palustre</i> - <i>Salix reticulata</i> - <i>Dryas octopetala</i> - <i>Empetrum nigrum</i> - <i>Poa alpina</i> (Hettinger and Janz 1974) <i>Loiseleuria procumbens</i> - <i>Vaccinium uliginosum</i> - <i>Salix arctica</i> - <i>Ledum palustre</i> (Griggs 1936)
			g. Open lichen – occurs on extremely harsh, windblown rocky sites with little or no soil development.	<i>Umbilicaria</i> spp.- <i>Rhizocarpon</i> spp. (Anderson 1974; Hanson 1953; Kessel and Schaller 1960; Klein 1958; Pegau 1968; Rausch and Rausch 1968; Webber et al. 1978) <i>Cladina</i> spp.- <i>Cetraria</i> spp.- <i>Stereocaulon</i> sp. (Johnson et al. 1966)
		(2) Closed mat and cushion	a. Prostrate shrubs and herbs on flood plains – occur along rivers in interior Alaska, northward and westward.	<i>Dryas integrifolia</i> - <i>Poa glauca</i> - <i>Oxytropis borealis</i> (Koranda 1960) <i>Dryas octopetala</i> - <i>Anemone drummondii</i> - <i>Lesquerella arctica</i> - <i>Crepis nana</i> (Drew and Shanks 1965)
			b. Mat and cushion-sedge – is found in all sections of Alaska except southeastern.	<i>Dryas octopetala</i> - <i>Carex scirpoidea</i> (Gjaerevoll 1954) <i>Dryas octopetala</i> - <i>Kobresia myosuroides</i> (Drew and Shanks 1965; Johnson et al. 1966; Spetzman 1959) <i>Dryas octopetala</i> - <i>Kobresia simpliciuscula</i> (Gjaerevoll 1954) <i>Dryas octopetala</i> - <i>Vaccinium vitis-idaea</i> - <i>Luzula</i> spp.- <i>Carex misandra</i> (Childs 1969) <i>Dryas octopetala</i> - <i>Carex franklinii</i> (Gjaerevoll 1954) <i>Dryas octopetala</i> - <i>Salix arctica</i> - <i>Carex bigelowii</i> -mosses (Anderson 1974)

- Dryas octopetala*-*Salix reticulata*-*Carex bigelowii* (Hanson 1950, 1953; Viereck 1963)
Salix reticulata-*Dryas octopetala*-*Carex podocarpa* (Scott 1974)
Vaccinium uliginosum-*Dryas octopetala*-*Carex bigelowii* (Anderson 1974)
Dryas integrifolia-*Salix reticulata*-*Carex scirpoidea* (Batten 1977; Drew and Shanks 1965; Hettinger and Janz 1974)
Dryas integrifolia-*Salix reticulata*-*Carex bigelowii* (Hettinger and Janz 1974)
Dryas integrifolia-*Carex misandra*-*Rhytidium rugosum* (Hettinger and Janz 1974)
Dryas integrifolia-*Vaccinium* spp.-*Carex* spp. (Drew and Shanks 1965)
Salix polaris-*S. reticulata*-*Hylocomium splendens*-*Carex podocarpa* (Scott 1974)
- c. Mat and cushion-grass – may not be a very abundant type.
Vaccinium vitis-idaea-*Dryas octopetala*-*Empetrum nigrum*-*Festuca altaica* (Scott 1974)
Salix ovalifolia-*Empetrum nigrum*-*Festuca rubra*-*Calamagrostis deschampsiioides* (Hanson 1951)
- d. *Dryas* – is a very widespread type throughout Alaska except south-central and southeastern.
Dryas octopetala (Viereck 1963)
Dryas octopetala-*Salix reticulata*-*Cassiope tetragona* (Anderson 1974; Batten 1977; Kessel and Schaller 1960; Viereck 1962a, 1963)
Dryas octopetala-*Vaccinium uliginosum*-*Salix reticulata* (Anderson 1974)
Dryas octopetala-*Arctostaphylos alpina* (Webber et al. 1978; Young 1974)
Dryas octopetala-*Arctostaphylos alpina*-*Tomenthypnum nitens*-*Carex bigelowii* (Webber et al. 1978)
Dryas octopetala-*Diapensia lapponica*-*Loiseleuria procumbens*-*Vaccinium vitis-idaea*-lichens (Racine and Young 1978)
Dryas octopetala-*Cetraria* spp.-*Cladonia* spp. (Pegau 1968; Viereck 1962a)
Dryas integrifolia (Komárková and Webber 1978, 1980; Webber and Walker 1975)
Dryas integrifolia-*Cassiope tetragona* (Komarkova and Webber 1978, 1980; Koranda 1960)
Dryas integrifolia-*Arctostaphylos rubra* (Koranda 1960; Webber et al. 1978)
- e. *Cassiope* – is a widespread type, usually in relatively mesic or shaded settings, in interior, western, and northern Alaska.
Cassiope tetragona (Anderson 1974; Komarkova and Webber 1978, 1980; Pegau 1968; Scott 1974; Webber et al. 1978)
Cassiope tetragona-*Salix rotundifolia*-mosses (Batten 1977, Webber and Walker 1975)
Cassiope tetragona-*Vaccinium uliginosum*-mosses (Hanson 1953; Scott 1974)
Cassiope tetragona-*Vaccinium vitis-idaea* (Childs 1969; Webber et al. 1978)

Preliminary Classification for Alaska Vegetation (Continued)

Level I	Level II	Level III	Level IV	Level V
2. Tundra (continued)	E. Mat and cushion tundra (continued)	(2) Closed mat and cushion (continued)	f. Bearberry — is common on the Seward Peninsula.	<i>Arctostaphylos alpina</i> - <i>Vaccinium vitis-idaea</i> (Hanson 1953) <i>Arctostaphylos alpina</i> - <i>Rhododendron camtschaticum</i> (Pegau 1968) <i>Arctostaphylos rubra</i> - <i>Cladonia</i> (Webber et al. 1978)
3. Shrub-land	A. Tall shrub	(1) Closed tall shrub	a. Willow — (sometimes called willow thickets) is especially characteristic of flood plains and common in interior, western, and northern Alaska.	<i>Salix alaxensis</i> (Bliss and Cantlon 1957; Griggs 1936; Hanson 1953; Johnson et al. 1966; Pegau and Hemming 1972; Spetzman 1959; Viereck 1963) <i>Salix alaxensis</i> - <i>S. glauca</i> - <i>S. lanata</i> (Drew and Shanks 1965; Komarkova and Webber 1980; Spetzman 1959; Wiggins and Thomas 1962; Young 1974) <i>Salix alaxensis</i> - <i>S. planifolia</i> (Johnson et al. 1966; Young and Racine 1977) <i>Salix alaxensis</i> - <i>S. arbusculoides</i> - <i>S. glauca</i> / <i>Equisetum arvense</i> - <i>Pyrola grandiflora</i> (Batten 1977; Bliss and Cantlon 1957) <i>Salix alaxensis</i> - <i>S. arbusculoides</i> / <i>Calamagrostis canadensis</i> - <i>Equisetum pratense</i> (Hulten 1966) <i>Salix planifolia</i> (Hopkins and Sigafos 1951; Hulten 1962; Johnson et al. 1966) <i>Salix glauca</i> - <i>S. planifolia</i> - <i>S. lanata</i> (Batten 1977; Childs 1969; Griggs 1936; Hanson 1953; Koranda 1960; Pegau 1968; Racine and Anderson 1979; Racine 1977; Viereck 1962a) <i>Salix barclayi</i> (del Moral and Watson 1978; Hulten 1960) <i>Alnus crispa</i> / <i>Calamagrostis canadensis</i> (Young and Racine 1977)
			b. Alder — closed <i>Alnus sinuata</i> communities are common in south-central and southeastern Alaska. In southwestern, northwestern, and interior Alaska, closed stands of <i>Alnus crispa</i> are common.	<i>Alnus crispa</i> / <i>Calamagrostis canadensis</i> (Hanson 1953; Viereck 1962a) <i>Alnus crispa</i> - <i>Salix arbusculoides</i> - <i>S. glauca</i> / <i>Delphinium glaucum</i> - <i>Aconitum delphinifolium</i> - <i>Calamagrostis</i> spp. (Viereck 1963) <i>Alnus sinuata</i> (Cooper 1942; Palmer 1942; Young and Racine 1978) <i>Alnus sinuata</i> / <i>Calamagrostis canadensis</i> (Hulten 1960, 1962) <i>Alnus sinuata</i> / <i>Rubus spectabilis</i> (Heusser 1960; Isleib and Kessel 1973; Streveler and Paige 1971) <i>Alnus tenuifolia</i> / <i>Calamagrostis canadensis</i> (Hanson 1953)
			c. Shrub birch — is generally found in openings in taiga in interior Alaska near tree line.	<i>Betula glandulosa</i> (Hanson 1953)
			d. Alder-willow — occurs on flood plain terraces and drainageways on slopes.	<i>Alnus crispa</i> - <i>Salix planifolia</i> / <i>Carex bigelowii</i> (George et al 1977; Racine and Anderson 1979) <i>Alnus crispa</i> - <i>Salix glauca</i> / <i>Arctagrostis latifolia</i> - <i>Pyrola grandiflora</i> (Churchill 1955) <i>Alnus crispa</i> - <i>Salix lanata</i> - <i>S. planifolia</i> - <i>S. glauca</i> (Bliss and Cantlon 1957)
			e. Shrub birch-willow — is apparently not a very common type but present on the Seward Peninsula.	<i>Betula glandulosa</i> - <i>Salix planifolia</i> - <i>S. lanata</i> - <i>Alnus crispa</i> (Hanson 1953)

	(2) Open tall shrub	a. Willow — occupies a variety of sites, from dunes to river banks; most common in interior, western, and northern Alaska. b. Alder — is not nearly as abundant as closed alder communities but can be found throughout the State. c. Shrub birch — occurs at and above tree line, especially in the Alaska Range. d. Alder-willow — occurs on flood plain terraces and steep slopes near tree line in interior and northern Alaska. e. Shrub birch-willow — occurs in the tree line zone, especially in the Alaska Range and western Alaska; this type has not yet been described.	<i>Salix alaxensis</i>-<i>S. glauca</i> (Komarkova and Webber 1980) <i>Salix alaxensis</i>/<i>Arctostaphylos rubra</i> (Webber et al. 1978) <i>Salix alaxensis</i>/<i>Astragalus alpinus</i>-<i>Epilobiurn latifolium</i> (Webber et al. 1978) <i>Salix alaxensis</i>/<i>Shepherdia canadensis</i>/<i>Dryas octopetala</i>-<i>Arctostaphylos rubra</i>-<i>Cladonia pyxidata</i> (Scott 1974) <i>Salix brachycarpa</i>-<i>S. barclayi</i>-<i>S. glauca</i>/<i>Hylocomium splendens</i> (Viereck 1966) <i>Salix plani folia</i>-<i>S. glauca</i>/<i>Calamagrostis canadensis</i>-<i>Epilobiurn angustifoliurn</i>-<i>Equisetum pratense</i> (Young and Racine 1978) <i>Alnus crispa</i>/<i>Calamagrostis canadensis</i> (Young and Racine 1977) <i>Betula glandulosa</i>/<i>Ledum palustre</i>- <i>Vacciniurn spp.</i>-<i>Arctostaphylos alpina</i>-<i>Festuca altaica</i> (Batten et al. 1979) <i>Alnus crispa</i>-<i>Salix lanata</i>-<i>S. planifolia</i>/<i>Ledum palustre</i>-<i>Carex bigelowii</i>/<i>Sphagnum</i> spp. (Viereck 1963)
B. Low shrub	(1) Closed low shrub	a. Dwarf birch — thickets are not common but do occur on the Seward Peninsula and in interior Alaska. b. Low willow — is common in interior, western, and northern Alaska. c. Dwarf birch-willow — has not yet been described.	<i>Betula nana</i> (Hopkins and Sigafos 1951; Racine and Anderson 1979) <i>Betula glandulosa</i>/<i>Pleurozium schreberi</i>-<i>Hylocorniurn splendens</i> (Viereck 1966) <i>Salix planifolia</i>/<i>Equisetum arvense</i> (Webber et al. 1978) <i>Salix glauca</i>-<i>S. planifolia</i>-<i>S. lanata</i> (Pegau 1968; Racine 1977)
	(2) Open low shrub	a. Dwarf birch — is common in the Alaska Range and on the Seward Peninsula. b. Low willow — is common in interior, northern, and western Alaska.	<i>Betula glandulosa</i>/<i>Hylocomium splendens</i> (Hettinger and Janz 1974; Viereck 1966) <i>Betula glandulosa</i>/<i>Vaccinium uliginosum</i>-<i>Carex bigelowii</i>/<i>Aulacomnium palustre</i>-<i>Hylocorniurn splendens</i> (Scott 1974) <i>Betula glandulosa</i>/<i>Vaccinium uliginosum</i>-<i>Ledum palustre</i>/<i>Cladonia</i>-<i>Cetraria</i> (Kessel and Schaller 1960; Pegau 1968) <i>Betula glandulosa</i>/<i>Vaccinium uliginosum</i>-<i>Festuca altaica</i>/<i>Dryas integrifolia</i>-<i>Salix reticulata</i>-<i>Cetraria cucullata</i>-<i>Cladonia</i> spp. (Viereck 1962b) <i>Betula glandulosa</i>/<i>Ledum palustre</i>- <i>Vacciniurn vitis-idaea</i> (Anderson 1974)

Preliminary Classification for Alaska Vegetation (Continued)

Level I	Level II	Level III	Level IV	Level V
3. Shrub-land (continued)	B. Low shrub (continued)	(2) Open low shrub (continued)	b. Low willow – is common in interior, northern, and western Alaska. c. Dwarf birch-willow – is present in interior and northern Alaska. d. Low alder – <i>Alnus crispa</i> forms low thickets at the north edge of its range in the Brooks Range and arctic foothills. e. Low alder-willow – is an uncommon type found on flood plains in northern Alaska, at the northern edge of the range of alder. f. Shepherdia-dryas – occurs on flood plains in interior Alaska. g. Dwarf birch-sphagnum – has not yet been described in Alaska. h. Mixed shrub-sphagnum – is common in interior and western Alaska.	<i>Salix planifolia</i>/<i>Carex bigelowii</i>-<i>Petasites frigidus</i>/<i>Hylocomium splendens</i> (Hettinger and Janz 1974) <i>Salix planifolia</i>/<i>Carex podocarpa</i>-<i>Petasites frigidus</i> (Anderson 1974) <i>Salix planifolia</i>/<i>Carex bigelowii</i>-<i>Arctagrostis latifolia</i> (Churchill 1955) <i>Salix glauca</i>/<i>Petasites frigidus</i> (Churchill 1955) <i>Salix glauca</i>/<i>Dryas octopetala</i> (Webber et al. 1978) <i>Salix glauca</i>/<i>S. reticulata</i>-<i>Carex podocarpa</i>-<i>Artemisia arctica</i> (Scott 1974) <i>Salix glauca</i>/<i>Arctostaphylos rubra</i>-<i>Dryas octopetala</i>-<i>Salix reticulata</i>-<i>Oxytropis deflexa</i> (Scott 1974) <i>Salix glauca</i>/<i>Arctostaphylos alpina</i> (Webber et al. 1978) <i>Salix lanata</i>-<i>S. glauca</i>/<i>Dryas integrifolia</i> (Komarkova and Webber 1980) <i>Salix lanata</i>/<i>Equisetum arvense</i> (Webber et al. 1978) <i>Betula nana</i>-<i>Salix brachycarpa</i>-<i>S. planifolia</i>-<i>S. lanata</i>/<i>Arctostaphylos rubra</i>-<i>Cassiope tetragona</i>-<i>Ledum palustre</i> (Spetzman 1959) <i>Salix arbusculoides</i>-<i>S. glauca</i>-<i>S. hastata</i>-<i>Betula glandulosa</i>/<i>Bromus pumellianus</i>-<i>Festuca altaica</i> (Batten 1977) <i>Betula glandulosa</i>-<i>Salix glauca</i>-<i>S. planifolia</i>/<i>Festuca altaica</i>-<i>Vaccinium vitis-idaea</i>-<i>Arctostaphylos alpina</i>/<i>Hylocomium splendens</i> (Vioreck 1963) <i>Salix glauca</i>-<i>Betula nana</i> (Childs 1969) <i>Alnus crispa</i>/<i>Vaccinium uliginosum</i> <i>Ledum palustre</i>-<i>Betula nana</i>-<i>Carex bigelowii</i>/<i>Hylocomium splendens</i>-<i>Aulacomnium palustre</i> (Bliss and Cantlon 1957) <i>Alnus crispa</i>-<i>Salix</i> spp./<i>Carex bigelowii</i>-<i>Empetrum nigrum</i>-<i>Vaccinium vitis-idaea</i>/<i>Cetraria cucullata</i>-<i>Cladonia</i> spp. (Bliss and Cantlon 1957) <i>Shepherdia canadensis</i>/<i>Dryas octopetala</i> (Scott 1974) <i>Betula nana</i>-<i>Ledum palustre</i>-<i>Vaccinium vitis-idaea</i>-<i>Carex</i> spp.-<i>Rubus chamaemorus</i>/<i>Sphagnum</i> spp. (Hanson 1953) <i>Empetrum nigrum</i>-<i>Vaccinium</i> spp.-<i>Carex pluriflora</i>-<i>Rubus chamaemorus</i>/<i>Sphagnum</i> spp. (Hulten 1960) <i>Myrica gale</i>-<i>Betula glandulosa</i>/<i>Carex kelloggii</i>-<i>Rubus chamaemorus</i>/<i>Sphagnum</i> spp. (Griggs 1936)

4. Herba- ceous vegetation	A. Tall grass	(1) Bluejoint	a. Bluejoint meadow – is found throughout the State except for southeastern and northern Alaska; occupies large areas in south-central and southwestern Alaska.	<i>Calamagrostis canadensis</i> (Bank 1951; Fries 1977; Hanson 1953; Heusser 1960; Hulten 1966; Pegau and Hemming 1972) <i>Calamagrostis nutkaensis/Festuca rubra</i> (Amundsen and Clebsch 1971; Byrd and Woolington 1977)
		(2) Bluejoint-herb	a. Bluejoint-fireweed – is widely distributed in the southern half of the State. It thrives in disturbed areas. b. Bluejoint-mixed herbs – are moist to wet meadow types located in southwestern, south-central, and southeastern Alaska.	<i>Calamagrostis canadensis-Epilobium angustifolium</i> (Hanson 1951; Klein 1958; Young and Racine 1978) <i>Calamagrostis canadensis-Epilobium angustifolium-Geranium erianthum</i> (Heusser 1960) <i>Calamagrostis canadensis-Thalictrum minus-Geranium erianthum-Epilobium angustifolium</i> (Hulten 1960) <i>Calamagrostis canadensis-Epilobium angustifolium-Heracleum lanatum-Angelica genuflexa</i> (Griggs 1936) <i>Calamagrostis canadensis-Deschampsia beringensis-Heracleum lanatum-Angelica lucida</i> (Bank 1951)
		(3) Bluejoint-shrub	a. Bluejoint-alder – is extensive in southwestern Alaska but virtually unknown throughout the rest of the State.	<i>Calamagrostis canadensis-Alnus sinuata</i> (Griggs 1936)
		(4) Herbs	a. Mixed herbs – occur on mesic slopes and streambanks from south-central Alaska to the Aleutian Islands.	<i>Aconitum delphinifolium-Aquilegia formosa-Sanguisorba stipulata-Geranium erianthum</i> (Cooper 1942) <i>Streptopus amplexifolius-Linnæa borealis-Juncus arcticus</i> (Bank 1951) <i>Platanthera</i> spp.- <i>Fritillaria camschatcensis-Polygonum viviparum-Erigeron peregrinus</i> (Bank 1951) <i>Athyrium filix-femina-Carex lyngbyaei-Heracleum lanatum-Geum macrophyllum</i> (Shacklette et al. 1969) <i>Potentilla egedii-Festuca rubra</i> (del Moral and Watson 1978)
			b. Fireweed – occurs on disturbed areas in south-central and southeastern Alaska.	<i>Epilobium angustifolium</i>
			c. Cow parsnip – occurs on moist to wet areas, often along drainages, in southeastern and south-central Alaska and the Aleutian Islands.	<i>Heracleum lanatum-Veratrum viride-Senecio triangularis</i> (Cooper 1942) <i>Heracleum lanatum-Athyrium filix-femina-Angelica lucida/Claytonia sibirica/Cardamine umbellata-Coptis trifolia/mosses</i> (Byrd and Woolington 1977)
			d. Ferns – are restricted to localized areas in southeastern and south-central Alaska and in the Aleutian Islands.	<i>Athyrium filix-femina-Cystopteris fragilis-Botrychium</i> spp.- <i>Gymnocarpium dryopteris</i> (Bank 1951)
		(5) Elymus	a. Coastal elymus – grows on beaches out of reach of normal tides along the entire Alaska coastline.	<i>Elymus arenarius</i> (Bank 1951; George et al. 1977; Griggs 1936; Hanson 1953; Klein 1958; Shacklette et al. 1969; Spetzman 1959; Stephens and Billings 1967; Ugolini and Walters 1974; Young 1971)

Preliminary Classification for Alaska Vegetation (Continued)

Level I	Level II	Level III	Level IV	Level V
4. Herbaceous vegetation (continued)	A. Tall grass (continued)	(5) Elymus (continued)	b. Coastal elymus-herb — has approximately the same distribution as the coastal elymus type.	<i>Elymus arenarius-Honckenya peploides-Mertensia maritima</i> (Fries 1977; Johnson et al. 1966; Potter 1972; Wiggins and Thomas 1962) <i>Elymus arenarius-Senecio pseudoarnica-Lathyrus maritimus</i> (Bank 1951; Hulten 1960; Rausch and Rausch 1968) <i>Elymus arenarius-Lathyrus maritimus-Poa eminens</i> (Hanson 1953) <i>Elymus arenarius-Ligusticum scoticum-Anemone narcissiflora</i> (Shacklette et al. 1969) <i>Elymus arenarius-Heracleum lanatum-Claytonia sibirica</i> (Byrd and Woolington 1977)
			c. Dune elymus — is common on dune systems, usually on or near the coast.	<i>Elymus arenarius-Festucarubra</i> (Palmer and Rouse 1945) <i>Elymus arenarius-Lathyrus maritimus-Senecio pseudoarnica-Angelica lucida</i> (Fries 1977) <i>Elymus arenarius-Polemonium boreale-Seneciopseudoarnica</i> (Young and Racine 1978) <i>Elymus arenarius-Dryas integrifolia</i> (Komarkova and Webber 1980)
			d. Inland shore elymus — occurs on gravel outwash flats and lake beach ridges on the Seward Peninsula	<i>Elymus arenarius</i> (Racine and Anderson 1979)
		(1) Dry midgrass	a. Dry elyrnus — is a relatively uncommon type that occurs in the Alaska Range and possibly in interior Alaska and the Brooks Range.	<i>Elymus innovatus-Festuca altaica/Hylocomium splendens</i> (Viereck 1966) <i>Elymus innovatus-Poa glauca</i> (Hanson 1951)
			b. Grass-shrub — is common on localized, steep, south-facing bluffs in interior and south-central Alaska.	<i>Festuca altaica-Salix lanata-Artemisia arctica</i> (Scott 1974) <i>Calamagrostis purpurascens-Artemisia frigida</i> (Hanson 1951) <i>Festuca altaica-Vaccinium vitis-idaea-V. uliginosum-Dryas octopetala</i> (Hanson 1951) <i>Festuca altaica-Empetrum nigrum-Salix reticulata</i> (Scott 1974)
			c. Dry bluejoint — is a bluejoint type of low stature occurring on dry sites, especially near the northern and western limits of the range of bluejoint.	<i>Calamagrostis canadensis</i> (Burns 1964; Hanson 1953; Pegau 1968)
			d. Dry fescue — occupies dry slopes in interior, south-central, and western Alaska.	<i>Festuca altaica</i> (Hanson 1951, 1953) <i>Festuca altaica-Calamagrostis canadensis</i> (Hanson 1951)
	B. Midgrass	(1) Dry midgrass		

	(2) Mesic midgrass	a. Midgrass-herb – occupies a variety of sites, from alpine meadows to streambanks. It is found in the Aleutian Islands and in southwestern, south-central, and interior Alaska. b. Hair-grass – is common in the Aleutian Islands and along the southern coast of Alaska.	<i>Festuca altaica</i>-<i>Anemone narcissiflora</i> (Anderson 1974; Pegau and Hemming 1972) <i>Festuca altaica</i>-<i>Lupinus arcticus</i> (Scott 1974) <i>Festuca altaica</i>-<i>Carex podocarpa</i>-<i>Aconitum delphinifolium</i>-<i>Mertensia paniculata</i>-<i>Artemisia arctica</i> (Hanson 1951) <i>Festuca altaica</i>-<i>Sanguisorba stipulata</i>-<i>Lycopodium alpinum</i>-<i>Salix reticulata</i>/Hydnaceae (Hanson 1951) <i>Festuca altaica</i>-<i>Calamagrostis canadensis</i>-<i>Cornus canadensis</i>-<i>Geranium erianthum</i> (Hanson 1951) <i>Festuca rubra</i>-<i>Angelica lucida</i>-<i>Achillea borealis</i>-<i>Cardamine umbellata</i> (Byrd and Woolington 1977) <i>Poa eminens</i>-<i>Deschampsia beringensis</i>-<i>Festuca rubra</i> (Shacklette et al. 1969) <i>Deschampsia beringensis</i> (Hanson 1951)
C. Sedge-grass	(1) Wet sedge-grass (fresh water)	a. Sedge marsh – occurs primarily in the southern part of the State and in the Aleutian Islands. b. Moss-sedge marsh – occurs primarily in southeastern and south-central Alaska and in the Aleutian Islands. c. Herb marsh – is a rare type that has been reported from the Aleutian Islands.	<i>Carex lyngbyaei</i> (Batten et al. 1978; Byrd and Woolington 1977; Griggs 1936; Hulten 1960) <i>Carex nigricans</i>-<i>C. limosa</i> (Cooper 1942) <i>Carex pluriflora</i>-<i>Trichophorum caespitosum</i>-<i>Eriophorum russeolum</i>-<i>Polygonum viviparum</i>-<i>Erigeron peregrinus</i> (Bank 1951) <i>Carex rostrata</i>-<i>Eriophorum angustifolium</i>-<i>Calamagrostis canadensis</i>-<i>Cicuta mackenziana</i> (Young and Racine 1978) <i>Carex lyngbyaei</i>-<i>C. pluriflora</i>-<i>C. anthoxantha</i>-<i>C. macrochaeta</i> (Shacklette et al. 1969) <i>Carex pluriflora</i> (Batten et al. 1978) <i>Scirpus validus</i> (Batten et al. 1978; del Moral and Watson 1978) <i>Carex mackenziei</i> (del Moral and Watson 1978) <i>Scapania paludosa</i>-<i>Nardia scalaris</i>-<i>Marsipella marginata</i> (Shacklette et al. 1969) <i>Philonotis fontana</i>-<i>Parnassia kotzebuei</i> (Shacklette et al. 1969) <i>Sphagnum teres</i>-<i>S. squarrosum</i>-<i>S. magellanicum</i>-<i>S. compactum</i>-<i>S. papillosum</i>-<i>S. girgensohnii</i> (Shacklette et al. 1969) <i>Caltha palustris</i>-<i>Claytonia sibirica</i> (Shacklette et al. 1969)
	(2) Saline sedge-grass (tidal marsh)	a. Halophytic grass – occurs on sheltered, gently sloping sites with silty substrates along the entire Alaska coastline. b. Halophytic sedge – occurs on sheltered sites along the Alaska coastline.	<i>Puccinellia phryganodes</i> (Jefferies 1977) <i>Puccinellia langeana</i> (Griggs 1936) <i>Puccinellia nutkaensis</i> (Batten et al. 1978) <i>Puccinellia grandis</i> (Batten et al. 1978) <i>Carex lyngbyaei</i> (Batten et al. 1978; del Moral and Watson 1978; Stephens and Billings 1967) <i>Carex subspathacea</i> (Hanson 1951) <i>Carex subspathacea</i>-<i>Puccinellia phryganodes</i> (Webber et al. 1978) <i>Carex ramenskii</i> (Batten et al. 1978; Jefferies 1977) <i>Carex ramenskii</i>-<i>Potentilla egedii</i> (George et al. 1977) <i>Eleocharis palustris</i> (del Moral and Watson 1978)

Preliminary Classification for Alaska Vegetation (Continued)

Level I	Level II	Level III	Level IV	Level V
4. Herba- ceous vegetation (continued)	C. Sedge- grass (continued)	(2) Saline sedge-grass (tidal marsh) (continued)	c. Halophytic herbs – are generally located seaward from the band of <i>Elymus arenarius</i> .	<i>Mertensia maritima</i> - <i>Honckenya peploides</i> (Amundsen and Clebsch 1971; Britton 1967; Griggs 1936; Hanson 1953; Potter 1972; Spetzman 1959; Thomas 1951) <i>Cochlearia officinalis</i> (Wiggins and Thomas 1962) <i>Cochlearia officinalis</i> - <i>Lathyrus maritimus</i> (Bank 1951) <i>Cochlearia officinalis</i> - <i>Puccinellia phryganodes</i> (Webber et al. 1978) <i>Honckenya peploides</i> - <i>Senecio pseudoarnica</i> (Shacklette et al 1969; Young 1971) <i>Cochlearia officinalis</i> - <i>Achillea borealis</i> - <i>Draba hyperborea</i> (Byrd and Woolington 1977) <i>Plantago maritima</i> - <i>Triglochin maritimum</i> - <i>Puccinellia</i> spp. (Batten et al. 1978) <i>Cochlearia officinalis</i> - <i>Fucus distichus</i> (Batten et al. 1978) <i>Juncus arcticus</i> (del Moral and Watson 1978)
		(3) Mesic sedge-grass	a. Sedge-grass – is found in south-central Alaska and on the Aleutian Islands. b. Sedge – is found on the Aleutian Islands.	<i>Calamagrostis canadensis</i> - <i>Carex macrochaeta</i> (Hanson 1951) <i>Carex macrochaeta</i> - <i>Festuca rubra</i> (Byrd and Woolington 1977) <i>Carex lyngbyaei</i> - <i>C. macrochaeta</i> - <i>Cladina impexa</i> (Shacklette et al. 1969)
5. Aquatic vegetation	A. Freshwater	(1) Ponds and lakes	a. Floating and submerged vegetation – is common through- out the State, except rare on the arctic coastal plain. b. Emergent vegetation – is common throughout the State.	<i>Ranunculus trichophyllus</i> - <i>Hippuris vulgaris</i> (Hanson 1953; Shacklette et al. 1969) <i>Sparganium hyperboreum</i> - <i>Potamogeton perfoliatus</i> (Hulten 1960, 1966) <i>Potamogeton</i> spp.- <i>Myriophyllum spicatum</i> (Batten et al. 1978) <i>Ranunculus hyperboreus</i> - <i>R. gmelini</i> - <i>R. trichophyllus</i> (Johnson et al. 1966) <i>Nuphar polysepalum</i> (Batten et al. 1978; Griggs 1936) <i>Isoetes muricata</i> - <i>Ranunculus reptans</i> - <i>Limosella aquatica</i> (Shacklette et al. 1969) <i>Siphula ceratites</i> - <i>Scapania paludosa</i> (Shacklette et al. 1969) <i>Subularia aquatica</i> - <i>Callitriche anceps</i> (Shacklette et al. 1969) <i>Arctophila fulva</i> (Clebsch 1957; Komarkova and Webber 1978, 1980; Potter 1972; Rausch and Rausch 1968; Webber 1978, Webber and Walker 1975; Wiggins and Thomas 1962) <i>Arctophila fulva</i> - <i>Hippuris vulgaris</i> - <i>Ranunculus pallasii</i> - <i>Potentilla palustris</i> (Johnson et al. 1966) <i>Hippuris vulgaris</i> (Potter 1972) <i>Menyanthes trifoliata</i> - <i>Ranunculus pallasii</i> (Webber et al. 1978) <i>Cicuta mackenzieana</i> - <i>Hippuris vulgaris</i> - <i>Menyanthes trifoliata</i> - <i>Equisetum fluviatile</i> (Hulten 1966)

	(2) Streams	a. Floating and submerged vegetation — is relatively rare but occurs in the southern two-thirds of the State. b. Emergent vegetation — is common throughout the State.	<i>Fontinalis neomexicana</i>-<i>Ranunculus trichophyllus</i> (Bank 1951; Shacklette et al. 1969) <i>Ranunculus hyperboreus</i>-<i>R. trichophyllus</i> (Griggs 1936) <i>Arctophila fulva</i> (Hulten 1966) <i>Potentilla palustris</i>-<i>Menyanthes trifoliata</i>-<i>Caltha palustris</i> (Griggs 1936)
B. Saltwater	(1) Estuarine		
	(2) Intertidal		

Key to Levels I, II, and III of the Proposed Classification of Alaska Vegetation

Although the classification is based primarily on the vegetation, it was necessary to use location and site characteristics for key characteristics in some instances. When more quantitative information is available on the plant communities it should be possible to separate the types based only on vegetation characteristics. Since the aquatic vegetation classification has not been developed, this key includes only the four terrestrial classes.

1. Trees present and with canopy cover of 10 percent or more 1 *Forest*. 2.
1. Trees absent or nearly so, with less than 10-percent cover 9.
2. Over 75 percent of tree cover contributed by
conifer species 1-A *Conifer forest* 3.
2. Less than 75 percent of tree cover contributed
by conifer species 5.
3. Tree canopy of 60- to 100-percent cover 1-A-(1) *Closed conifer forest*
3. Tree canopy of less than 60-percent cover 4.
4. Tree canopy of 25- to 59-percent cover 1-A-(2) *Open conifer forest*
4. Tree canopy of 10- to 24-percent cover 1-A-(3) *Conifer woodland*
5. Over 75 percent of tree cover contributed by
deciduous species 1-B *Deciduous forest* 6.
5. Deciduous or conifer species contribute
25 to 74 percent of tree cover 1-C *Mixed conifer and deciduous forest* 8.
6. Tree canopy of 60- to 100-percent cover 1-B-(1) *Closed deciduous forest*
6. Tree canopy of less than 60-percent cover 7.
7. Tree canopy of 25- to 59-percent cover 1-B-(2) *Open deciduous forest*
7. Tree canopy of 10- to 24-percent cover 1-B-(3) *Deciduous woodland*
8. Tree canopy of 60- to 100-percent cover 1-C-(1) *Closed mixed forest*
8. Tree canopy of 25- to 59-percent cover 1-C-(2) *Open mixed forest*
9. Vegetation dominated by erect to decumbent
(but not matted) woody shrubs; shrub cover
at least 25 percent 3 *Shrubland* and 2-D *Shrub tundra* 10.
9. Vegetation herbaceous or of low, cushionlike shrubs,
less than 20 centimeters (8 inches) in height; taller shrubs
if present with less than 25-percent cover. 14.
10. Shrubs more than 1.5 meters (5 feet) tall 3-A *Tall shrubland* 12.
10. Shrubs less than 1.5 meters (5 feet) tall 11.
11. Shrubs associated with typical tundra sedges,
herbs, and mosses. Located in areas above
or beyond the limit of trees 2-D *Shrub tundra*. 25.
11. Shrubs not associated with tundra species. Located
adjacent to tree line or in forested region 3-B *Lowshrubland*. 13.
12. Shrub canopy cover greater than 75 percent 3-A-(1) *Closed tall shrubland*
12. Shrub canopy cover 25 to 75 percent 3-A-(2) *Open tall shrubland*
13. Shrub canopy cover greater than 75 percent 3-B-(1) *Closed low shrubland*
13. Shrub canopy cover 25 to 75 percent 3-B-(2) *Open lowshrubland*

14. Vegetation dominated by grass species, primarily *Calamagrostis* and *Elymus*, or if dominated by sedges and forbs, found primarily within forested areas 4 *Herbaceous vegetation* 27.
14. Vegetation dominated by sedges and low, matted shrubs; if grasses are dominant they are typical arctic species, such as *Arctagrostis latifolia* or *Poa arctica*. Found in areas above and beyond the limit of trees. 2 *Tundra*. . . . 15.
15. Tussocks of *Eriophorum vaginatum* dominant 2-C *Tussock tundra* 16.
15. Tussock not dominant, vegetation dominated by a sedge-grass mat, by mat and cushion plants, or by forbs. 17.
16. Tussock vegetation without interspersed shrubs 2-C-(1) *Sedge tussock tundra*
16. Tussock vegetation with scattered shrubs on and between the tussocks 2-C-(2) *Sedge tussock-shrub tundra*
17. Vegetation a sedge-grass mat – not forming tussocks 2-A *Sedge-grass tundra* 18.
17. Vegetation dominated by mat and cushion plants or forbs 22.
18. Dominated by sedges and grasses common to wet sites, primarily *Carex aquatilis*, *Eriophorum angustifolium*, or *Dupontia fischeri*, with or without shrubs 2-A-(1) *Wet sedge-grass tundra* and 2-A-(3) *Sedge-shrub tundra* 19.
18. On mesic sites, dominated by sedges, grasses, or forbs, such as *Poa arctica*, *Arctagrostis latifolia*, *Carex microchaeta*, *Carex nesophila*, *Carex bigelowii* 20.
19. Sedges dominate, but with up to 25-percent cover of willows or birch 2-A-(3) *Sedge-shrub tundra*
19. Sedges and grasses nearly pure with less than 10-percent shrub cover 2-A-(1) *Wet sedge-grass tundra*
20. With 10- to 25-percent cover of low or matted shrubs 21.
20. With less than 10-percent cover of low or matted shrubs 2-A-(2) *Mesic sedge-grass tundra*
21. With up to 25-percent cover of low shrubs of birch or willow 2-A-(3) *Sedge-shrub tundra*
21. With up to 25-percent cover of matted shrubs, such as *Dryas* and *Arctostaphylos* 2-A-(4) *Sedge-mat and cushion tundra*
22. Dominated by mat and cushion plants 2-E *Mat and cushion tundra* 23.
22. Dominated by forbs 2-B *Herbaceous tundra* 24.
23. At least 75 percent or more of the surface covered with plants 2-E-(2) *Closed mat and cushion tundra*
23. Less than 75 percent of the surface covered with plants 2-E-(1) *Open mat and cushion tundra*
24. Seral communities at low elevations in tundra areas – limited distribution 2-B-(1) *Low elevation herbaceous tundra*
24. Snow beds, cliffs, and scree slopes in alpine tundra areas – a diverse group 2-B-(2) *Alpine herbaceous tundra*
25. Dominated by low willows 2-D-(1) *Willow shrub tundra*
25. Dominated by birch, ericaceous shrubs, or a mixture of shrub species 26.

Key, continued

- 26. Dominated by birch and ericaceous shrubs 2-D-(2)*Birch and ericaceous shrub tundra*
- 26. Dominated by birch, ericaceous shrubs,
and willows 2-D-(3)*Mixed shrub tundra*
- 27. Dominated by grasses but with occasional forbs and sedges 30.
- 27. Dominated by a nearly equal mixture of sedges,
grasses, and forbs 4-C *Herbaceous sedge-grass* 28.
- 28. On wet sites, usually with some standing water 29.
- 28. On mesic sites 4-C-(3)*Mesic sedge-grass*
- 29. Growing in fresh water 4-C-(1) *Wet sedge-grass (fresh water)*
- 29. Growing in salty or brackish water 4-C-(2)*Saline sedge-grass (tidal marsh)*
- 30. Grasses at maturity over 1 meter (3.3 feet) in height 4-A *Ta// grass/and* . . . 31.
- 30. Grasses at maturity less than 1 meter (3.3 feet) in height 35.
- 31. Dominants are species of *Ca/amagrostis* 32.
- 31. Dominants are *Elymus* and herbs 34.
- 32. Grass species nearly pure with less than 25-percent herbs 4-A-(1) *Bluejoint*
- 32. Grass mixed with at least 25-percent herbs and shrubs 33.
- 33. Grasses mixed with at least 25-percent cover of shrubs 4-A-(3)*Bluejoint-shrub*
- 33. Grasses mixed with at least 25-percent herbs 4-A-(2) *Bluejoint-herb*
- 34. Dominant cover is *Elymus arenarius* 4-A-(5)*Elymus*
- 34. Dominant cover is herbs 4-A-(4)*Herbs*
- 35. Found on dry, usually south-facing slopes 4-B-(1) *Dry midgrass*
- 35. Found on mesic sites 4-B-(2)*Mesic midgrass*

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