

ALPINE TUNDRA VEGETATION ON MAINE MOUNTAINS AND
ITS RELEVANCE TO THE CRITICAL AREAS PROGRAM

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FOREWORD

The following report on alpine tundra vegetation on Maine mountains is one of a series of planning reports being prepared for Maine's Critical Areas Program. This program was established by an act of the Legislature in 1974 which directed the State Planning Office to develop an official Register of Critical Areas and to encourage and coordinate the conservation of such areas as part of its overall responsibility for comprehensive statewide planning and coordination of planning activities. The Act defines Critical Areas as natural features of statewide importance because of their unusual natural, scenic, scientific, or historical significance.

The Act also created the Critical Areas Advisory Board to advise and assist the State Planning Office in the establishment of the Register and the conservation of critical areas. The program established by the Act is not regulatory, with the minor exception that notification to the Critical Areas Advisory Board of proposed alterations of critical areas is required of the landowners thereof. The program is primarily one of identifying critical areas and providing advice to and coordinating the voluntary activities of landowners, state and local government organizations, conservation groups and others to the end of encouraging the conservation of critical areas. The Critical Areas Program further provides a specific focus for the evaluation and coordination of programs relating to critical areas in Maine. The program also serves as a source of information on critical areas and their management.

The purpose of these reports is to present the results of thorough investigations of subject areas chosen for consideration in the Critical Areas Program. The reports are an intermediate phase in a systematic registration process which starts with the identification of subjects for consideration and concludes with the analysis of each potential critical area individually and, if appropriate, inclusion of areas on the Register.

In addition to the specific task they are intended to fulfill in the registration process, it is my hope that these reports will be useful in a more general sense as a source of information on the various topics they cover. For more information on alpine tundra vegetation on Maine mountains or other aspects of the Critical Areas Program, feel free to contact me or other members of the staff of the State Planning Office.

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ABSTRACT

Treeless mountains are infrequent in Maine, and the occurrence of alpine tundra vegetation is uncommon because of the limited high altitude habitat. This report documents and describes areas containing alpine tundra vegetation on eight summits on Maine mountains. The alpine tundra plant communities are described for Maine mountains in general. Provided for each specific area is a partial list of vascular plants and cryptogams, and a description and map of plant communities. Several tundra plant species reach their southern limit on Maine mountains. The small areas of tundra plant communities in Maine are often adjacent to hiking trails. Alpine tundra can be disturbed by excessive trampling. We recommend that eight alpine tundra areas in Maine be evaluated for inclusion in the register of Critical Areas, and that strict controls on use of these areas be instituted.

ACKNOWLEDGMENTS

Loren Goode and Warren Nelson of Baxter State Park offered assistance in the field and at Chimney Pond campground. We thank them for their generosity. Terry May and Darlene Ebert volunteered their time in the field which we greatly appreciate. James Rae provided his services as pilot and photographer. We graciously thank him for this help. We thank Dr. Charles Richards for his advice on distribution of alpine plants in Maine.

INTRODUCTION

Alpine tundra regions occur in New England in the White Mountains of New Hampshire, the Green Mountains of Vermont, and in the White Mountain section of Maine. The most extensive alpine tundra areas in eastern U.S. (19.5 km²) occur in the Presidential Range, New Hampshire (Bliss 1969). Here the tundra ecosystem has been studied extensively because of its relatively large area and accessibility (Bliss 1963, 1966).

Few mountain areas in Maine have been recognized as containing tundra ecosystems. Presence of alpine tundra vegetation in Maine is uncommon because of the limited high elevation habitat. Tundra areas in Maine mountains have been identified and discussed in general (Hanstedt 1975), and descriptions of the alpine vegetation on Mt. Katahdin are available (Fernald 1901, Antevs 1932). Other areas containing tundra vegetation in Maine have either not been recognized or not been described in the literature.

This report has been prepared for the Critical Areas Program of the Maine State Planning Office to document and describe the areas containing alpine tundra vegetation on Maine mountains. Included in the report is

(1) a literature review on alpine tundra vegetation in Maine and relevant literature on alpine tundra vegetation elsewhere in New England; (2) a description of the distribution of alpine tundra vegetation in Maine; (3) descriptions of the important plant species observed in this study; (4) descriptions of Maine alpine tundra communities; and (5) a description of each area including a partial list of vascular plants and cryptogams, a description and map of plant communities, and an indication of any distinctive aspects. Also, field data reports, management suggestions, black and white aerial photographs, and 35 mm slides were submitted to the State Planning Office but are not included in this report.

LITERATURE REVIEW

Arctic and Alpine Environments

The terms "arctic" and "alpine" have been used to describe the physical and biological environments of treeless areas with severe, cold climate. The actual delineation of arctic tundra is open to great differences in interpretation, especially for the arctic, because individual trees and isolated patches of trees extend well into the area of otherwise treeless vegetation. Arctic treeline in the northern hemisphere often coincides with the area where no summer month attains a mean temperature of 10°C or greater (Barry and Ives 1974). It is assumed that this is the boundary condition for the establishment of trees in the northern hemisphere. Other physical factors such as permafrost also are considered in the delineation of arctic tundra regions. In the case of alpine tundra, the boundaries usually have been established using treeline since climatic data are relatively limited for mountain areas. Difficulties arise in parts of the world where treeline has been modified by man or in tropical mountains where the life forms of tundra plants are difficult to classify (Barry and Ives 1974).

In this study, alpine tundra ecosystems are considered treeless areas beyond timberline which are dominated by low herbaceous or shrubby vegetation, often with extensive mats of lichens and/or mosses. Beyond these generalities there are many variations of alpine tundra principally due to topographic gradients ranging from ridgetops which are snow-free and relatively dry to lee slopes where snow accumulates to form snowbanks that may not melt during the growing season (Billings and Mooney 1968). In this report, the term "dry" is used as a rough indication of moisture conditions at the immediate site of growth. These conditions derive from slope, exposure to sun and wind, microtopography, and soil water-holding capacity. Actual precipitation is greater than in the surrounding lowlands, as hikers in Maine mountains will attest.

The transition zone (ecotone) between the forest and alpine tundra is variable in vertical extent and is often indistinct or virtually missing. According to Löve (1970) it consists of a belt of flagged conifers, upright and prostrate tree islands (krummholz) and dwarf shrubs separated

by stretches of alpine meadows and heath. In several mountain areas in Maine, krummholz extends to the peaks and dominates the ridges to mountain tops. These summits appear from a distance to be open areas, but because they are dominated by krummholz vegetation, they cannot be said to possess alpine tundra.

Only certain of the plant species found at high elevations on Maine mountains are considered to be tundra species. For the purpose of this report, we define a "tundra species" as one which occurs widely in arctic tundra at the northern end of its range, and is virtually restricted to alpine tundra at the southern end of its range. Only one strictly alpine tundra species was found in the Maine mountains where the tundra is very similar floristically to that found in the arctic of eastern North America (in author Davis' experience). This is also true for the cryptogams (lichens and mosses, ferns and fern-relatives). In contrast, the flora of alpine tundra areas in western U. S. possesses a good deal of endemism (Weber 1972). Low mean annual temperature is the major factor contributing to the similarities in vegetation of arctic and alpine regions, but considerable variability is maintained due to the complex histories of the vegetation in local areas.

The climate at the highest elevations in Maine is probably similar to that of Mt. Washington (Bliss 1963) with a combination of low temperatures, frequent heavy fog, and strong winds. High winter snowfall and rainy summer conditions occur in these mountain areas.

Geology of Maine Mountains

Mountains over 1067 m (3500 ft) elevation in Maine occur in the White Mountains Section of the New England Province. The White Mountains Section is somewhat irregular and not clearly defined, but it includes a number of mountains that rise conspicuously above the New England Upland (Thornbury 1965). In Maine, three major mountain groups occur in the section: the Katahdin Group, the Boundary Mountains, and the Longfellow Mountains (Handstedt 1975). Their bases lie above an elevation of 457 m (1500 ft) and several extend to maximum elevations exceeding 1219 m (4000 ft) and one (Katahdin) exceeding 1524 m (5000 ft).

The mountains are composed of igneous rocks (granites or rhyolites) or metamorphosed rocks including slates, schists, gneisses, and quartzites (Doyle 1967, Handstedt 1975). Thornbury (1965) suggested the relatively level areas of the high peaks in the Presidential Range and Katahdin are remnants of an old erosion surface. Alternatively, Thompson (1960, 1961a, 1961b) believed these areas and other alpine features resulted from mass-wasting processes including rock glacier movement and felsenmeer creep. He concluded that the processes of severe frost action are still very important in the alpine and subalpine zones of Mt. Katahdin.

Among the striking features of Maine mountains are the large cirque basins and montane U-shaped valleys (Bliss and Woodwell 1965). Antevs (1932) believed that such valleys at Mount Katahdin and the Presidential Range must have been excavated by alpine glaciers mostly prior to the last ice sheet (late Wisconsinan, which overtopped these mountains) since there are no moraines large enough to account for the amount of material removed. However, he also believed that the sharpness of certain cirque walls and other evidence indicated that cirque glaciers existed (at least briefly) after the ice sheet had receded. More recent work presents additional evidence that the formation of the cirques took place before the late Wisconsinan ice sheet, and also this work argues for the complete absence of cirque glaciers following the ice sheet in the Presidential Range (Goldthwaite 1970) and at Mount Katahdin (Davis 1976). The latter reference is in contrast to Caldwell (1972) who believed that cirque glaciers at Mount Katahdin postdated the last ice sheet.

Other geologic features in Maine mountains include stone stripes, stone nets, solifluction terraces, and extensive areas of felsenmeer with huge angular, frost-cracked blocks which are lichen covered and well-weathered (Thompson 1960). Intensive frost action is an important phenomenon causing these features which strongly influence the dynamics of alpine plant communities.

New England Alpine Vegetation Studies

Most of the early plant community studies in New England mountains have been of the forests, the revegetation of landslides, and the timberline (Bliss 1963). Harshberger (1919, 1929) and Antevs (1932) briefly described alpine tundra plant communities, Fernald (1907) made floristic studies above timberline, and both Fernald (1950) and Harris (1940-1949) wrote floras for the areas. More recently Harries (1961, 1966) completed a study of the alpine soils and related their development to that of the plant communities. Bliss (1963) described the major tundra plant community types in the Presidential Range of New Hampshire and evaluated the inter-relationships between soil, climate, and the plant communities. In a later study, Bliss (1966) measured the primary productivity of several alpine tundra plant community types and correlated environmental parameters with net primary production.

Quantitative plant community studies of alpine tundra areas in Maine have not been pursued. Rather, descriptions of the flora mainly in the form of species lists were made by naturalists on various climbing expeditions. These include lists of vascular plants found on Mt. Katahdin by Bailey (1837), Briggs (1892), Scribner (1892), Churchill (1901), Fernald (1901), Harshberger (1902) and Ewer (1930). Howe (1913) identified the lichens on Katahdin, and Lorenz (1917) provided notes on the hepatics. The physiographic ecology of Katahdin has been described. Harvey (1903) and Bliss and Woodwell (1965) studied an alpine podzol soil on Katahdin and briefly discussed plant-environmental interactions.

Many authors indicate that Katahdin has the only true alpine tundra area in Maine. This has perhaps caused the lack of botanical description of other high mountains in Maine. Knowlton (1903) described the flora of Saddleback Mountain, Avery (1945) listed some of the plants he recognized on Bigelow, and Forbes (1958) completed a species list of Baldpate Mountain. Other than these studies, we have not been able to find descriptions of the vegetation of the treeless peaks in Maine.

The recent increase in recreational use by hikers of high mountain areas in Maine has prompted the examination of these areas in terms of their unique features and their susceptibility to damage. Vogelmann (1974) evaluated the environment and vegetation of the Bigelow Range prior to the State of Maine referendum to preserve the area. Spencer et al. (1976) examined the effects of trail erosion on different sites along sections of the Appalachian Trail in the Mahoosuc Range in western Maine. Efforts are being made to relocate trails to areas where the substrate and vegetation would be most resilient to trampling by hikers.

METHODS

The distribution of alpine tundra vegetation on Maine mountains was initially determined by checking mountain peaks exceeding 1067 m (3500 ft) in elevation that were listed by Hanstedt (1975). This was accomplished on June 2 and 3, 1976, using a light aircraft (Cessna 172). Peaks exceeding 1067 m (3500 ft) are located in the three major mountain groups: the Boundary Mountains; the Longfellow Mountains; and the Katahdin Group (Figure 1). Aerial flight lines were plotted on USGS 15-minute series topographic maps. During the flight each recognizable mountain peak was classified as being forested or treeless. In addition, vertical black-and-white photographs (2 1/4 inch negative) were taken of each area at a scale of 1:250. These photographs were used to estimate the relative extent of treeless areas. The majority of mountain summits less than 1067 m (3500 ft) elevation are forested and these were not considered as potential alpine tundra sites.

The treeless mountain areas in Maine occur mainly in the Katahdin mountains of central Maine and in the Saddleback, Bigelow, and Mahoosuc Ranges of western Maine (Table 1). A majority of the mountains exceeding 1067 m (3500 ft) in the Boundary Mountains and several of those in central Maine do not have alpine tundra sites (Table 1). Clearly, elevation is not the only variable influencing the distribution of treeless areas on the tops of Maine mountains.

All but three (North Brother, Fort Mt., and Mt. Coe) of the 14 treeless peaks found in the aerial survey were visited on foot. At each site the following information was collected:

- (1) description of the alpine tundra plant communities including species composition and associated environment;

Figure 1. The three major mountain areas in Maine and the location of mountain peaks that were classified as forested or treeless.

KATAHDIN GROUP

- 1 - North Traveler
- 2 - Traveler Mt.
- 3 - Fort Mt.
- 4 - North Brother
- 5 - South Brother
- 6 - Mt. Coe
- 7 - Doubletop Mt.
- 8 - North Turner
- 9 - Mt. Katahdin
- 10 - The Owl
- 11 - Barren Mt.
- 12 - White Cap Mt.

BOUNDARY MOUNTAIN GROUP

- 13 - Caribou Mt.
- 14 - Kibby Mt.
- 15 - Snow Mt.
- 16 - East Kennebago Mt.
- 17 - West Kennebago Mt.

LONGFELLOW MOUNTAIN GROUP

- 18 - Bigelow Mt.
- 19 - Crocker Mt.
- 20 - Sugarloaf Mt.
- 21 - Burnt Hill
- 22 - Spaulding Mt.
- 23 - Saddleback Jr.
- 24 - Saddleback Mt.
- 25 - Mt. Abraham
- 26 - Elephant Mt.
- 27 - Baldpate Mt.
- 28 - Old Speck Mt.
- 29 - Goose Eye Mt.
- 30 - Mt. Carlo

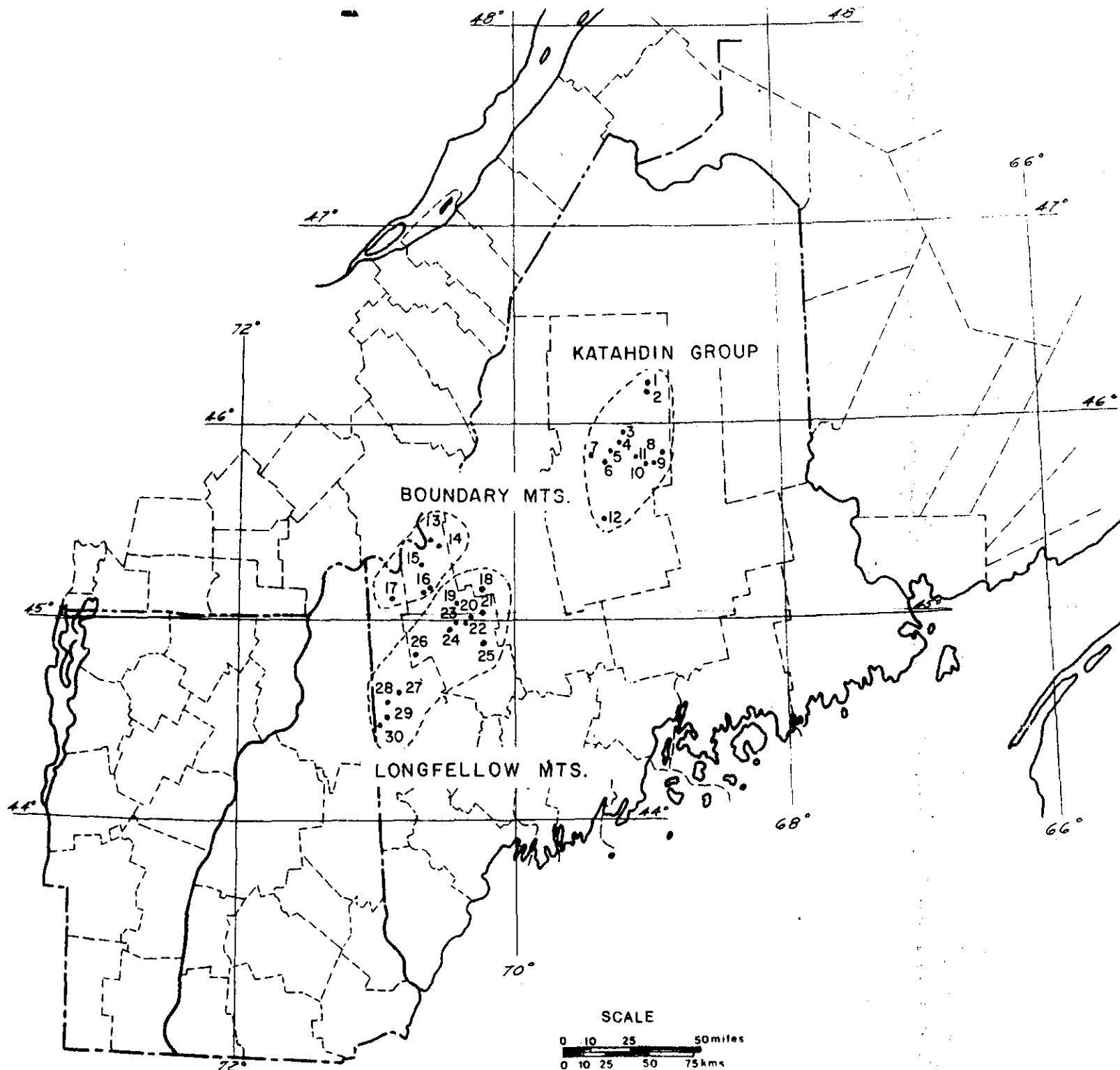


Table 1. Mountain peaks exceeding 1067 m (3500 ft) in Maine that were examined on the aerial survey. Eleven of the treeless peaks and North Turner were subsequently studied on foot.

Mountains with Treeless Summits	(m)	(ft)	Mountains with Forested Summits	(m)	(ft)
Katahdin					
(Baxter Pk)	1605	5267	Old Speck	1274	4180
(Hamlin Pk)	1143	4751	Spaulding	1216	3988
Sugarloaf	1291	4237	Snow	1203	3948
Bigelow			South Brother	1198	3930
(West Pk)	1265	4150	East Kennebago	1166	3825
(Avery Pk)	1246	4088	West Kennebago	1129	3705
†North Brother	1263	4143	Saddleback Jr.	1109	3640
Saddleback	1254	4166	Kibby	1108	3638
Abraham	1234	4049	Caribou	1097	3600
Goose Eye	1180	3870	Burnt Hill	1096	3595
†Fort	1177	3861	*Doubletop	1063	3488
Baldpate	1162	3812	North Turner	1013	3323
†Coe	1147	3764			
Whitecap	1111	3644			
Traveler	1079	3541			

* Examined on aerial survey even though elevation is under 1067 m (3500 ft).

†Not examined on foot.

- (2) estimates of the boundaries and relative abundance of plant communities;
- (3) description of outstanding flora in any particular community;
- (4) observation of impacts of hiking and other activities on the alpine tundra vegetation;
- (5) color 35 mm slides of representative plant communities and overviews of mountain summits; and
- (6) outline maps of the plant communities in each area based on the black and white aerial photographs superimposed on enlarged sections of USGS topographic maps.

In addition, field data forms including management suggestions were completed for each area visited and were submitted to the State Planning Office.

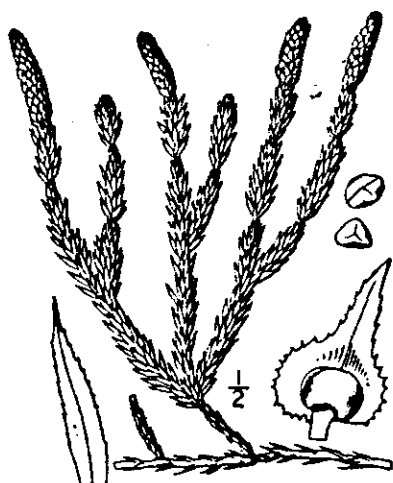
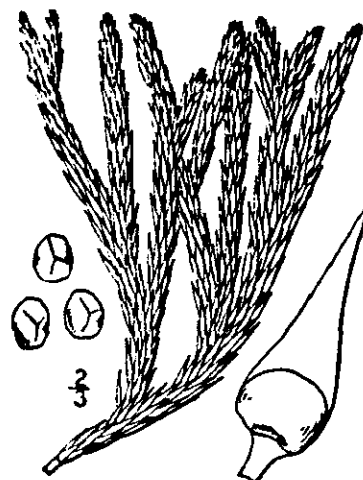
DESCRIPTIONS OF THE VASCULAR PLANTS
DISCUSSED IN THIS REPORT

Thirty-four species of vascular plants were observed on all or some of the treeless summits in Maine. The following are descriptions of these species including the major characteristics for identification, a drawing, and the geographic distribution in eastern North America and in Maine specifically. Species are arranged taxonomically by families, descriptive information is from Fernald (1950) and Anon. (1964), nomenclature and distributional information is according to Fernald (1950) and Dr. Charles Richards (pers. comm.), and drawings are from Britton and Brown (1913) and Anon. (1964). There are additional species of vascular plants in the tundra areas of Maine mountains; however, our surveys were extensive rather than intensive. Certainly this list includes the dominant vascular plant tundra species which occur in Maine mountains. Tundra species (defined earlier) are marked with a T. While only ten of the species are so-marked, it should be pointed out that also most of the other species occur in arctic tundra, and with some exceptions (esp. bog species) in Maine they do not occur commonly apart from mountain tops.

LYCOPODIACEAE (Clubmoss family)

Lycopodium selago L. Fir Clubmoss

Stems tufted and rising from the root-stocks in dense, flat-topped clusters. The stems are densely clothed with pungent leaves broadest at the base. The spikes characteristic of most clubmosses are lacking in this species. Sporangia are borne in axils of unmodified leaves. In south end of range found near damp or mossy rocks, barrens, cold woods or bare mountains. Distribution: arctic and south to the mountains of Virginia; in Maine subalpine and alpine only.



Lycopodium annotinum var. *pungens* L.
Bristly Clubmoss

Stems are trailing or creeping with ascending leafy branches first simple then later, forking slightly. Leaves are stiff and sporangia are borne in spikes at the ends of leafy stems. Distribution: arctic and south to the mountains of New England and northern New York; in Maine subalpine and alpine only.

GRAMINEAE (Grass family)

Agrostis borealis Hartm. Boreal Bentgrass

Grass grows in tufts without stolons. Basal leaves are flat or involute and broad. The panicle is purple and loose and spreading. The one-flowered spikelets are small, the glumes are narrowly ovate and about equal in length. Lemma nearly as long as the glumes and bears a bent awn. Found in gravelly or rocky open soil. Distribution: arctic to Roan Mt. in North Carolina and Tennessee; in Maine subalpine and alpine only.



Calamagrostis canadensis (Michx.) Nutt.
Bluejoint

This highly variable grass is common in the lowlands and a number of varieties are recognized, var. *robusta*, the mountain variety. Panicle is purplish and varies in density and compactness. Awn of the lemma is straight and short, being hidden by the glumes. Glume is often transparent at the tip. Hairs at the base of the lemma equal or exceed the lemma and are uniform in length. Distribution: arctic to eastern U.S. (gen.); in Maine widely distr.



Deschampsia flexuosa (L.) Trin.
Crinkled Hairgrass

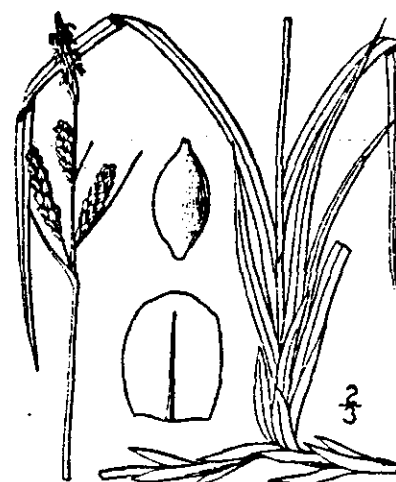
Grows in dense tufts, culms are high and erect. The panicle is loose, few flowered, the spikelets are two-flowered; the glumes are thin, pointed and shorter than the florets; the lemmas bear long twisted awns attached near the base. Found in dry open areas. Distribution: arctic to mountains of Georgia; in Maine widely distr.

CYPERACEAE (Sedge family)

Carex bigelowii Torr. Bigelow's Sedge, T

Stoloniferous sedge, culms one to a few growing from leafy tufts. Leaves dark green, smooth and relatively broad. The spikes are stout and cylindrical. Scales are oblong to ovate and dark purple with a pale midrib. The perigynia are usually purplish. Species easily recognized by dark color of the spikes.

Distribution: arctic to alpine areas of northern New England and northern New York; in Maine alpine only.



Carex brunnescens (Pers.) Poir
Brownish Sedge

Slender sedge of medium height with a deep green or brownish cast to the plant. Leaves are firm, erect and head is straight and stiffish. Perigynia are loosely spreading when mature and distinctly beaked and the scales are broadest at the base rather than near the middle.

Distribution: arctic to North Carolina; in Maine widely distr.



Eriophorum spissum Fern. Hare's Tail

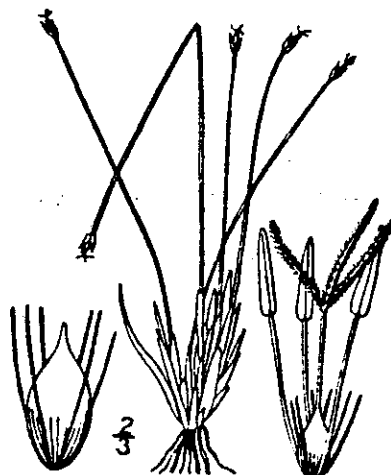
Typical cottongrass, densely caespitose forming broad tussocks. Basal sheaths are brown, basal leaves are slender. Stem is tall and triangular and surrounded by bladeless leaf sheaths. One spiklet per stem with conspicuous white bristles.

Distribution: arctic to New Jersey and Pennsylvania; in bogs throughout Maine.

Scirpus cespitosus L. var. *callosus*
Bigel. Deer's Hair

Dwarf densely tufted sedge. Spikes are small and brown. Achenes are small and 3-sided surrounded by five or six short scales. Two or three of the lowest scales are awn-tipped. Species forms extensive turf on tundra, acid bogs, and peat.

Distribution: arctic to mountains of Georgia; in bogs throughout Maine.



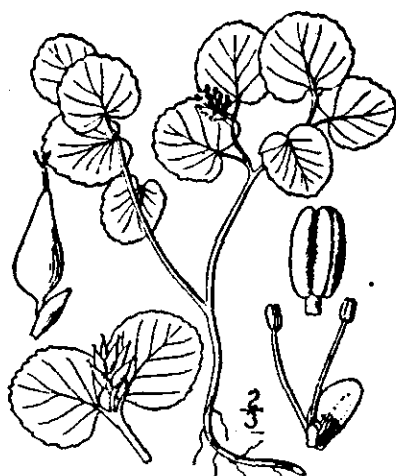
JUNCACEAE (Rush family)

Juncus trifidus L. Highland Rush

The stems of this plant are hard, sheathed, and mostly leafless at the base, two to three leaved at the summit. The flowers are brown, inconspicuous and contained within a beak-pointed deep brown capsule. Occurs in dense tufts in rocky and relatively exposed areas. Distribution: arctic to mountains of North Carolina; in Maine subalpine and alpine.



SALICACEAE (Willow family)

Salix herbacea L. Dwarf Willow, T

Dwarf, prostrate shrub with trunks and main branches and stolon subterranean. Short and slender branches are aboveground. Leaves are broadly oval to somewhat heart-shaped, veined network, rounded teeth on margin and green on both faces. Distribution: arctic to alpine areas of northern New England and northern New York; in Maine alpine only.

Salix uva-ursi Pursh. Bearberry Willow, T

Dwarf, prostrate shrub with a stout base and forking branches trailing and forming dense mats. The leaves are elliptical, tapering to the base, green above and pale beneath. The fertile catkins are 1.5-3 cm long with small brown capsules. Distribution: arctic to alpine areas of northern New England and northern New York; in Maine alpine only.

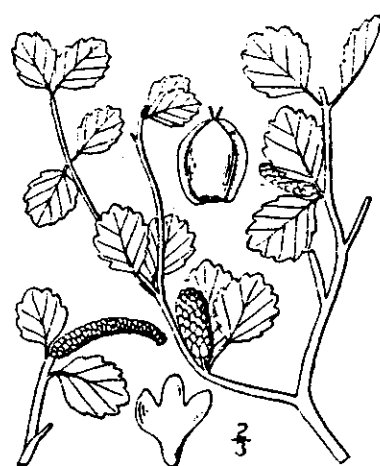


CORYLACEAE (Hazel family)

Betula glandulosa Michx. Dwarf Birch, T

Small shrub birch, erect or prostrate growth form. Young branches are hairless and conspicuously dotted with resinous wart-like glands. Leaves vary from obovate and over 2.5 cm long to kidney-shaped or almost circular, scarcely 0.5 cm long.

Distribution: arctic to alpine areas in northern New England and northern New York; in Maine alpine only.



Betula minor (Tuckerm.) Fern.
Dwarf White Birch

Small upright shrub, tough branches with dark close bark. New twigs smooth often bearing glandular warts. Leaves are ovate, and tapered at base, and often secrete a gummy substance. Species found on acidic rock barrens, peats and alpine summits.

Distribution: Labrador to mountains of northern New England and northern New York; in Maine alpine only.

CARYOPHYLLACEAE (Pink family)

Arenaria groenlandica (Retz.) Spreng.
Mountain Sandwort

Tufted, forming dense mats of short leafy shoots. Leaves are linear and very small. White blossoms are very conspicuous above timberline during the summer. Plants are particularly numerous in disturbed areas close to trails.

Distribution: arctic to mountains of Georgia; in Maine gravelly, rocky, exposed places, especially at coast and mountains.



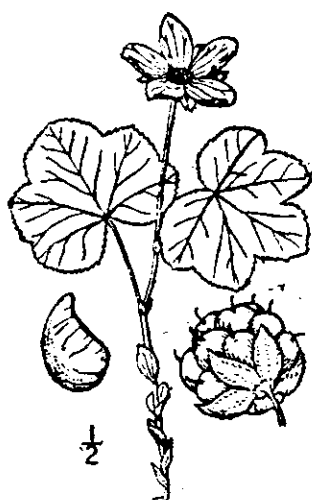
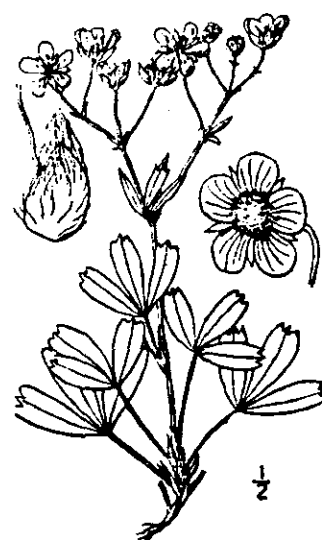
ROSACEAE (Rose family)

Potentilla tridentata Ait.

Three-toothed Cinquefoil

This perennial has main stems that are creeping and subterranean. The leaves are palmate and the leaflets are smooth and have three-teeth at the apex. The flowering branches are erect and petals are white.

Distribution: arctic to mountains of Georgia; in Maine gravelly, rocky, exposed places, especially at coast and mountains.

*Rubus chamaemorus* L. Baked-apple Berry

Extensively creeping herb. Leaves are round to kidney-shaped, more or less five-lobed. Flowers are solitary, terminal, petals are white. Fruits are amber-colored, soft when ripe, large drupelets (similar to raspberries) with stones. Occurs in acid bogs. Distribution: arctic to mountains of northern New England; in Maine eastern coastal bogs, and alpine and subalpine bogs.

EMPETRACEAE (Crowberry family)

Empetrum nigrum L. Black Crowberry

Procumbent and spreading, with branches creeping in peaty soil. Leaves are linear and narrow. Fruits are black with watery juice and stone-like seeds. Distribution: arctic to alpine areas of northern New England and northern New York; in Maine peaty soil in exposed places, especially at coast and mountains.



ERICACEAE (Heath family)

Andromeda glaucophylla Link. Bog-Rosemary

Low shrub with narrow blue-green leaves which become inrolled. The under surface of leaf is whitened with minute hairs. Flowers are turban-shaped, white or pink. Species found in bogs, peats, margins of pools.

Distribution: subarctic to bogs of West Virginia; in bogs throughout Maine.



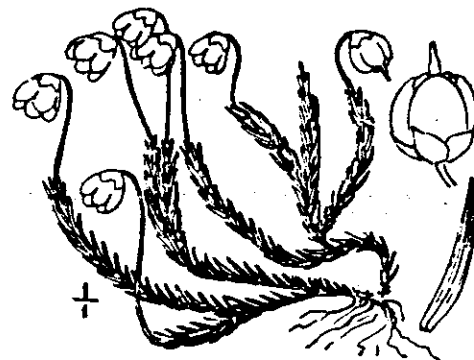
Arctostaphylos alpina (L.) Spreng.
Alpine Bear Berry, T

Matted and trailing plant, with brittle branches covered with papery bark. Leaves are deciduous, deeply veined giving a withered appearance to blade. Yellowish-green flowers, black berries. Occurs on bare rock and gravel. Distribution: arctic to alpine areas of northern New England; in Maine alpine only.

Cassiope hypnoides (L.) D. Don, Moss Plant, T

Small, moss-like evergreen plant with scale-like or needle-like leaves. Flowers are solitary white or rose-colored.

Distribution: arctic to northern New England and northern New York; in Maine alpine only.



Chamaedaphne calyculata (L.) Moench var.
latifolia (Ait.) Fern. Leather-Leaf

Low and much branched circumpolar shrub with evergreen leaves that are flat and scurfy on the under surface. Leaves are one-half as broad as long and the sepals are blunt. It is common in peaty barrens and bogs.

Distribution: subarctic to northern New England (bogs); in bogs throughout Maine.



Kalmia polifolia Wang. Pale Laurel

Slender shrub with opposite leaves, margins are in rolled, conspicuously whitened beneath, blades grow directly from twigs. Flowers are deep pink to crimson. Found in peaty soils. Distribution: subarctic to bogs of northern Pennsylvania; in Maine bogs throughout and peaty alpine soils.

Ledum groenlandicum Oeder. Labrador Tea

Low boreal shrubs with thick alternate leaves with a dense brown woody coating beneath. Leaves yield an aromatic resin. Flowers are white and small in terminal, umbel-like clusters. The plant occurs in bogs.

Distribution: arctic to bogs in northern Pennsylvania; in Maine bogs throughout and peaty alpine soils.



Loiseleuria procumbens (L.) Desv.
Alpine Azalea, T

Low, shrubby evergreen with small, leathery leaves with margins inrolled. Flowers small, white or rose-colored, 2-5 in a cluster. Found in peaty or rocky exposed habitats.

Distribution: arctic to alpine areas of northern New England; in Maine alpine only.



Phyllodoce caerulea (L.) Bab.
Mountain Heath, T

Low, evergreen undershrub with leaves that are blunt, rough-margined and often moss-like on the plants. Purplish flowers are urn-shaped and nodding. Occurs in alpine heaths at south end of range.

Distribution: arctic to alpine areas of northern New England; in Maine alpine only.

Rhododendron lapponicum (L.) Wahlenb.
Lapland Rosebay, T

Dwarf shrub that grows prostrate on the ground and forms mats. The leaves are narrow, leathery and evergreen, and the whole plant is covered with rusty-colored scales or dots. The flowers are regular, pink to magenta in color.

Distribution: arctic to alpine areas of northern New England and northern New York; in Maine alpine only.



Vaccinium angustifolium Ait.
Low Sweet Blueberry

Dwarfed, intricately branched shrub, leaves lanceolate, bright green, smooth on both sides, and finely toothed. Flowers are white or tinged with pink. Berries are blue. A number of varieties are recognized most which occur in dry open barrens, peats and rocky areas.

Distribution: subarctic to eastern U.S. (gen.); in Maine widely distr.



Vaccinium cespitosum Michx. Dwarf Bilberry

Small tufted shrub, leaves are smooth and shiny, broadest above the middle and have toothed margins. Flowers are solitary and nodding, 5-parted, pink to coral-reddish. Berries are light blue.

Distribution: subarctic to northern New England and northern New York; in Maine occas. throughout at open sites.

Vaccinium oxycoccos L. Wren's Egg Cranberry

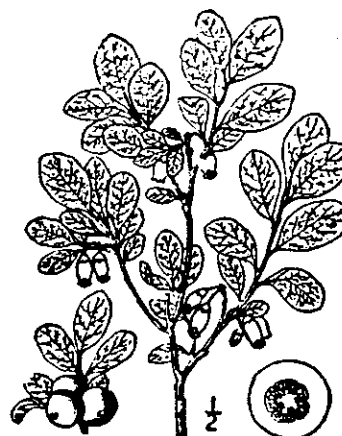
Stem very slender and creeping. Leaves oblong and broad, conspicuously whitened or glaucous beneath. Nodding pink flowers resemble shooting stars, red berries. Found in boggy or peaty soil.

Distribution: arctic to mountains of North Carolina; in bogs throughout Maine.



Vaccinium uliginosum L. var. *alpinum*
Bigel. Alpine Bilberry

Stiff and stout small shrub with strong woody branches. Leaves are leathery in texture, more roundish than oblong, dull green above, pale and reticulate beneath. Berries are blue to blackish, with a bloom. Occurs in rocky to dry peaty barrens. Distribution: arctic to mountains of northern New England and northern New York; in Maine subalpine and alpine, at low elev. n. Maine.



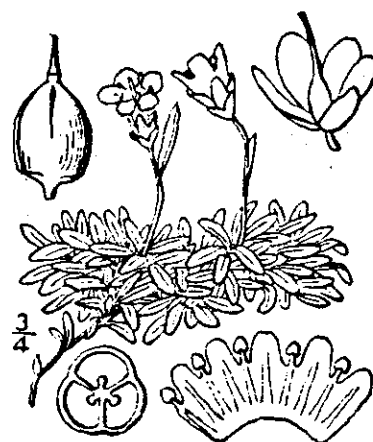
Vaccinium vitis-idaea L. var. *minus* Lodd.
Mountain Cranberry

Extensively creeping evergreen with slender stems and branches. Leaves are broad, smooth shining above, paler and dotted beneath with blackish bristly points. Flowers pink or reddish, berries red, acid, and slightly bitter. Distribution: subarctic to New England; in Maine subalpine and alpine and coastal.

DIAPENSIACEAE (Diapensia family)

Diapensia lapponica L. Diapensia,

Dwarf evergreen growing in very dense tussocks. Leaves are bright green, opposite, and flowers are white. A cushion-like plant generally found on bare ledges and dry, gravelly habitats. Distribution: arctic to alpine northern New England and northern New York; in Maine alpine only.

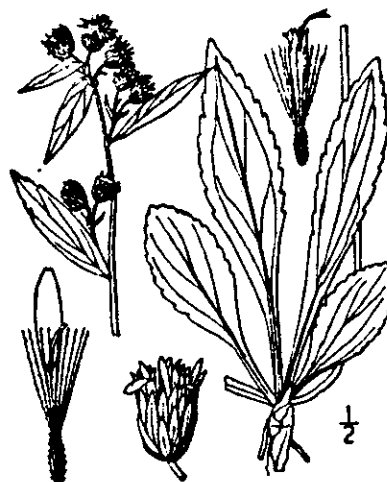


COMPOSITAE (Composite family)

Solidago cutleri Fern. Alpine Goldenrod

Perennial herb with solitary stem or commonly tufted. Leaves are basal and broadest above the middle, with rounded to jagged teeth. Inflorescence has relatively few heads that are many flowered. Species is confined to granitic alpine areas.

Distribution: alpine northern New England and northern New York; in Maine alpine and subalpine only.



DESCRIPTION OF ALPINE TUNDRA PLANT COMMUNITIES

Each alpine tundra area is described using community types modified from those of Bliss (1963) for the Presidential Range, New Hampshire. This was done because the plant communities on Maine mountains are similar to those. The name of each community type represents the characteristic plant types, and the description includes the dominant species of vascular plants and cryptogams which we found on the Maine mountains, and a qualitative assessment of the microenvironment.

Sedge or Rush Meadow Communities

Sedge meadow communities are dominated by Bigelow's Sedge (*Carex bigelowii*) and rush meadow by Highland Rush (*Juncus trifidus*), with Mountain Sandwort (*Arenaria groenlandica*) usually present, particularly along trails and at other disturbed sites. The important cryptogams include Hair-cap Moss (*Polytrichum juniperinum* var. *alpestre*), Iceland Lichen (*Cetraria islandica*) and *Cladonia* species. Within these communities, often adjacent to rocks are small areas of heath including Alpine Bilberry (*Vaccinium uliginosum*) and Mountain Cranberry (*Vaccinium vitis-idaea*). The rush meadow usually occurs in areas of greater exposure than the sedge meadow, and in the former *Diapensia* (*Diapensia lapponica*), Three-toothed Cinquefoil (*Potentilla tridentata*) and heath species are often present. Sedge and rush meadows occur on the highest slopes of most areas and intergrade downslope into a sedge-rush dwarf shrub heath community.

Sedge-rush Dwarf Shrub Heath Communities

Sedge-rush dwarf shrub heath communities are common in alpine tundra areas of Maine. These communities occur on moist to dry slopes above the krummholz. These communities may be termed sedge dwarf shrub heath or rush dwarf shrub heath, depending on the relative abundance of Bigelow's Sedge (*Carex bigelowii*) or Highland Rush (*Juncus trifidus*). Some combination of heath species shares dominance with the sedges and/or rushes. Common among the heath species are Alpine Bilberry (*Vaccinium uliginosum*), Mountain Cranberry (*Vaccinium vitis-idaea*), Black Crowberry (*Empetrum nigrum*), and Lapland Rosebay (*Rhododendron lapponicum*). Three-toothed Cinquefoil (*Potentilla tridentata*) is also often common. In dry, more exposed sites *Diapensia* (*Diapensia lapponica*) and Mountain Sandwort (*Arenaria groenlandica*) may intermix with the dwarf shrub heath community. Lichens and mosses form the most extensive ground cover in these community types with Alpine Reindeer Lichen (*Cladonia alpestris*) and Hair-cap Moss (*Polytrichum juniperinum* var. *alpestre*) being the dominant species.

Dwarf Shrub Heath Communities

The dwarf shrub heath occurs just above the continuous krummholz in the lee of rocks and in small depressions where snow patches provide moisture in the spring. The dominant vascular plants are Low Sweet Blueberry (*Vaccinium angustifolium*), Alpine Bilberry (*V. uliginosum*), Labrador Tea (*Ledum groenlandicum*), Black Crowberry (*Empetrum nigrum*), and Pale Laurel (*Kalmia polifolia*), while in moist sites Bigelow's Sedge (*Carex bigelowii*) and Highland Rush (*Juncus trifidus*) also are abundant. Species composition and relative cover in the dwarf shrub heath varies in response to differences in moisture conditions. Other common species in the dwarf shrub heath include Mountain Cranberry (*Vaccinium vitis-idaea*), Three-toothed Cinquefoil (*Potentilla tridentata*), Mountain Sandwort (*Arenaria groenlandica*), Alpine Goldenrod (*Solidago cutleri*), Fir Clubmoss (*Lycopodium selago*), and Mountain Heath (*Phyllodoce caerulea*). Dwarfed specimens of tree species including Black Spruce (*Picea mariana*), Balsam Fir (*Abies balsamea*), and Paper Birch (*Betula papyrifera* var. *cordifolia* --a variety of paper birch which is common in subarctic and subalpine areas) occur in relatively small numbers. Alpine Reindeer Lichen (*Cladonia alpestris*) and Hair-cap Moss (*Polytrichum juniperinum* var. *alpestre*) are the most important cryptogams present in this community type.

Diapensia Communities

Diapensia communities occur at wind-swept sites along trails and other especially exposed areas. They are dominated by Diapensia (*Diapensia lapponica*) and Mountain Sandwort (*Arenaria groenlandica*). Species of lesser importance include Three-toothed Cinquefoil (*Potentilla tridentata*), Bigelow's Sedge (*Carex bigelowii*), Highland Rush (*Juncus trifidus*), and occasionally Lapland Rosebay (*Rhododendron lapponicum*). These communities are characterized by low (approximately 50 percent or less) vascular plant cover and few species of lichens and mosses. The remainder of the ground is usually covered by gravel. Diapensia communities are small and form discontinuous patches of vegetation in well-drained, winter-exposed sites. These sites typically contain active to partially stabilized soil polygons.

Snowbank Communities

Snowbank communities occur wherever winter snows are deep and do not become snow-free until late spring. Small areas of this type are found in depressions and in the lee of rocks usually below the highest elevations, and just beyond the downward edge of windswept plateaus and ridges where reduced wind velocity allows for accumulation of snow. Snowbank communities found near timberline usually are floristically richer than those at higher elevations. The dominant vascular plants are

Labrador Tea (*Ledum groenlandicum*), Dwarf Bilberry (*Vaccinium cespitosum*) and Alpine Bilberry (*Vaccinium uliginosum*). Other common species include Black Crowberry (*Empetrum nigrum*), Bigelow's Sedge (*Carex bigelowii*), Boreal Bentgrass (*Agrostis borealis*), Mountain Heath (*Phyllodoce caerulea*), and Fir Clubmoss (*Lycopodium selago*). In areas of extremely late-lying snowbanks, Moss Plant (*Cassiope hypnoides*) occurs. It is not commonly found in Maine mountain areas. Several boreal species are present in snowbank communities: Bunchberry (*Cornus canadensis*), Canada Mayflower (*Maianthemum canadense*), and Goldthread (*Coptis groenlandica*). The abundant mosses are Hair-cap Moss (*Polytrichum juniperinum* var. *alpestre*) and Small Hair-cap Moss (*P. piliferum*).

Fellfield Communities

Rocks and boulders dominate the features of fellfield communities. However, patches of vegetation are present between rocks where soil formation has occurred. Species composition of these patches depends on the microenvironment of the depression where soil is present. In patches of late-lying snow, Dwarf Birch (*Betula glandulosa*), Dwarf Willow (*Salix herbacea*), Black Spruce (*Picea mariana*), and Balsam Fir (*Abies balsamea*) are common. In deeply shaded, cold crannies where fine soil has accumulated, moss mats may be present and vascular plants virtually absent. Depressions with well-drained substrates are characterized by Highland Rush (*Juncus trifidus*) and Bigelow's Sedge (*Carex bigelowii*). Several different species of rock lichens are present on the boulders and are the dominant plant type in fellfield communities.

Alpine Bog

Alpine bogs are wet areas dominated by Pale Laurel (*Kalmia polifolia*) and Hare's Tail (*Eriophorum spissum*). Also present but of lesser importance are Wren's Egg Cranberry (*Vaccinium oxycoccus*), Leather-leaf (*Chamaedaphne calyculata*), Mountain Cranberry (*Vaccinium vitis-idaea*), Alpine Bilberry (*Vaccinium uliginosum*), Sundew (*Drosera rotundifolia*), and Black Crowberry (*Empetrum nigrum*). Baked-apple Berry (*Rubus chamaemorus*) was found in several alpine bogs. The ground is covered largely by *Sphagnum* moss.

MOUNTAINS WITH ALPINE TUNDRA VEGETATION IN MAINE

Nine treeless mountains were field checked during the summer of 1976 and eight of these were considered to possess alpine tundra areas. Table 2 summarizes the features and vegetation of these mountains. The highest alpine tundra area in Maine is on Mt. Katahdin with Baxter Peak and Hamlin Peak having elevations of 1605 m (5267 ft) and 1448 m (4751 ft), respectively. Alpine tundra areas occurring at intermediate elevations were on Bigelow Mountain 1265 m (4150 ft) and Saddleback Mountain 1254 m (4116 ft), and the lowest mountain exhibiting alpine tundra plant communities is Traveler Mountain 1079 m (3541 ft) which is also the northernmost mountain studied. Mt. Katahdin has the largest area of alpine tundra vegetation, 2.41 km², whereas all of the other tundra areas are considerably less extensive (Table 2).

Surface features which were observed on the mountain areas include massive slabs that form flat rock faces (Saddleback and Baldpate). In cracks between the rocks in these areas are bog-like depressions where soil has formed. Other mountains exhibit large boulder fields (Mt. Abraham and Katahdin) whereas some surfaces are composed of gravel where needle-ice crystals have contributed to the movement of surface rocks and uprooting of plants (Bigelow and Katahdin) (Rieger 1974).

Characteristic alpine tundra communities on each mountain have developed in response to microenvironmental variation. For example, Mt. Katahdin has the greatest environmental variability and exhibits three dominant community types: sedge meadow, dwarf shrub heath, and *Diapensia* communities (Table 2). Baldpate Mt. and Goose Eye Mt. are moist alpine areas on which alpine bogs are common while Mt. Abraham is a dry, rocky alpine site where sedge meadows are characteristic (Table 2). Also, the number of tundra species observed on a mountain generally was related to the size of the area, the variation in environmental conditions, and the relative amount of soil development that has occurred. Hence, the number of species varied from Katahdin with the highest number (10) to Whitecap, Baldpate, and Traveler Mts. with none (Table 2).

The alpine tundra area on Sugarloaf Mountain is not described (below) because of its disturbed nature. The mountain top is occupied by a communications facility and ski lift structures.

Mt. Katahdin

Piscataquis County

T3 R9

The largest area and topographic variation of the Katahdin massif provides the habitat for the greatest number (10) of tundra species in the Maine mountains (Table 3). However, the description of the alpine tundra vegetation is incomplete because we were not able to adequately cover the large area above treeline (2.41 km² [.93 mi²]) (Figure 2). The vegetation description is representative but additional species may occur. Variants of the six alpine tundra plant communities described for the Presidential Range, New Hampshire (Bliss 1963) are present on Katahdin (Table 4).

Table 2. Characteristics of vegetation and environments of the treeless mountain areas visited in Maine during 1976. The mountain peaks appear in order from highest to lowest elevation.

Mountain	Elevation		Alpine Tundra		Bedrock Type ¹	Characteristic Communities	No. Tundra Species ²
	m	ft	Area km ²	(mi ²)			
Katahdin			2.41	(0.93)			
Baxter Pk.	1605	(5267)			Biotite, biotite	Sedge meadow	10
Hamlin Pk.	1448	(4751)			muscovite granite, quartz monzonite	Dwarf shrub heath Diapensia	
Sugarloaf	1291	(4237)	0.13	(0.05)	Slate	Rush dwarf shrub heath	1 ⁴
Bigelow							
West Pk.	1265	(4150)	0.25	(0.10)	Dark gray slate,	Dwarf shrub heath	1
Avery Pk.	1246	(4088)			meta sandstone, calcium-silicate gneiss and granulite		
Saddleback	1254	(4116)	0.83	(0.32)	Shale, sandstone, quartz conglomerate	Sedge rush dwarf shrubs heath	2
Abraham	1234	(4049)	1.61	(0.62)	Metamorphosed shale and sandstone	Sedge meadow Dwarf shrub heath	2
Goose Eye	1180	(3870)	0.21	(0.08)	Dark gray slate, schist, gneiss	Dwarf shrub heath Alpine bog	3
Baldpate	1162	(3812)	0.16	(0.06)	Dark gray slate, schist, gneiss	Rush dwarf shrub heath Alpine bog	0
Whitecap ³	1111	(3644)	0.06	(0.02)	Dark gray slate and metasandstone	Krummholz Spruce-fir forest	0
Traveler	1079	(3541)	0.49	(0.19)	Felsic volcanic rock	Rush dwarf shrub heath Krummholz	0
Total			6.15	(2.37)			

¹ According to Doyle (1967).

² Not based on an exhaustive survey, but in each case including the great majority of vascular tundra species present. See text for definition of a "tundra species."

³ Lacks alpine tundra communities.

⁴ *Betula glandulosa*.

Table 3. Vascular plants and cryptogams identified on Mt. Katahdin above 1067 m (3500 ft). T = tundra species.

Shrubs and Herbs

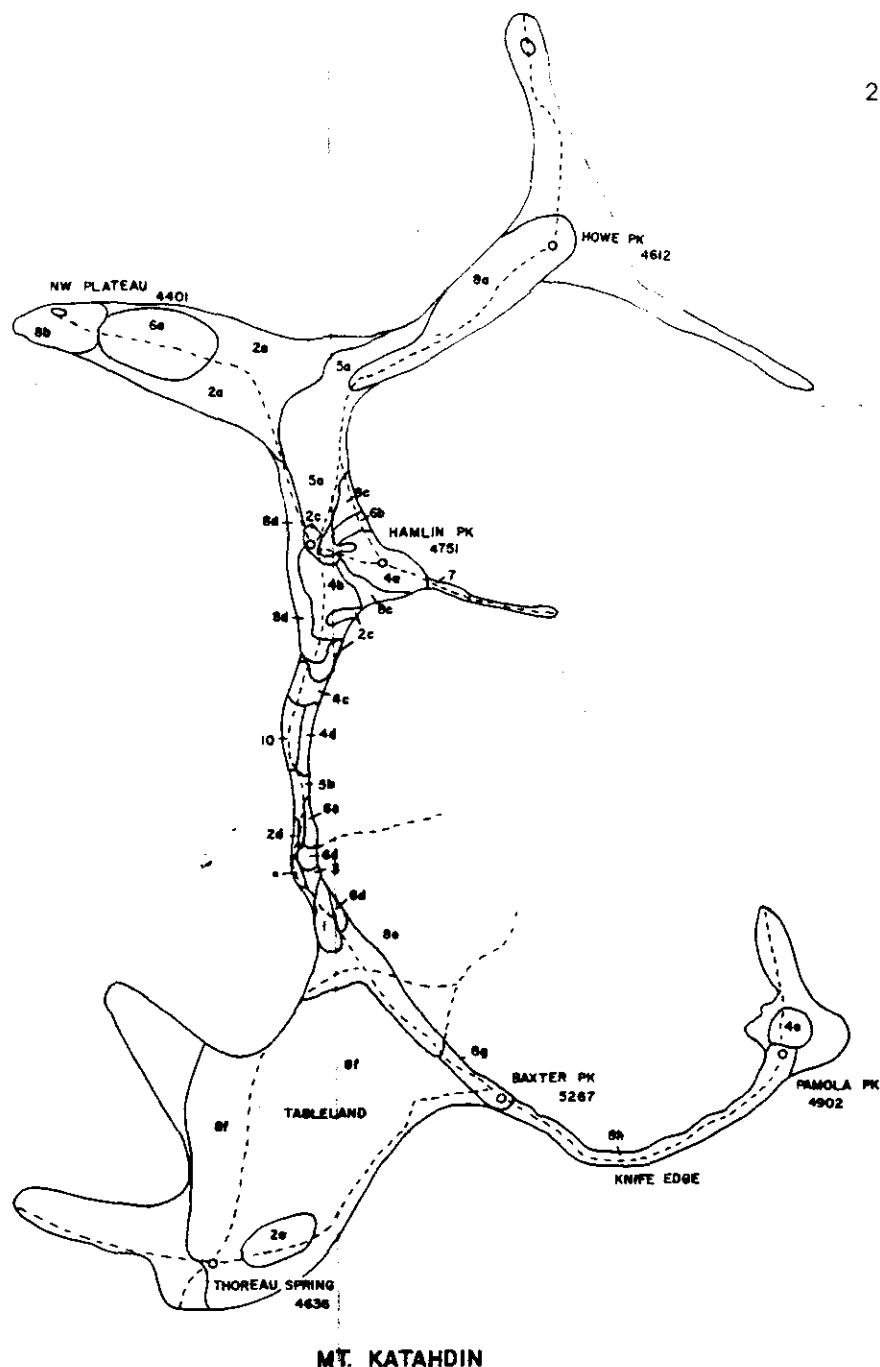
Agrostis borealis
Andromeda glaucophylla
Arenaria groenlandica
 T *Arctostaphylos alpina*
 T *Betula glandulosa*
 B. minor
 T *Carex bigelowii*
 C. brunnescens
 T *Cassiope hypnoides*
 Deschampsia flexuosa
 T *Diapensia lapponica*
 Empetrum nigrum
 Eriophorum spissum
 Juncus trifidus
 Kalmia polifolia
 Ledum groenlandicum
 T *Loiseleuria procumbens*
 Lycopodium annotinum var. *pungens*
 L. selago
 T *Phyllodoce caerulea*
 Potentilla tridentata
 Prenanthes boottii
 T *Rhododendron lapponicum*
 T *Salix herbacea*
 T *S. uva-ursi*
 Scirpus coespitosus var. *callosus*
 Solidago culteri
 Vaccinium angustifolium
 V. cespitosum
 V. uliginosum var. *alpinum*
 V. vitis-idaea var. *minus*

Cryptogams

Cetraria alpestris
C. islandica
Cladonia nivalis
C. rangeriferina
Polytrichum spp.
Sphagnum spp.

Trees

Abies balsamea
B. papyrifera var. *cordifolia*
Picea mariana



MT. KATAHDIN

UNIT	COMMUNITY TYPE
1	RUSH MEADOW
2a, 2b, 2c, 2d, 2e	DWARF SHRUB HEATH
3	SEDGE DWARF SHRUB HEATH
4a, 4b, 4c, 4d, 4e	RUSH DWARF SHRUB HEATH
5a, 5b	SEDGE - RUSH DWARF SHRUB HEATH
6a, 6b, 6c, 6d	DIAPENSIA COMMUNITY
7	SNOWBANK COMMUNITY
8a, 8b, 8c, 8d, 8e, 8f	FELLFIELD
10	KRUMMHOLZ
•	TRAIL EROSION
---	TRAIL

Figure 2. Alpine plant communities delineated on Mt. Katahdin.

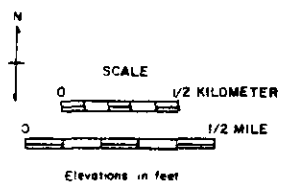


Table 4. Plant communities that correspond to the Mt. Katahdin map units (Figure 2). The dominant plant species are included for each vegetation type.

Map Unit	Vegetation Description
1	Rush meadow - <i>Juncus trifidus</i> , <i>Diapensia lapponica</i> , <i>Arenaria groenlandica</i>
2a	Dwarf shrub heath - <i>Vaccinium angustifolium</i> , <i>V. uliginosum</i> , <i>Ledum groenlandicum</i>
2b	Dwarf shrub heath - trail vegetation, <i>Vaccinium angustifolium</i> , <i>Ledum groenlandicum</i> , <i>Kalmia polifolia</i>
2c	Dwarf shrub heath - <i>Vaccinium uliginosum</i>
2d	Dwarf shrub heath - <i>Vaccinium uliginosum</i> , <i>Empetrum nigrum</i> , 15 percent krummholz inclusions
2e	Dwarf shrub heath - <i>Vaccinium uliginosum</i> , <i>Ledum groenlandicum</i>
3	Sedge dwarf shrub heath - <i>Carex bigelowii</i> , <i>Vaccinium uliginosum</i>
4a	Rush dwarf shrub heath - Rock lichens, <i>Juncus trifidus</i> , <i>Loiseleuria procumbens</i>
4b	Rush dwarf shrub heath - (40-50 percent boulders); <i>Juncus trifidus</i> , <i>Carex bigelowii</i> , <i>Vaccinium angustifolium</i> , <i>Salix herbacea</i> ; krummholz
4c	Rush dwarf shrub heath - <i>Juncus trifidus</i> , <i>Vaccinium uliginosum</i> ; patches of <i>Potentilla tridentata</i> , <i>Diapensia lapponica</i>
4d	Rush dwarf shrub heath - <i>Juncus trifidus</i> , <i>Vaccinium uliginosum</i> ; patches of <i>Diapensia lapponica</i>
4e	Rush dwarf shrub heath - (85 percent rock); <i>Juncus trifidus</i> , <i>Vaccinium uliginosum</i>

Table 4. Continued.

Map Unit	Vegetation Description
5a	Sedge-rush dwarf shrub heath - <i>Carex bigelowii</i> , <i>Juncus trifidus</i> . Mosaic of small patches of vegetation including <i>Salix herbacea</i> , <i>Betula glandulosa</i> , <i>Abies balsamea</i> , <i>Diapensia lapponica</i>
5b	Sedge-rush dwarf shrub heath - <i>Juncus trifidus</i> , <i>Carex bigelowii</i> , <i>Vaccinium uliginosum</i> , <i>Empetrum nigrum</i>
6a	Diapensia community - <i>Diapensia lapponica</i> , <i>Loiseleuria procumbens</i>
6b	Diapensia community - (75 percent gravel); <i>Diapensia lapponica</i> , <i>Carex bigelowii</i> , <i>Empetrum nigrum</i> , <i>Potentilla tridentata</i>
6c	Diapensia community - <i>Diapensia lapponica</i> , <i>Arenaria groenlandica</i> , <i>Potentilla tridentata</i> , <i>Arctostaphylos alpina</i>
6d	Diapensia community - <i>Diapensia lapponica</i>
7	Snowbank community - <i>Ledum groenlandicum</i> , <i>Vaccinium uliginosum</i> ; also present <i>Cassiope hypnoides</i> , <i>Deschampsia flexuosa</i>
8a	Fellfield community - boulder field dominated by rock lichens; small patches of <i>Carex bigelowii</i> or <i>Juncus trifidus</i>
8b	Fellfield community - (80 percent rock); small inclusions of <i>Juncus trifidus</i> , <i>Diapensia lapponica</i> , <i>Potentilla tridentata</i>
8c	Fellfield community - (95 percent rock); inclusions of <i>Picea mariana</i> , <i>Abies balsamea</i> , <i>Betula glandulosa</i>
8d	Fellfield community - boulder field dominated by rock lichens; small patches of <i>Juncus trifidus</i> , <i>Carex bigelowii</i> , <i>Diapensia lapponica</i> , <i>Arenaria groenlandica</i>

Table 4. Continued.

Map Unit	Vegetation Description
8e	Fellfield community - boulder field dominated by rock lichens; patches of <i>Vaccinium uliginosum</i> , <i>Juncus trifidus</i> and krummholz
8f	Fellfield community (Tableland) - boulder fields, includes patches of rush-dwarf shrub heath dominated by <i>Juncus trifidus</i> , <i>Vaccinium uliginosum</i> ; krummholz with <i>Abies balsamea</i> , <i>Betula papyrifera</i> var. <i>cordifolia</i>
8g	Fellfield community (Baxter Peak) - (100 percent rocks); vegetation in cracks between rocks, includes <i>Arenaria groenlandica</i> , <i>Juncus trifidus</i>
8h	Fellfield community (Knife Edge) - rocky ridges, vegetation in patches where soil present, includes <i>Agrostis borealis</i> , <i>Deschampsia flexuosa</i> , rock lichens, mosses
10	Krummholz - (100% cover by tree species); <i>Picea mariana</i> , <i>Abies balsamea</i> , <i>Betula papyrifera</i> var. <i>cordifolia</i> ; dwarf shrub heath understory
Trail erosion	Deep troughs, small patches of <i>Juncus trifidus</i> , <i>Carex bigelowii</i>

Description of Vegetation--The dwarf shrub heath is the most abundant community type on Mt. Katahdin (Figure 2). These communities occur just above the continuous krummholz. The dominant species vary according to the microenvironment of the site but the overall species composition is the same. Low Sweet Blueberry (*Vaccinium angustifolium*), Alpine Bilberry (*V. uliginosum*), Labrador Tea (*Ledum groenlandicum*), and Pale Laurel (*Kalmia polifolia*) are characteristic of a dwarf shrub heath and often krummholz species (e.g., dwarfed Balsam Fir [*Abies balsamea*], Paper Birch [*Betula papyrifera*], and Black Spruce [*Picea mariana*]) intermix with these.

Above the dwarf shrub heath at a higher elevation sedge-rush dwarf shrub heath communities occur. The major shift floristically in these communities is dominance by Bigelow's Sedge (*Carex bigelowii*) and/or Highland Rush (*Juncus trifidus*), which depends on the microenvironment. In drier areas Rush (*Juncus*) is dominant and the unit is classified as rush dwarf shrub heath. With increasing moisture, dominance changes to Sedge (*Carex*) and the community is named sedge dwarf shrub heath. In other areas Sedge (*Carex*) and Rush (*Juncus*) may be co-dominant hence the term sedge-rush dwarf shrub heath is used. Other common species in these units include Alpine Bilberry (*Vaccinium uliginosum*), Mountain Cranberry (*V. vitis-idaea*), Black Crowberry (*Empetrum nigrum*), Alpine Goldenrod (*Solidago cutleri*), Three-toothed Cinquefoil (*Potentilla tridentata*), *Cladonia* spp., and Hair-cap Moss (*Polytrichum juniperinum* var. *alpestre*).

Several areas on the tablelands of Katahdin are exposed to extreme winds and have a dry, gravelly substrate. Discontinuous patches of Diapensia (*Diapensia lapponica*) occur at these sites and form a distinct cushion plant vegetation type. These units are the Diapensia communities and include other species such as Mountain Sandwort (*Arenaria groenlandica*), Three-toothed Cinquefoil (*Potentilla tridentata*), and small patches of Highland Rush (*Juncus trifidus*) or Bigelow's Sedge (*Carex bigelowii*).

Fellfield communities occur in extremely dry, rocky sites. Crustose lichens on the rocks, and mosses on the soil between the rocks are the most important plants. Patches of dwarfed Black Spruce (*Picea mariana*) and Balsam Fir (*Abies balsamea*) occur in the lee of large boulders.

Two shrub species of birch are present on Katahdin. Dwarf Birch (*Betula glandulosa*) occurs abundantly only in limited areas and is sporadic or absent over much of the area, and Dwarf Willow (*Salix herbacea*) occurs on wind swept flats. Katahdin is the only mountain area in our survey where we found the latter species. Also the following species were found exclusively on Mt. Katahdin: Bearberry Willow (*Salix uva-ursi*), Alpine Bear Berry (*Arctostaphylos alpina*), Moss Plant (*Cassiope hypnoides*), Alpine Azalea (*Loiseleuria procumbens*) and Mountain Heath (*Phyllodoce caerulea*).

In areas where winter snows are deep and do not melt until late May or June snowbank communities are found. Species that are characteristic of these communities include Labrador Tea (*Ledum groenlandicum*), Alpine

Bilberry (*Vaccinium uliginosum*), Dwarf Bilberry (*Vaccinium cespitosum*), and *Polytrichum* spp. Two species not common in Maine mountains, Moss Plant (*Cassiope hypnoides*) and Mountain Heath (*Phyllodoce caerulea*) are found in some snowbank communities. Also, species common at lower elevations, such as Bunchberry (*Cornus canadensis*), Canada Mayflower (*Maianthemum canadense*), Goldthread (*Coptis groenlandica*) occur in snowbank communities.

An alpine bog community does not occur above treeline on Katahdin. This vegetation type probably is absent because of the well-drained substrate and overall dry soil moisture regime on Katahdin.

Bigelow Mountain

Somerset County

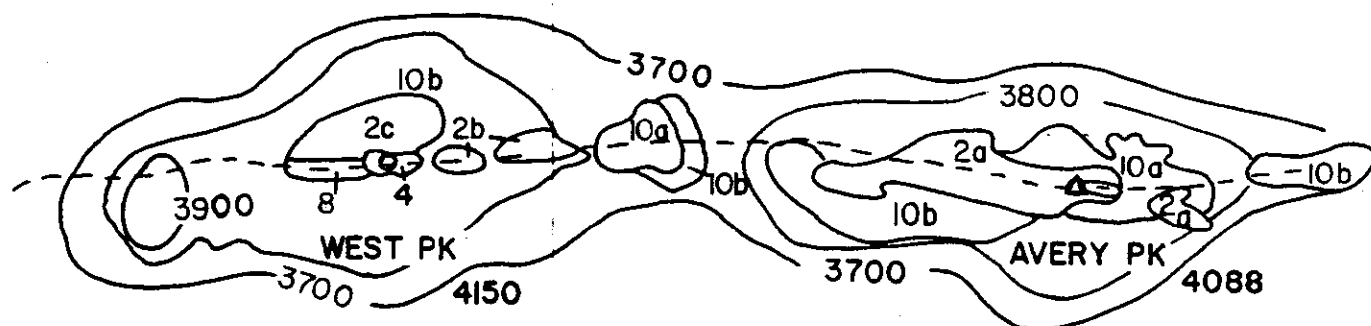
Wyman and Dead River, Maine

Description of Vegetation--The Bigelow Range forms a long wind-swept ridge with several high peaks of which two are treeless, Avery Peak and West Peak. The open area on these peaks is small (Figure 3), but alpine tundra plant communities and one tundra species is present (Table 5).

Avery Peak is rocky and dry, and alpine tundra vegetation occurs in the leeward side of large boulders, in moist soil depressions, and in disturbed areas near the abandoned fire tower and along the trail. Dwarf shrub heath communities are the dominant vegetation type, and the spruce-fir forest is interspersed with the tundra vegetation (Table 6). In several areas (e.g., Unit 10, Figure 3) spruce-fir krummholz is the dominant cover type and dwarf shrub heath forms the understory.

The treeless area on West Peak is smaller than that on Avery Peak. Alpine tundra vegetation occurs along the hiking trail which has a bare gravelly substrate as a result of disturbance. Mountain Sandwort (*Arenaria groenlandica*) is dominant in dry, disturbed areas along the trail, whereas Highland Rush (*Juncus trifidus*) is characteristic in moist soil depressions and adjacent to large rocks. These two species also occur along the trails on Avery Peak.

Compared to the other alpine sites in Maine, the number of tundra species on Bigelow is small (1) because of the relatively dry, wind-swept terrain. Vogelmann (1976) evaluated the flora on Bigelow and commented that the treeless ridges support tundra vegetation. The tundra vegetation on Bigelow is less extensive in comparison to certain other alpine regions in Maine (Table 2). While the tundra communities on Bigelow contain no truly rare species, the alpine tundra communities are themselves uncommon in Maine.



BIGELOW MT.

UNIT	COMMUNITY TYPE
2a, 2b, 2c	DWARF SHRUB HEATH
4	RUSH DWARF SHRUB HEATH
8	FELLFIELD
10a, 10b	KRUMMHOLZ
-----	APPALACHIAN TRAIL
Δ	LOOKOUT TOWER



SCALE

0 1/2 KILOMETER

0 1/2 MILE

Elevations in feet

Figure 3. Alpine plant communities delineated on Bigelow Mountain.

Table 5. Vascular plants and cryptogams identified on Bigelow Mountain above 1067 m (3500 ft). T = tundra species.

<u>Shrubs and Herbs</u>	<i>Arenaria groenlandica</i>
	T <i>Carex bigelowii</i>
	<i>Empetrum nigrum</i>
	<i>Juncus trifidus</i>
	<i>Ledum groenlandicum</i>
	<i>Lycopodium annotinum</i> var. <i>pungens</i>
	<i>L. selago</i>
	<i>Potentilla tridentata</i>
	<i>Vaccinium angustifolium</i>
	<i>V. cespitosum</i>
	<i>V. uliginosum</i>
	<i>V. vitis-idaea</i> var. <i>minus</i>
<u>Cryptogams</u>	<i>Cetraria islandica</i>
	<i>C. nivalis</i>
	<i>Cladonia rangiferina</i>
	<i>Cladonia</i> spp.
	<i>Polytrichum juniperinum</i>
<u>Trees</u>	<i>Abies balsamea</i>
	<i>Betula papyrifera</i> var. <i>cordifolia</i>
	<i>Picea mariana</i>

Table 6. Plant communities that correspond to the Bigelow Mountain Map Units (Figure 3). The dominant plant species are included for each vegetation type.

Map Unit	Vegetation Description
2a	Dwarf shrub heath - <i>Vaccinium uliginosum</i> , <i>Ledum groenlandicum</i> , <i>Cladonia</i> spp.
2b	Dwarf shrub heath - (75 percent rock); <i>Vaccinium uliginosum</i> , <i>V. angustifolium</i> , <i>Ledum groenlandicum</i> , <i>Cladonia</i> spp.
2c	Dwarf shrub heath - <i>Vaccinium uliginosum</i> , <i>Ledum groenlandicum</i> ; krummholz (5 percent cover); patches of <i>Juncus trifidus</i> , <i>Carex bigelowii</i> in moist depressions
4	Rush dwarf shrub heath - <i>Juncus trifidus</i> , <i>Arenaria groenlandica</i> , <i>Vaccinium uliginosum</i> , <i>Ledum groenlandicum</i>
8	Fellfield - (90 percent rock); patches of <i>Arenaria groenlandica</i> , <i>Juncus trifidus</i> , <i>Potentilla tridentata</i> , <i>Empetrum nigrum</i>
10a	Krummholz - (60 percent cover by tree species); <i>Abies balsamea</i> , <i>Picea mariana</i> , <i>Betula papyrifera</i> var. <i>cordifolia</i> ; dwarf shrub heath - <i>Vaccinium uliginosum</i> , <i>Ledum groenlandicum</i>
10b	Krummholz - (100% cover by tree species); <i>Abies balsamea</i> , <i>Betula papyrifera</i> var. <i>cordifolia</i> ; dwarf shrub heath understory

Saddleback MountainFranklin CountySandy River and Madrid, Maine

Description of Vegetation--Saddleback Mt. has an extensive treeless area along a ridge approximately 4 km (2.5 mi) long. Although the wind-swept ridge is dominated by rock slabs and boulder fields, several alpine tundra plant communities are present (Figure 4) which contain two tundra species (Table 7). The vegetation occurring on the west end of the ridge forms a mosaic of plant communities that were classified into a single unit (2a, Table 8). Dwarf shrub heath communities occur along the trail and Sedge (*Carex*) or Rush (*Juncus*) are present in such communities at relatively moist sites. Krummholz intermixes with the dwarf shrub heath communities and often extends up to the crest of the ridge. *Diapensia* communities provide the dominant plant cover near the fire tower. A pond is located to the southwest of the fire tower and bog species are present along its margin. This was the only high elevation pond found in this survey, and likely it is biologically distinctive and worthy of special investigation and possibly special protection.

The col between the fire tower and the Horn is a wide ridge approximately 2.6 km (1.6 mi) long. This wide ridge is covered by rock slabs and boulders and krummholz, and subalpine spruce-fir forests are dominant, although alpine tundra plant communities occur (Figure 4). Dwarf shrub heath is the common alpine tundra community type on the ridge and within each of these communities the relative cover of krummholz varies. Similarly, the patches of alpine tundra vary according to the micro-environment. For example, Hare's Tail (*Eriophorum spissum*) and *Sphagnum* moss occur in wet depressions, whereas Mountain Sandwort (*Arenaria groenlandica*) and *Diapensia* (*Diapensia lapponica*) are present in trampled, exposed, and well-drained microsites. Baked-apple Berry (*Rubus chamaemorus*) occurs at a moist site.

A finger-shaped ridge extends southeast from the middle of the col (Figure 4) and is represented as a treeless area on the USGS topographic map. This ridge is dominated by krummholz. The Horn 1226 m (4023 ft) is a treeless peak dominated by a sedge-rush dwarf shrub heath. Krummholz does not occur on the summit but dwarfed fir and paper birch are present up to the summit (Figure 4).

Mt. AbrahamFranklin CountyMt. Abraham, Maine

Description of Vegetation--Mt. Abraham forms an extensive treeless ridge, approximately 3.8 km (2.4 mi) long, that is covered by boulder fields, is exposed to the wind, and has dry microenvironmental conditions. Thus growth of most vegetation is limited and alpine tundra plant communities are restricted to protected areas with adequate soil (Figure 5). Two tundra species occur on Mt. Abraham (Table 9).

Dwarf shrub heath communities with lichen ground cover are present in sheltered depressions on the north and south side of the ridge.

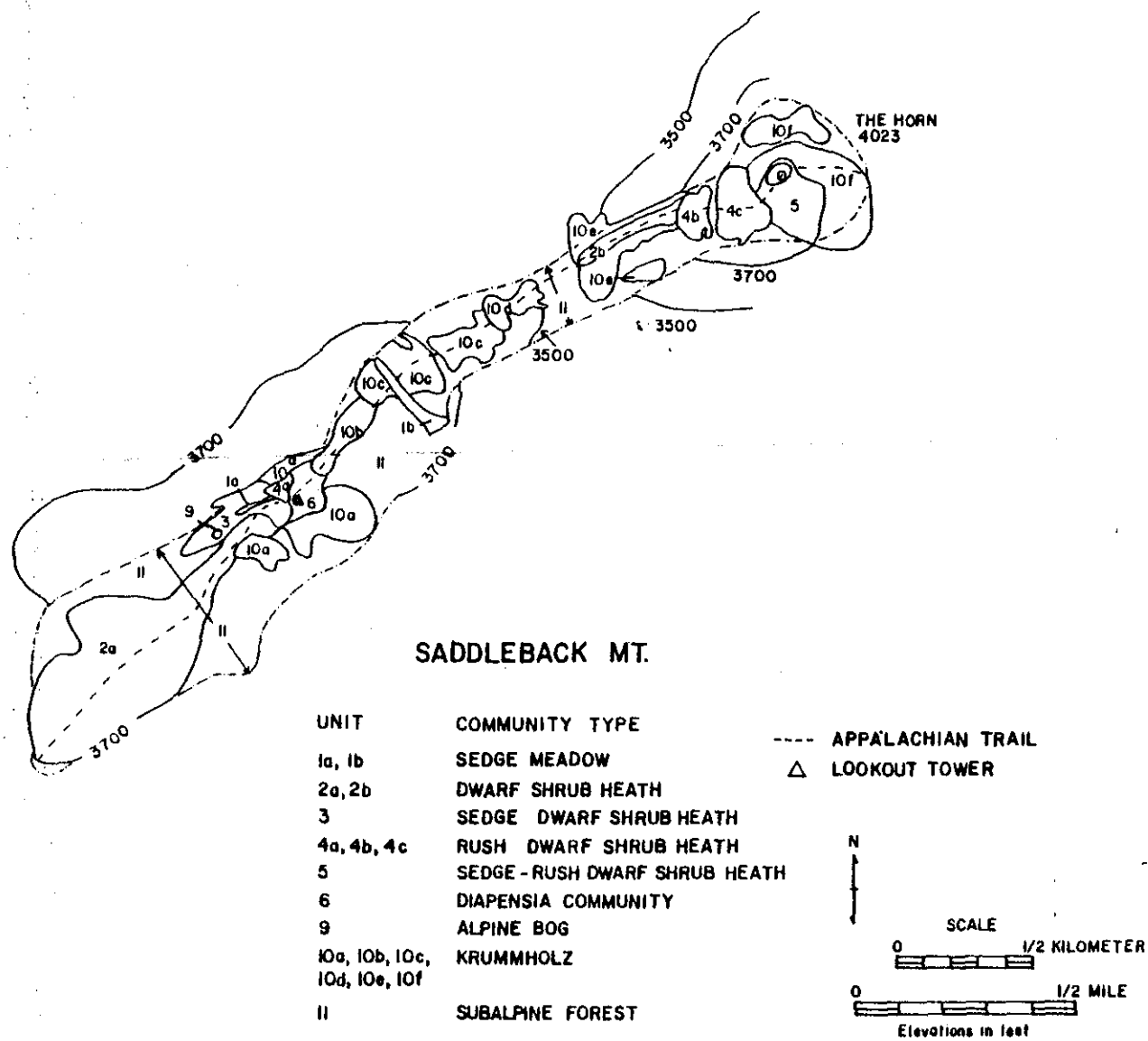


Figure 4. Alpine plant communities delineated on Saddleback Mountain.

Table 7. Vascular plants and cryptogams identified on Saddleback Mountain. T = tundra species.

Shrubs and Herbs

Arenaria groenlandica
T *Carex bigelowii*
C. brunnescens
T *Diapensia lapponica*
Empetrum nigrum
Eriophorum spissum
Juncus trifidus
Kalmia polifolia
Ledum groenlandicum
Lycopodium annotinum var. *pungens*
L. selago
Potentilla tridentata
Rubus chamaemorus
Scirpus cespitosus var. *callosus*
Vaccinium angustifolium
V. cespitosum
V. oxycoccus
V. uliginosum
V. vitis-idaea var. *minus*

Cryptogams

Cetraria islandica
C. nivalis
Gladonia alpestris
C. rangiferina
Polytrichum juniperinum var. *alpestre*
Rhizocarpon geographicum
Sphagnum spp.

Trees

Abies balsamea
Betula papyrifera var. *cordifolia*
Picea mariana

Table 8. Plant communities and dominant plant species on Saddleback Mountain. Map units correspond to Figure 4.

Map Unit	Vegetation Description
1a	Sedge meadow - <i>Carex bigelowii</i> , <i>Scirpis cespitosus</i> var. <i>callosus</i> , <i>Arenaria groenlandica</i> . This unit occurs in the old vehicle tracks.
1b	Sedge meadow - <i>Carex bigelowii</i> , <i>Vaccinium uliginosum</i> , <i>Eriophorum spissum</i> , <i>Polytrichum juniperinum</i> var. <i>alpestre</i>
2a	Dwarf shrub heath - <i>Vaccinium uliginosum</i> , <i>Ledum groenlandicum</i> , <i>Cladonia</i> spp.; krummholz -(40-90 percent cover), inter-mixed with dwarf shrub heath; isolated patches of <i>Eriophorum spissum</i> in wet depressions, <i>Arenaria groenlandica</i> , <i>Diapensia lapponica</i> in dry, wind-swept areas
2b	Dwarf shrub heath - <i>Vaccinium uliginosum</i> , <i>V. vitis-idaea</i> var. <i>minus</i> , <i>Empetrum nigrum</i> . <i>Diapensia lapponica</i> is present in dry areas adjacent to the trail
3	Sedge dwarf shrub heath - <i>Carex bigelowii</i> , <i>Vaccinium uliginosum</i>
4a	Rush dwarf shrub heath - <i>Juncus trifidus</i> , <i>Vaccinium uliginosum</i> , <i>Potentilla tridentata</i> , <i>Polytrichum juniperinum</i> var. <i>alpestre</i>
4b	Rush dwarf shrub heath - <i>Juncus trifidus</i> , <i>Vaccinium uliginosum</i> ; krummholz -(40 percent cover), <i>Abies balsamea</i> , <i>Betula papyrifera</i> var. <i>cordifolia</i>
4c	Rush dwarf shrub heath - <i>Juncus trifidus</i> , <i>Vaccinium uliginosum</i> ; krummholz -(20 percent cover)
5	Sedge-rush dwarf shrub heath - <i>Juncus trifidus</i> , <i>Vaccinium uliginosum</i> , <i>Carex bigelowii</i> , <i>Cladonia</i> spp.
6	<i>Diapensia</i> community - <i>Diapensia lapponica</i> , <i>Empetrum nigrum</i>

Table 8. Continued.

Map Unit	Vegetation Description
9	Pond. Alpine bog community - <i>Eriophorum</i> <i>spissum</i> , <i>Sphagnum</i> spp., <i>Carex bigelowii</i>
10a	Krummholz - (50 percent cover by tree species); dwarf shrub heath - <i>Vaccinium uliginosum</i> , <i>Ledum groenlandicum</i>
10b	Krummholz - (50 percent cover by trees); <i>Abies balsamea</i> , <i>Betula papyrifera</i> var. <i>cordifolia</i> , <i>Vaccinium uliginosum</i> ; rocks - (50 percent cover); <i>Rubus chamaemorus</i> present in wet depressions along the trail
10c	Krummholz - (60 percent cover by trees); <i>Abies balsamea</i> , <i>Betula papyrifera</i> var. <i>cordifolia</i> , <i>Vaccinium uliginosum</i>
10d	Krummholz - (90 percent cover by trees); <i>Abies balsamea</i> , <i>Betula papyrifera</i> var. <i>cordifolia</i>
10e	Krummholz - (75 percent cover by trees); <i>Abies balsamea</i> , <i>Picea mariana</i> , <i>Betula papyrifera</i> var. <i>cordifolia</i> , <i>Vaccinium uliginosum</i> , <i>Ledum groenlandicum</i>
10f	Krummholz - (75 percent cover by trees); <i>Abies balsamea</i> , <i>Betula papyrifera</i> var. <i>cordifolia</i> ; dwarf shrub heath - <i>Vaccinium uliginosum</i> , <i>Ledum groenlandicum</i>
11	Subalpine forest

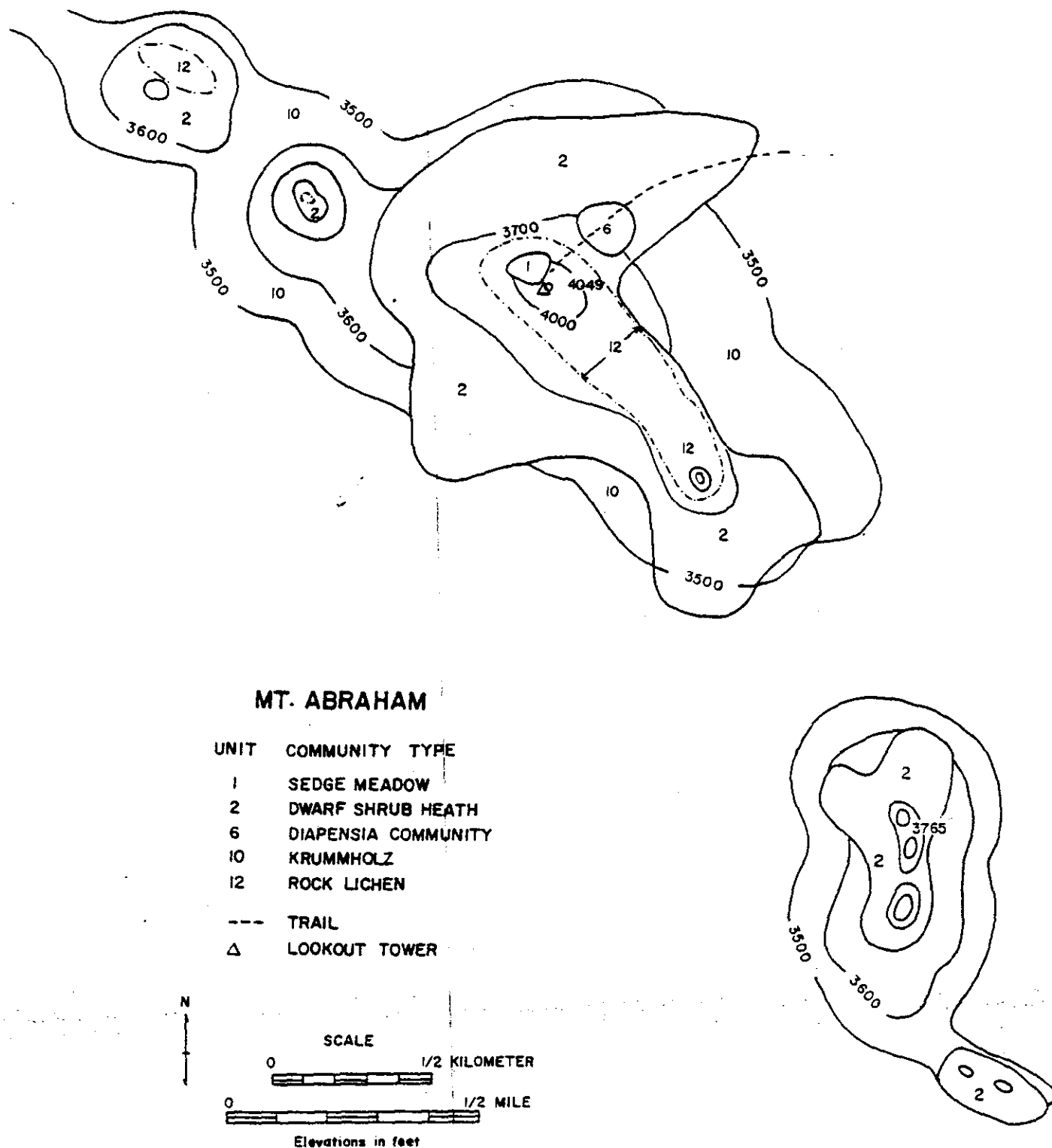


Figure 5. Alpine plant communities delineated on Mt. Abraham.

Table 9. Vascular plants and cryptogams identified on Mt. Abraham.
T = tundra species.

Vascular Plants

T *Carex bigelowii*
T *Diapensia lapponica*
Empetrum nigrum
Juncus trifidus
Ledum groenlandicum
Vaccinium angustifolium
V. uliginosum
V. vitis-idaea var. *minus*

Cryptogams

Cladonia alpestris
C. cristatella
C. rangiferina
Parmelia centrifuga
Polytrichum spp.
Rhizocarpon geographicum
Sphagnum spp.
Umbilicaria hyperborea

Trees

Abies balsamea
Betula papyrifera var. *cordifolia*
Picea mariana

Patches of Highland Rush (*Juncus trifidus*) and Bigelow's Sedge (*Carex bigelowii*) are present near the summit. These species form a mosaic of sub-units which are classified as a sedge meadow plant community (Table 10). A *Diapensia* community occurs along the trail, northeast of the fire tower. The microenvironment of this area, gravelly and well-drained soils and exposure to wind, promotes growth of cushion plant communities.

The treeline of Mt. Abraham is irregular and the spruce-fir forest extends to the ridge line on both north and south facing slopes in several places (Figure 5). Intermixed with the forest are large patches of krummholz dominated by dwarfed Balsam Fir (*Abies balsamea*), Black Spruce (*Picea mariana*), and Paper Birch (*Betula papyrifera* var. *cordifolia*).

The large boulders on Mt. Abraham are substrate for many species of rock lichens. Although these species were not identified, they form the plant community with the largest number of species on the mountain.

Goose Eye Mountain

Oxford County

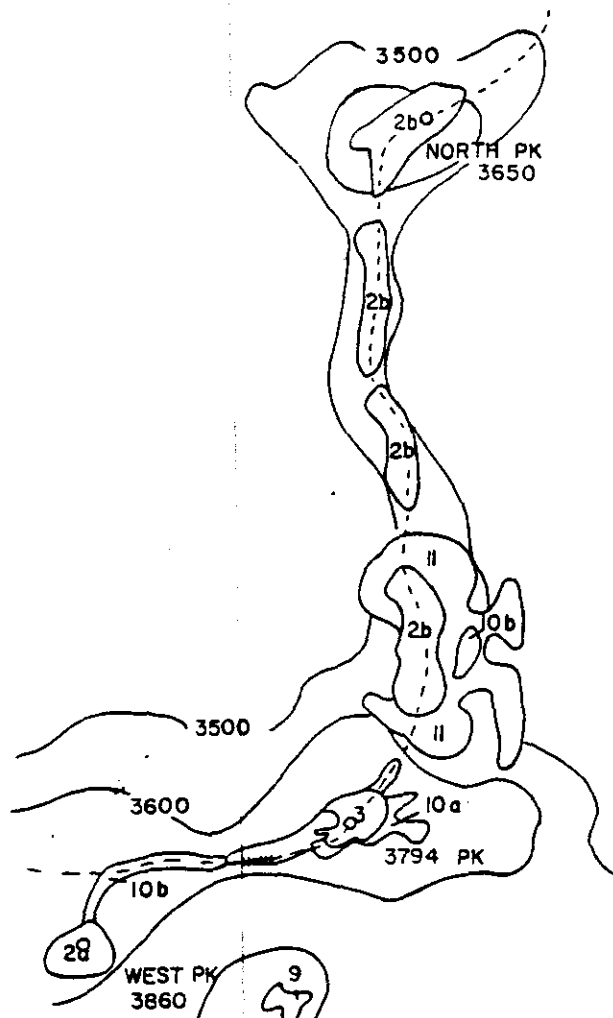
Riley, Maine

Description of Vegetation--The Goose Eye Mountain Range has a long and narrow treeless zone (Figure 6). The west and east peaks are rocky with vegetation cover approximately 50 percent. Three tundra plant species occur on Goose Eye (Table 11). The major alpine plant community on Goose Eye is the dwarf shrub heath (Table 12). Three sides of both peaks form steep slopes dominated by the spruce-fir forests. Dwarfed spruce and fir form a narrow krummholz ecotone between the open summit and the forest.

The ridge to the north of the east peak is relatively flat (broad) (Figure 6). The vegetation consists predominately of alpine tundra, although patches of krummholz and subalpine forest occur on the ridge. Tundra plant communities form a complex mosaic of small units that vary with the microenvironment and are difficult to delimit. Hence, the vegetation of the ridge is classified as a single unit (2b) containing several sub-units (Table 12): alpine bog communities in wet depressions; homogeneous Hare's Tail (*Eriophorum spissum*) depressions; dwarf shrub heath communities, which are often interspersed with small spruce and fir and trees; and fellfields and *Diapensia* communities in dry, wind-swept areas. Several alpine bogs occur on Goose Eye, each with similar species composition but dominant species occur in differing proportions. Baked-apple Berry (*Rubus chamaemorus*), was found in two bogs on Goose Eye (Units 2b and 9, Figure 6).

Table 10. Plant communities on Mt. Abraham. Map units correspond to Figure 5.

Map Unit	Vegetation Description
1	Sedge meadow - homogeneous patches of <i>Juncus trifidus</i> , <i>Carex bigelowii</i> , intermixed with <i>Ledum groenlandicum</i> and lichens
2	Dwarf shrub heath - <i>Vaccinium uliginosum</i> , <i>Ledum groenlandicum</i> and lichens
6	Diapensia community - <i>Diapensia lapponica</i>
10	Krummholz - (>90 percent cover by trees); <i>Picea mariana</i> , <i>Abies balsamea</i> , <i>Betula papyrifera</i> var. <i>cordifolia</i> . Includes small patches of dwarf shrub heath
12	Boulder fields - rock lichens



GOOSE EYE MT.

UNIT	COMMUNITY TYPE
2a, 2b	DWARF SHRUB HEATH
3	SEDGE DWARF SHRUB HEATH
9	ALPINE BOG
10a, 10b	KRUMMHOLZ
II	SUBALPINE FOREST
----	APPALACHIAN TRAIL

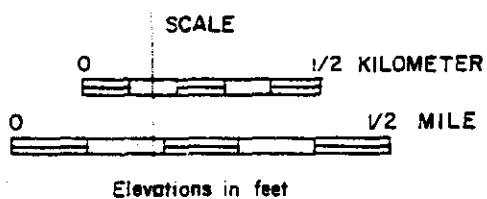


Figure 6. Alpine plant communities delineated on Goose Eye Mountain.

Table 11. Vascular plants and cryptogams identified on Goose Eye Mountain.
T = tundra species.

Shrubs and Herbs

- Arenaria groenlandica*
T *Carex bigelowii*
Chamaedaphne calyculata
T *Diapensia lapponica*
Drosera rotundifolia
Empetrum nigrum
Eriophorum spissum
Juncus trifidus
Kalmia angustifolia
K. polifolia
Ledum groenlandicum
Lycopodium selago
Potentilla tridentata
T *Rhododendron lapponicum*
Rubus chamaemorus
Solidago cutleri
Vaccinium angustifolium
V. oxycoccus
V. vitis-idaea var. *minus*
V. uliginosum

Cryptogams

- Cladonia alpestris*
C. cristatella
C. rangiferina
Polytrichum spp.
Sphagnum spp.

Trees

- Abies balsamea*
Betula papyrifera var. *cordifolia*
Picea mariana
Larix laricina
-

Table 12. Plant communities and dominant plant species on Goose Eye Mountain. Map units correspond to Figure 6.

Map Unit	Vegetation Description
2a	Dwarf shrub heath - <i>Vaccinium uliginosum</i> , <i>Vaccinium angustifolium</i> ; Krummholz intermixed - 10 percent cover
2b	Dwarf shrub heath - Includes mosaic with areas too small to map at this scale: (1) Alpine bog, <i>Juncus trifidus</i> , <i>Vaccinium oxycoccus</i> , <i>Sphagnum</i> spp. (2) Homogeneous <i>Eriophorum spissum</i> depressions; (3) Dwarf shrub heath intermixed with sub-alpine forest; (4) Fellfield, <i>Empetrum nigrum</i> , <i>Juncus trifidus</i> , <i>Cladonia</i> spp.; (5) <i>Diapensia</i> community, <i>Diapensia lapponica</i> , <i>Arenaria groenlandica</i>
3	Sedge dwarf shrub heath - <i>Carex bigelowii</i> , <i>Vaccinium uliginosum</i> , <i>Potentilla tridentata</i> , <i>Cladonia</i> spp.
9	Alpine bog - <i>Eriophorum spissum</i> , <i>Kalmia polifolia</i> , <i>K. angustifolia</i> ; dwarf shrub heath intermixed with krummholz surrounds the bog (too limited to map)
10a	Krummholz - (50 percent cover); <i>Abies balsamea</i> , <i>Betula papyrifera</i> var. <i>cordifolia</i> ; dwarf shrub heath - 50 percent cover
10b	Krummholz
11	Subalpine forest

Baldpate MountainOxford CountyGrafton, Maine

Description of Vegetation--The treeless area on Baldpate Mt. is relatively small (Figure 7) and no tundra species were found (Table 13). The uppermost ridges of Baldpate are covered by massive slabs of rock, and vascular plant vegetation is present only in the depressions and in cracks between rocks where soil formation has occurred. The west peak is a dry, open area dominated by krummholz vegetation with a dwarf shrub heath understory (Table 14). The col between the west and east peak is approximately 90 percent lichen-covered rock and alpine tundra occurs in isolated patches. Two alpine bog communities, dominated by Hare's Tail (*Eriophorum spissum*) and *Sphagnum* moss, were identified on the col. The south side of the east peak is a rock face dominated by rock lichens. The summit is gravelly and wind-swept and a rush dwarf shrub heath is the dominant community.

The alpine bogs on Baldpate are of botanical interest because Baked-apple Berry (*Rubus chamaemorus*) is known to occur in them (Forbes 1958). However, this species was not observed at this site in this survey.

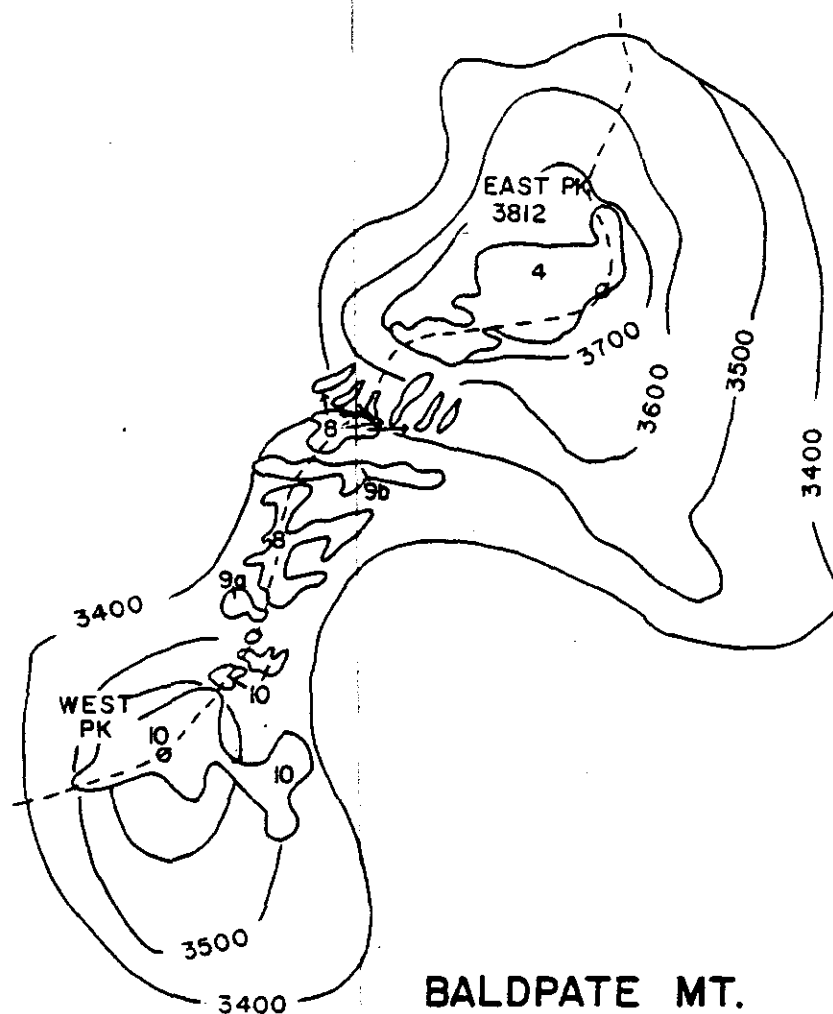
Whitecap MountainPiscataquis CountyT7 R10, Maine

Description of Vegetation--Whitecap Mt. is the highest peak between the Katahdin Range and the Bigelow-Saddleback group in western Maine (Figure 1). Areas on Whitecap appear treeless from aerial views but the ground survey showed that alpine tundra plant communities are not dominant in these open areas. The south side of the summit is a boulder scree slope and the spruce-fir forest, intermixed with patches of krummholz, extends to the summit of Whitecap (Figure 8). An extensive krummholz area is present north of the fire tower which has an understory of tundra-like vegetation (Table 15). Dwarf shrub heath communities, lichens, and mosses occur with the krummholz (Table 16). Rock lichens are the dominant species in the boulder fields.

Traveler MountainPiscataquis CountyT5 R9, Maine

Traveler Mountain is the northernmost peak over 1067 m (3500 ft) in the state. The mountain has burned* several times, the most recent forest fire occurring in 1903 (Anon. 1971). Thus, the upper slopes of Traveler are barren and from aerial views appear to be habitat for tundra vegetation.

*This probably occurred on other mountains in this study, but evidence was not noticed or sought.



UNIT	COMMUNITY TYPE
4	RUSH DWARF SHRUB HEATH
8	FELLFIELD
9a, 9b	ALPINE BOG
10	KRUMMHOLZ
----	APPALACHIAN TRAIL



SCALE

0 1/2 KILOMETER

0 1/2 MILE

Elevations in feet

Figure 7. Alpine plant communities delineated on Baldpate Mountain.

Table 13. Vascular plants and cryptogams identified on Baldpate Mountain.

Shrubs and Herbs

Arenaria groenlandica
Chamaedaphne calyculata
Empetrum nigrum
Eriophorum spissum
Juncus trifidus
Kalmia polifolia
Ledum groenlandicum
Vaccinium angustifolium
V. oxycoccos
V. uliginosum
V. vitis-idaea var. *minus*

Cryptogams

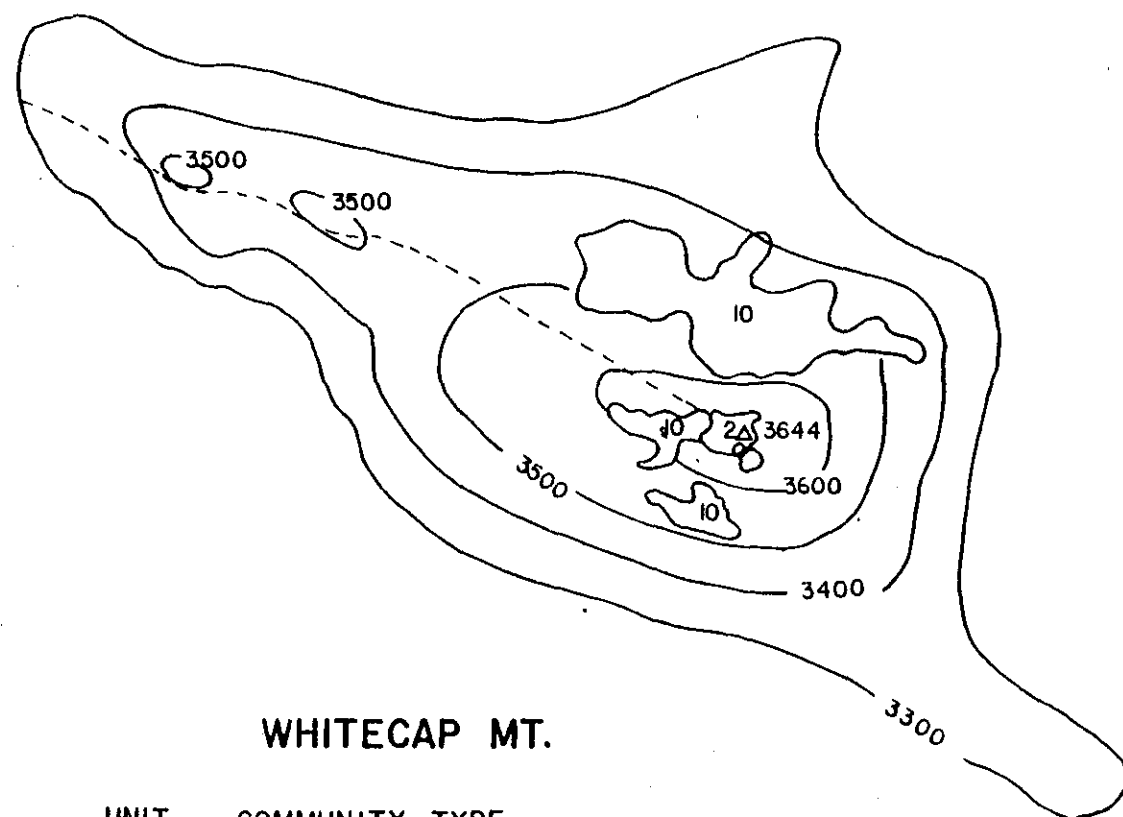
Cetraria islandica
Cladonia alpestris
C. cristatella
C. rangiferina
Polytrichum spp.
Rhizocarpon geographicum
Sphagnum spp.
Umbilicaria hyperborea

Trees

Abies balsamea
Betula papyrifera var. *cordifolia*
Picea mariana

Table 14. Plant communities identified on Baldpate Mountain and dominant species in each. Map units correspond to Figure 7.

Map Unit	Vegetation Description
4	Rush dwarf shrub heath - <i>Juncus trifidus</i> , <i>Vaccinium uliginosum</i> , <i>Polytrichum</i> spp., <i>Cladonia</i> spp.; patches of <i>Arenaria groenlandica</i>
8	Fellfield - <i>Arenaria groenlandica</i> , <i>Juncus trifidus</i> , <i>Potentilla tridentata</i> , <i>Polytrichum</i> spp., rock lichens
9a	Alpine bog - <i>Eriophorum spissum</i> , <i>Sphagnum</i> spp.; 5 percent standing water
9b	Alpine bog - <i>Eriophorum spissum</i> , <i>Sphagnum</i> spp.; 10 to 15 percent standing water; 50 percent subalpine forest
10	Krummholz - (80 percent cover by trees); <i>Picea mariana</i> , <i>Abies balsamea</i> ; dwarf shrub heath, <i>Kalmia polifolia</i> , <i>Vaccinium uliginosum</i> , <i>Ledum groenlandicum</i>



WHITECAP MT.

UNIT	COMMUNITY TYPE
2	DWARF SHRUB HEATH
10	KRUMMHOLZ
---	TRAIL
Δ	LOOKOUT TOWER

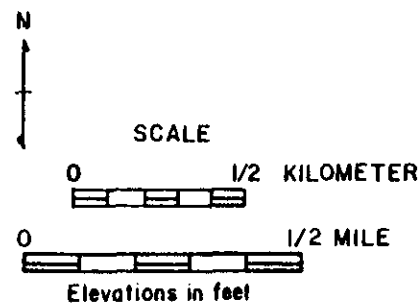


Figure 8. Alpine plant communities delineated on Whitecap Mountain.

Table 15. Vascular plants and cryptogams identified on Whitecap Mountain.

Shrubs and Herbs

Andromeda glaucophylla
Empetrum nigrum
Kalmia polifolia
Ledum groenlandicum
Vaccinium angustifolium
V. uliginosum
V. vitis-idaea var. *minus*

Cryptogams

Cladonia alpestris
C. cristatella
C. nivalis
C. rangiferina
Cladonia spp.
Polytrichum spp.
Sphagnum spp.

Trees

Abies balsamea
Betula papyrifera var. *cordifolia*
Picea mariana

Table 16. Plant communities identified on Whitecap Mountain and dominant species in each. Map units correspond to Figure 8.

Map Unit	Vegetation Description
2	Dwarf shrub heath - <i>Vaccinium uliginosum</i> , <i>Empetrum nigrum</i> , <i>Ledum groenlandicum</i>
10	Krummholz - <i>Abies balsamea</i> , <i>Picea mariana</i> , <i>Betula papyrifera</i> var. <i>cordifolia</i>

Description of Vegetation--The terrain above treeline is dominated by large rocks and boulders with several small patches of gravel, and no tundra species were found (Table 17). Rock lichens are the dominant vegetation type on the boulders, and Three-toothed Cinquefoil (*Potentilla tridentata*) is the dominant vascular plant that occurs in the gravelly areas. Much of the treeless area may be due to slow succession to forest or woodland following fire. Near the summit a small (approximately 10 m²) rush dwarf shrub heath community occurs in a dry, well-drained soil (Table 18).

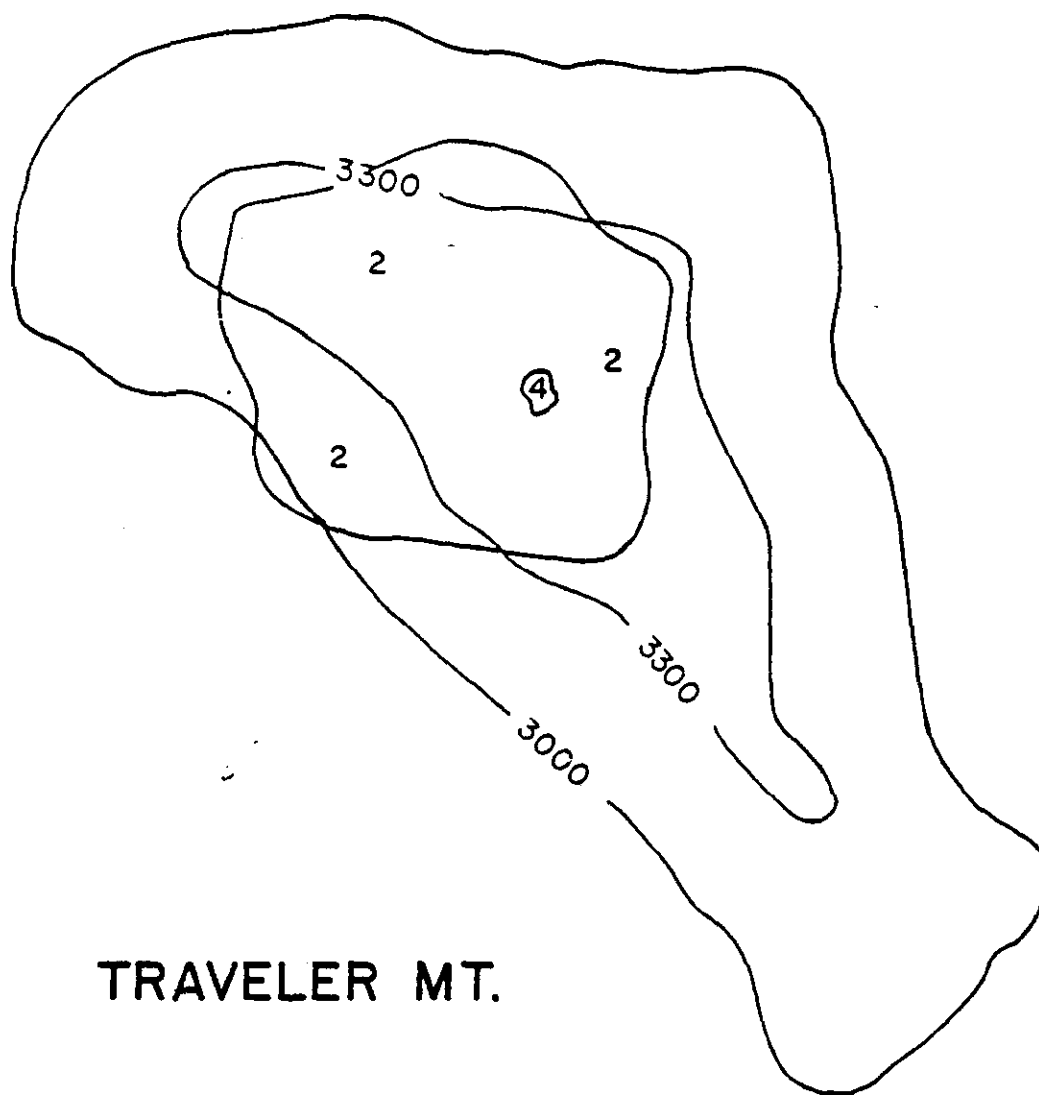
The slopes immediately below the summit of Traveler are dominated by Low Sweet Blueberry (*Vaccinium angustifolium*) and Mountain Cranberry (*Vaccinium vitis-idaea*) which are characteristic species in dry, rocky areas (Fernald 1950). At lower elevations well developed krummholz and spruce-fir forest occurs (Figure 9).

Table 17. Vascular plants and cryptogams identified on Traveler Mountain.

<u>Shrubs and Herbs</u>	<i>Cornus canadensis</i> <i>Empetrum nigrum</i> <i>Gaultheria hispidula</i> <i>Juncus trifidus</i> <i>Kalmia polifolia</i> <i>Ledum groenlandicum</i> <i>Lycopodium selago</i> <i>Maianthemum canadense</i> <i>Pyrus americana</i> <i>Solidago macrophylla</i> var. <i>thyrsoides</i> <i>Trientalis borealis</i> <i>Vaccinium angustifolium</i> <i>V. vitis-idaea</i> var. <i>minus</i> <i>V. uliginosum</i>
<u>Cryptogams</u>	<i>Cetraria nivalis</i> <i>Cladonia alpestris</i> <i>C. cristatella</i> <i>C. rangiferina</i> <i>Polytrichum juniperinum</i> <i>Sphagnum</i> spp.
<u>Trees</u>	<i>Abies balsamea</i> <i>Betula papyrifera</i> var. <i>cordifolia</i> <i>Picea mariana</i>

Table 18. Plant communities identified on Traveler Mountain and dominant species in each. Map units correspond to Figure 9.

Map Unit	Vegetation Description
2	Dwarf shrub heath - burned area, <i>Vaccinium angustifolium</i> , <i>Vaccinium vitis-idaea</i> ; krummholz intermixed
4	Rush dwarf shrub heath - <i>Juncus trifidus</i> , <i>Vaccinium uliginosum</i> , rock lichens



TRAVELER MT.

UNIT	COMMUNITY TYPE
2	DWARF SHRUB HEATH
4	RUSH DWARF SHRUB HEATH

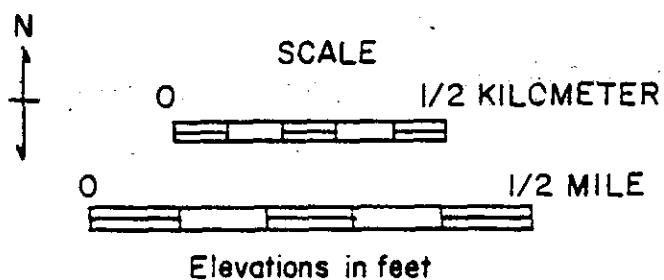


Figure 9. Alpine plant communities delineated on Traveler Mountain.

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General Evaluation of Tundra Vegetation on Maine Mountains for Inclusion on the Register of Critical Areas

Prepared by: Harry R. Tyler, Jr., State Planning Office

1. Considerations in Registration

A. Values and qualities represented by the feature (specifically including any unique or exemplary qualities of the feature).

More than 10 species of vascular plants characteristic of tundra grow on mountain summits in Maine above 3500 ft (1067 meters). The alpine tundra plant communities grow on a very small land surface in the State of Maine. These communities cover only about 615 hectares and are rare in Maine. Botanists and naturalists are greatly interested in the tundra plants because they have adapted to a very harsh environment. Many of the species are found growing in the arctic. Thus, small areas are Maine's only representatives of arctic environments. Alpine tundra plant communities may be some of the oldest plant communities existing in Maine because they are probably relict populations existing since the retreat of the last glacier.

B. Probable Effects of Uncontrolled Use (specifically in relation to its intrinsic fragility).

Uncontrolled construction of trails through alpine tundra areas could seriously damage the vegetation. Also, extensive walking (off trails) on the vegetation could pose a threat to the vegetation. Uncontrolled use of off-the-road motorized vehicles pose a definite threat to alpine tundra vegetation. The construction of communication structures, electrical transmission line corridors, ski lifts, and associated structures would pose a threat to the vegetation on mountain summits.

C. Present and Probable Future Use (specifically present and future threats of destruction).

Mountain summits where alpine tundra grows receive comparatively intense use during the late spring through fall from hikers. Increased hiking activities could result in increased erosion of the shallow mountain soils and destruction of the surface vegetation. Recreational developments that promote skiing and snowmobiling could pose a destructive threat. The construction of structures on mountain summits would also pose a destructive threat to these areas.

D. Level of Significance

Alpine tundra community areas in Maine are of national significance because the plant communities are very rare in the eastern continental U.S.

E. Probable Effects of Registration - Positive and Negative (specifically including the economic implications of inclusion of the feature on the Register).

The expected positive effect of registration will be to give official recognition to the importance of alpine tundra vegetation areas. Also, the landowner will be

informed of the importance of alpine tundra communities. Registration will encourage monitoring of the mountain summit areas and will also encourage the conservation of the area.

The expected negative effect of registration may be some publicity generated by the registration process.

There should be few economic implications concerning the registration of alpine tundra vegetation areas.

F. Management Suggestions

1. Alpine tundra communities should be maintained in a natural condition to perpetuate a suitable and proper habitat for tundra plant species. Management of these fragile areas should be carried out with the advice and approval of botanists knowledgeable with the species.

2. The feature should be monitored periodically to check on the condition of the Critical Area.

3. Trails should not be constructed through high quality areas.

4. Motorized vehicles should be prohibited from the alpine tundra vegetation areas.

5. The building of structures on alpine tundra areas should be discouraged.

G. Programs which directly affect or are particularly relevant to the use and management of the feature.

1. Land use zoning by the Land Use Regulation Commission.

2. Management plans of the landowners.

2. Conclusions and Recommendations

A. Conformance with definition contained in the Act.

The Act defines a critical area as meaning: "areas containing or potentially containing plant and animal life or geological features worthy of preservation in their natural condition, or other natural features of significant scenic, scientific, or historical value." Because alpine tundra communities are rare in Maine and worthy of preservation, they can be considered to be critical areas under the legislated definition.

B. Conformance with the Guidelines for the Registration of Critical Areas, adopted by the Critical Areas Advisory Board on September 11, 1975.

Section 1. Knowledge of the feature: The report on alpine tundra vegetation by Diane May and Ronald Davis was prepared for the Critical Areas Program in order to provide detailed documentation about alpine tundra communities in Maine.

Section 2. Representation on the Register: Alpine tundra plant communities are not included on the Register of Critical Areas at this time.

Section 3. Variety of Values: Alpine tundra communities do possess a variety of values because of the variety of rare and noteworthy plants which compose them.

Section 4. Scarcity: Alpine tundra communities are scarce in Maine.

Section 5. Quality: The areas studied in this report appear to be of high quality.

Section 6. Persistence: The alpine tundra plant communities are persistent in Maine.

Section 7. Geographic Distribution: Alpine tundra communities are found on mountains in four counties: Oxford, Somerset, Franklin, and Piscataquis.

Section 8. Use: The alpine tundra plant community areas have the potential for scientific and educational use.

Section 9. Manageability: Alpine tundra community areas can easily be managed to perpetuate the communities and species.

Section 10. Potential Economic Effects: Registration of the mountain areas should result in few economic implications for the landowner.

Section 11. Potential Effect on the Conservation of the Feature: Registration should have a positive effect on the conservation of the area.

RECOMMENDATIONS

1. Because alpine tundra communities are rare and unusual in Maine, the following mountain areas should be investigated in detail for consideration as candidate critical areas to be included on the Register of Critical Areas: Katahdin, Sugarloaf, Bigelow, Saddleback, Abraham, Goose Eye, Baldpate, and Traveler.
2. Registered critical areas should be monitored periodically.
3. North Brother, Fort Mountain, and Mount Coe should be field checked and evaluated to see if the summit areas qualify as critical areas.
4. New natural alpine tundra communities that are found in Maine should be field checked and evaluated. If they meet the criteria of a critical area, the area should be registered.

