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The Muskegs of Southeast Alaska and Their Diminished Extent

Southeast Alaska receives abundant, year-round precipitation and has cool summers. Precipitation exceeds calculated evapotranspiration throughout the year in most of the area, and three-fourths of the stations have projected moisture deficits of less than 0.1 inch (Patric and Black, 1868). Mainly because of the late Pleistocene glaciation, it also has many depressions and extensive impermeable soil layers (commonly compact glacial till or waterlaid glacial flour). As a result of these factors, there are extensive areas of organic soils.

The term "muskeg" according to Dachnowski-Stokes (1941) denotes "an area covered with sphagnum mosses and tufts of sedges." In southeast Alaska, all relatively open peat bogs that have a ground cover high in sphagnum mosses and/or sedges are called "muskegs."

The muskegs of southeast Alaska vary in depth, composition, and vegetative relations. Depth of organic soil material ranges from less than two feet to over 40 feet. They may be composed of sphagnum peat, sedge peat, or muck, usually with some component of wood. Vegetation growing on a muskeg is related to type of organic material, which in turn is related to water table regime and movement. In addition, a large acreage of wet organic soils supports forest vegetation.

A few publications have discussed the muskegs of southeast Alaska with conflicting interpretations of whether forest or muskeg is expanding. Zach (1950) and Lawrence (1958) have postulated that muskeg, except on steep slopes, is the climax vegetative type in southeast Alaska. They point out that most open peat soils contain wood at some depth. They also interpret the presence of spike-topped and dead trees near the margin of muskegs as evidence that muskegs are enlarging.

Dachnowski-Stokes (1941, p. 32) and Heusser (1960, p. 187) both state (without quantitative evidence) that forest is invading muskeg in southeast Alaska.

New evidence, developed from soil surveys and other detailed soil investigations, shows that muskeg area has diminished greatly in the recent geologic past.

Methods

The Alaska Region of the U.S. Forest Service has been conducting soil surveys in southeast Alaska since 1961 when the Hollis Area soil survey was initiated. This survey has been completed (Gass, *et al.*, 1967) and other surveys are now underway or completed (Fig. 1). As National Cooperative Soil Surveys, the soils are classified

Soils and Vegetation

Organic soils in southeast Alaska include alpine organic soils, well-drained organic soils derived from forest litter over bedrock or gravel, and wet organic soils derived from various vegetative materials. Here we are concerned with the wet organic soils below the alpine. Most of these soils are in four groups:

1. Poorly decomposed moss peat (Kogish Series)
2. Moderately decomposed sedge peats (Kina Series)
3. Poorly decomposed sedge peats (Staney Series)
4. Mucks over peats (Maybeso and Kaikli Series)

Of these four major kinds of wet organic soils, only those of the last group (Maybeso and Kaikli soils) support forest vegetation; the others are muskeg; that is, the vegetation on them is dominated by sphagnum mosses and/or sedges with low shrubs and forbs and only scattered, open-grown trees (Table 1).

Kogish soils are moss peats ranging in thickness of organic material from a usual 8 or 10 feet to more than 40 feet. They are nearly level and occupy depressions and broad flats. They are often convex in profile. The soils have a surface layer of live sphagnum moss ranging in thickness from about 4 to 12 inches. Beneath this is 6 to many feet of very fibrous reddish brown or brown moss peat that, when squeezed, is yellowish brown or light yellowish brown. The fibers are not easily destroyed by rubbing. The water table is at or near the surface the year around. Wood content

TABLE 1. Estimated average cover of common species on four southeast Alaska soils. Cover on individual bogs may vary considerably.

Species	Approximate percent crown cover on			
	Kogish	Kina	Staney	Maybeso
<i>Trees</i>				
Sitka spruce	*	**	0	5
Western hemlock	*	**	0	30
Mountain hemlock	2	5	0	5
Western red cedar	*	**	0	10
Alaska-cedar	2	5	0	10
Lodgepole pine	5	10	0	5
<i>Shrubs</i>				
Blueberry	0	*	0	60
Rusty menziesia	0	*	0	20
Crabapple	0	*	0	5
Crowberry	20	**	0	0
Labrador tea	10	5	0	*
Bog rosemary	10	5	0	0
Swamp laurel	10	5	0	0
Juniper	**	0	0	0
<i>Herbs</i>				
Sedges	**	75	90	*
Sphagnum	80	40	5	10
Scirpus	5	10	0	*
Grasses	**	**	5	*
Skunk cabbage	**	**	0	10
Bracken fern	*	**	0	**

* Rarely occurs
 ** Commonly occurs, but occupies little area

and mapped according to National Standards, (U.S. Department of Agriculture, 1951). In addition, we have made many detailed soil investigations throughout southeast Alaska (Fig. 1). More than 20 man-years of intensive investigations have been invested in the Regional soils program.

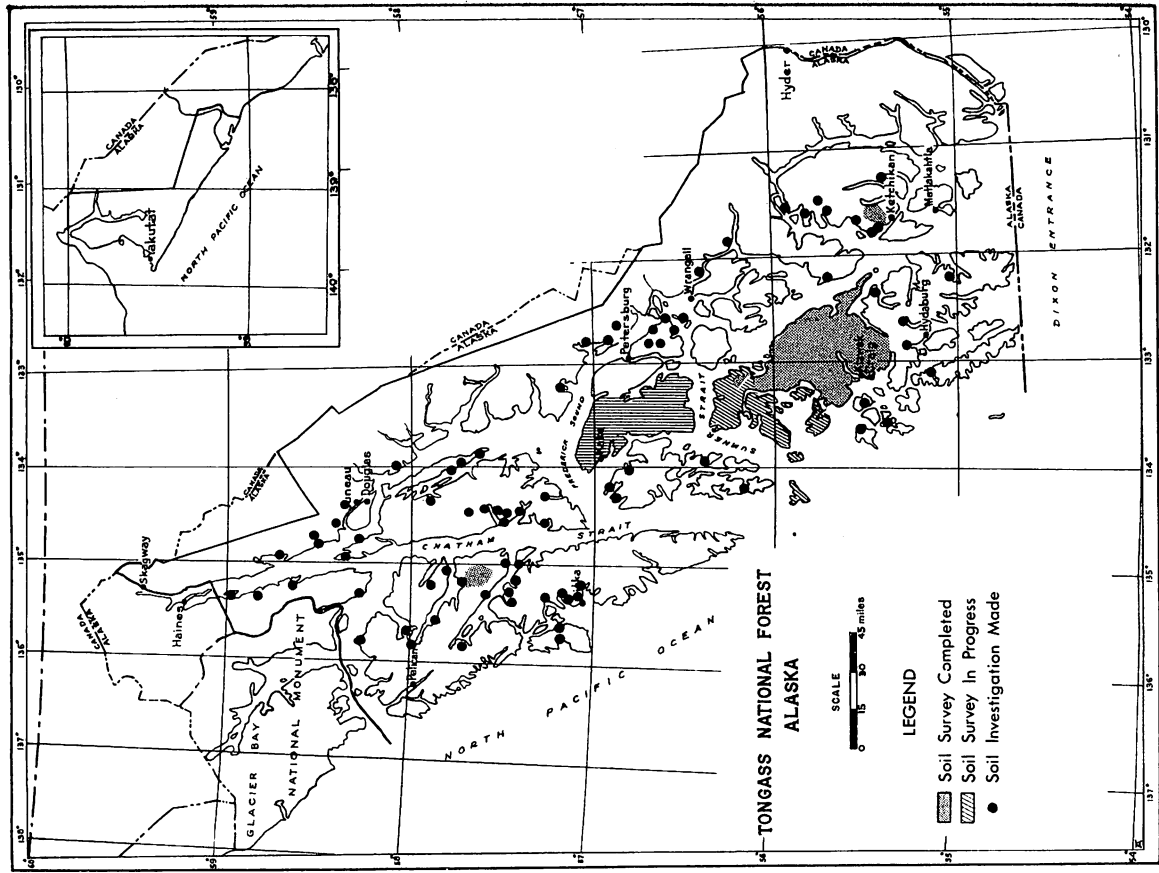


Figure 1. Locations of completed and active soil surveys and detailed soil investigations in southeast Alaska.

ranges up to about 20 percent by volume. They occupy about 5.6 percent of completed soil survey areas.

Sphagnum moss dominates the vegetation cover (Fig. 2). Scattered, stunted lodgepole pines and mountain hemlocks are found. Sitka spruce and western hemlock occur



Figure 2. A Kogish soil landscape. This soil occupies a filled lake, as it is more than 30 feet to a mineral substratum.

only rarely. Other common plants include swamp laurel, bog rosemary, Labrador tea, lingenberry, swamp cranberry, Alaska cotton, crowberry, hooked violet, shooting star, juniper, and sundew. Occasional hummocks with sedges and grasses are found. Stagnant ponds may contain buckbean and yellow pond-lily.

Kina soils occur on rolling benches, sloping hillsides (Fig. 3) and broad rolling ridgetops. They have also been observed on wet seepy slopes up to 60 percent in grade. Ponds are often numerous. *Kina* and related soils have 3 to 5 feet or more of fibrous dark reddish brown sedge peat that, when rubbed, becomes only about one third as fibrous. When squeezed it remains about the same color. They contain from 10 to 20 percent wood by volume and usually overlie compact glacial till. A surface water table is present during periods of wet weather. They occupy 6.8 percent of completed soil survey areas. They may support a scattering of lodgepole pine, Alaska-cedar, mountain hemlock and occasional Sitka spruce. The dominant vegetation is sedge, often



Figure 3. A *Kina* soil landscape. This soil has about 3 feet of sedge peat overlying compact glacial till. The slow-growing forest in the background is supported by *Maybeso* soils.

with a component of grass or scirpus and sphagnum moss. Common plants include buckbean, crowberry, Labrador tea, shooting star, Alaska cotton, and hooked violet.

Staney soils occur mostly along drainage ways and lakes (Fig. 4) and on broad flats. They are the least extensive of the muskeg soils. They are loose, poorly-decomposed fibrous sedge peats occupying filled and filling lakes. Thin layers of sands or other mineral sediments are common. They are nearly level with a water table at or above the surface the year around. About 5 percent wood by volume is present in the soil (primarily from trees blown over on adjacent soils). They occupy about 1 percent of completed soil survey areas. Vegetative growth is largely sedges. A few scattered forbs such as great burnet, monkshood, and white bog orchid are found. Little sphagnum moss and no living trees occur.

Maybeso and *Kaikli* soils are the most extensive known soils in southeast Alaska, occupying about 10 percent of completed soil survey areas. They occur on gentle to steep slopes of all types of landforms below the alpine. These are forested soils, and do not have muskeg vegetation. However, they were muskegs in the recent geologic past as evidenced by a sedge or sphagnum peat layers immediately above their substrata. These poorly-drained soils have 4 to 6 inches of reddish black or black forest litter peat over 6 to 8 inches of black muck. Beneath this is a layer of sedge peat or sphagnum moss peat. Mineral substrates are commonly gray compact glacial till (*Maybeso* Series), massive bedrock (*Kaikli* Series) or other slowly-permeable deposit. The water table

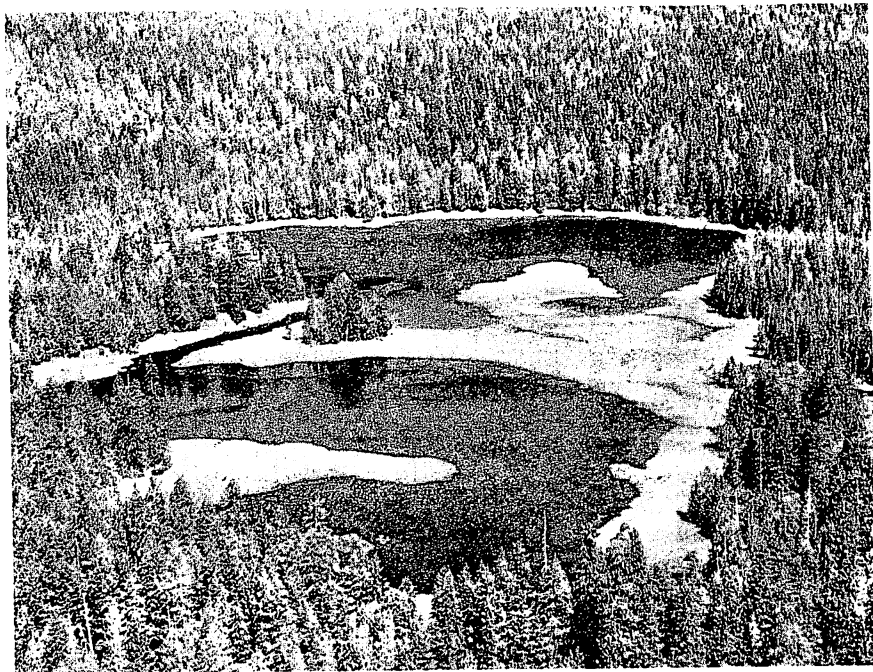


Figure 4. Stoney soils developing along the margins of a lake and slow-moving stream. The slow-moving forest, with the light-toned cedars adjacent to the Stoney soils, is growing on Maybeso soils.

seldom reaches the surface but is commonly within 6 to 12 inches of the surface. About 20 percent wood by volume is present in the upper layers and 5 to 10 percent below. At least a fringe of these soils surrounds most muskegs.

South of Petersburg the overstory is dominantly western red-cedar, Alaska-cedar, and western hemlock with occasional Sitka spruce and mountain hemlock. From about Petersburg north, western red-cedar disappears, Alaska-cedar distribution becomes sporadic, and western and mountain hemlocks become dominant. Stocking in climax stands is poor, with a normal overstory crown closure of around 50 percent. However, a dense conifer understory is usually present, and young stands after logging or wildfire are fully-stocked. Individual tree growth is slow, and rooting is shallow. Many of the old trees, especially the cedars, have dead tops.

Shrub vegetation is dominated by blueberry, red huckleberry, and rusty menziesia, the dominant shrubs of the better-drained timbered soils. Occasional crabapple, red alder, and highbush cranberry appear in the ecotone to open muskeg. Other common plants include salal, bracken fern, skunk cabbage, deer cabbage, ground dogwood, marsh marigold, and grasses and mosses (including patches of shade-tolerant sphagnum moss).

Discussion

Maybeso and Kaikli soils, according to present data, occupy about 10 percent of the Tongass National Forest of southeast Alaska. These now-forested soils have gone

List of Plant Species¹

Common Name	Scientific Name
<i>Trees</i>	
Alaska-cedar	<i>Chamaecyparis nootkatensis</i> (Lamb.) Spach.
Lodgepole pine	<i>Pinus contorta</i> Loud.
Mountain hemlock	<i>Tsuga mertensiana</i> (Bong.) Sarg.
Red alder	<i>Alnus rubra</i> Bong.
Sitka spruce	<i>Picea sitchensis</i> (Bong.) Carr.
Western hemlock	<i>Tsuga heterophylla</i> (Raf.) Sarg.
Western redcedar	<i>Thuja plicata</i> D. Don.
<i>Shrubs</i>	
Blueberry	<i>Vaccinium ovalifolium</i> Smith, <i>V. alaskensis</i> Howell, and <i>V. membranaceum</i> Dougl.
Bog rosemary	<i>Andromeda polifolia</i> L.
Crabapple	<i>Malus fusca</i> (Raf.) Schneider
Crowberry	<i>Empetrum nigrum</i> L.
Highbush cranberry	<i>Viburnum edule</i> (Michx.) Raf.
Juniper	<i>Juniperus communis</i> L.
Labrador tea	<i>Ledum groenlandicum</i> Oeder.
Lingonberry	<i>Vaccinium vitis-idea</i> L.
Red huckleberry	<i>Vaccinium parvifolium</i> Smith
Rusty menziesia	<i>Menziesia ferruginea</i> Smith
Salal	<i>Gaultheria shallon</i> Pursh.
Swamp cranberry	<i>Oxycoccus microcarpus</i> Turcz.
Swamp laurel	<i>Kalmia polifolia</i> Wang.
<i>Herbs</i>	
Alaska cotton	<i>Eriophorum</i> spp.
Bracken fern	<i>Pteridium aquilinum</i> (L.) Kuhn
Buckbean	<i>Menyanthes trifoliata</i> L.
Deer cabbage	<i>Nephrophyllidium crista-galli</i> (Menz.) Gilg.
Ground dogwood	<i>Cornus canadensis</i> L.
Hooked violet	<i>Viola adunca</i> Smith
Marsh marigold	<i>Caltha biflora</i> D. C.
Great burnet	<i>Sanguisorba menziesii</i> Rydb. and <i>S. sitchensis</i> C. A. Mey.
Monkshood	<i>Aconitum</i> spp.
Scirpus	<i>Scirpus</i> spp.
Sedge	<i>Carex</i> spp.
Shooting star	<i>Dodecatheon</i> spp.
Skunk cabbage	<i>Lysichitum americanum</i> Hult. & St. J.
Sphagnum	<i>Sphagnum</i> spp.
Sundew	<i>Drosera rotundifolia</i> L.
Yellow pond-lily	<i>Nuphar polysepalum</i> Engelm.
White bog-orchid	<i>Limnorchis dilatata</i> (Pursh.) Rydb.

¹ Nomenclature follows Anderson, 1959.

through a muskeg stage, illustrating classic ecologic succession. Thus, of the approximately 16 million acres in the Tongass National Forest, about 1,600,000 acres have progressed, since glaciation, through a muskeg stage before becoming forested. This has reduced the original muskeg area by about 40 percent. Surely this would not be the case if muskeg is the climax vegetative type in southeast Alaska.

Wood in peat bogs does not necessarily indicate buried forests. Most muskegs are surrounded by timber (that often falls into them), and support a limited number of trees.

It seems likely that the present vegetation and organic soils are adjusted to the drainage conditions of the land, and that these conditions have been little changed since glacial recession. The present vegetation seems to have been predetermined by the glaciers, except in minor areas of water table changes due to geologic erosion, beaver activity, sedimentation, etc. Maybeso and Kaikli soils demonstrate classic succession. During the muskeg stage, organic matter continued to accumulate until soil drainage improved enough for tree growth.

In conclusion, we wish to emphasize the following points:

1. Muskegs (open bogs) in southeast Alaska are variable in depth and composition.
2. Wet organic soils that do not carry depressional sites are underlain by impermeable or nearly-impermeable mineral substrata.
3. Buried wood is not synonymous with buried forest.
4. Geologic erosion, tipovers, beaver dams, sedimentation, etc. often cause local changes in water tables, which result in vegetative changes.
5. Muskegs are much less extensive now than they were sometime after major Pleistocene deglaciation.
6. There are extensive timber stands on flat or gently sloping, well-drained mineral soils that shown no evidence of major disturbance since Pleistocene ice recession.

Many questions about the wet organic soils of southeast Alaska remain. For instance, quantitative data are needed on hydrology and nutrient relations, and how these factors affect plant communities. The data show, however, that muskeg is not the climax vegetative type in southeast Alaska.

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The Petrology of Granite Point, Southeastern Washington

Granite Point is a small exposure of the pre-Columbia River Basalt erosion surface cropping out deep within the Snake River Canyon in Whitman County about 10 miles downstream from Lewiston, Idaho (Fig. 1). A brief description has been given by Treasher (1925) and the extent of outcrop is shown on the Geologic Map of Washington (Hunting et al., 1961). It appears to be the most westerly member of a series of hills and ridges of pre-basalt granitic rocks extending into eastern Washington from Idaho south of Moscow, through Paradise Ridge and Bald Butte (Treasher, 1925).

Similar granitic rocks crop out for approximately one-half mile along the north bank and a slightly greater distance along the south bank of the river. Active quarrying on the north bank provides excellent but rapidly diminishing exposures (Fig. 2). Later, horizontal basalt flows lap up again the granitic rocks (Treasher, 1925), but the contact itself has been hollowed out and filled with talus from the basalt cliffs so that it is nowhere exposed. A pegmatite dike, two feet thick, reported by Treasher (1925) was not observed in the present study and presumably has been removed by quarrying.

Construction of dams along the Snake River will eventually result in the loss of a significant portion of the Granite Point rocks due to rising water levels and to extensive quarrying for construction material. Since the petrology of Granite Point has not been studied to date, the time is opportune to record as much data as possible concerning these rocks.

Field Description

The bulk of the rocks at Granite Point and the corresponding projection on the south bank of the Snake River are coarse grained and of granitic composition. Crystals of quartz and light-colored potassium feldspar of greater than average size can be seen in hand specimens, the latter exhibiting distinct marginal zones reminiscent of Rapakivi texture. Biotite is abundant, occurring as small crystals in vague bands which are partially responsible for the slight foliation which is characteristic of the rock. The foliation is slightly enhanced by the elongation of feldspar crystals and, more dramatically, by the orientation of frequent sheet-like segregations of much more mafic composition (Fig. 4).

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