

OCCASIONAL PAPERS OF THE MUSEUM OF
ZOOLOGY

UNIVERSITY OF MICHIGAN

ANN ARBOR, MICHIGAN

PUBLISHED BY THE UNIVERSITY

THE LAND VERTEBRATE ASSOCIATIONS OF
INTERIOR ALASKA

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INTRODUCTION

While serving as Deputy Fur Warden in the Alaska Fisheries Service during 1911 and 1912, many notes were secured on vertebrate habitats in interior Alaska. The present paper attempts to organize these notes, and is being published with the permission of the United States Bureau of Fisheries.

Interior Alaska was reached via Skagway and Dawson in July, 1911. Most of the time from then until February, 1912, was spent in the neighborhood of Tanana. In this time, however, a visit continuing through the month of August, 1911, was made to Fairbanks. In February and March, 1912, a portage was made by dog sled from Tanana to the head of the north fork of the Kuskokwim. Here a boat was constructed, in which the trip, beginning in June, was made to Bethel at the mouth of the Kuskokwim. During this journey a side trip of several weeks' duration was made to Takotna and its vicinity. From Bethel the Kuskokwim was

again ascended in August to Kaltshak, from near which a portage was made to Russian Mission-on-the-Yukon. Here, in September, a river steamer was boarded, and from St. Michael passage was secured to Seattle.

The part of Alaska for which the land vertebrate associations are here described includes the interior of the territory north of the Alaska Range, south of the Endicott Mountains, and east of the Bering Sea tundra. This area is the Alaskan-Canadian faunal district of Nelson,¹ and is part of the Hudsonian Yukon district of Osgood.² The timbered parts would be considered in the Hudsonian life-zone, while the areas above timber-line are in the Arctic-alpine life-zone.

The land vertebrate associations of interior Alaska may be listed as follows:

Aquatic	Black spruce
Shore	Timber-line willow-alder
Cut-bank	Blueberry-dwarf birch
Cliff	Bare-ridge
Equisetum	Rocky-slope
Sedge	Aerial
Niggerhead	Burn
Valley willow-alder	Cultivated-field
Poplar	Edificarian
White spruce-paper birch	

The descriptions of the habitats and associations here given are based mainly on the study of the regions near Fairbanks, near Tanana, and along the Kuskokwim River. A brief preliminary description of the region has already been given.³

¹ E. W. Nelson, *Report upon Natural History Collections Made in Alaska*, 1887, p. 32.

² W. H. Osgood, *North American Fauna*, No. 19, 1900, 13-15.

³ H. J. Christoffers and L. R. Dice, *U. S. Bur. Fish. Doc.*, No. 780, 1912, 100-111.

The interior of Alaska north of the Alaska Range is made up mostly of broad, nearly level valleys and massive, rounded hills which rise in many cases above timber-line into high, isolated domes. The older forest fringing the streams and extending over the sunny slopes of the hills is mostly of white spruce and Alaska paper birch, though on islands and on newly formed river bars there are thickets of willows and alders and some areas of poplars. The extensive forests of the region, however, are of stunted black spruce, which covers the lower hills and the greater parts of the valleys. In the valleys are numerous small lakes, each usually surrounded by a fringe of swamp. Growths of niggerheads and patches of blueberries occur also in the valleys. Timber-line at Tanana is at about 2,000 feet; above this are numerous patches of blueberries and dwarf birches, with occasional growths of scrub willows or alders. On the ridges are low growths of grass and a scanty growth of sphagnum. Talus and rock exposures are rather rare even on the higher slopes.

These conditions continue westward to the tundra along Bering Sea, which along the Yukon is met at Andreafski, and on the Kuskokwim at Bethel. Between the two rivers tundra extends farther inland, being found on the Kuskokwim-Yukon portage between Kaltshak and Russian Mission-on-the-Yukon.

To the lists of vertebrates found by the author in the different habitats have been added a number of records from Osgood¹ and Blackwelder.² The lists are very incomplete, but no species has been included in a list without positive evidence of its occurrence in that particular habitat within the region.

Mr. Edward A. Preble and Dr. H. C. Oberholser gave much help in working up the taxonomy of the mammals and birds respectively. Dr. Frederick V. Coville assisted with the plant

¹ W. H. Osgood, *op. cit.*, 22-45, and *North American Fauna*, No. 30, 1909, 13-44.

² Eliot Blackwelder, *Auk*, XXXVI, 1919, 57-64.

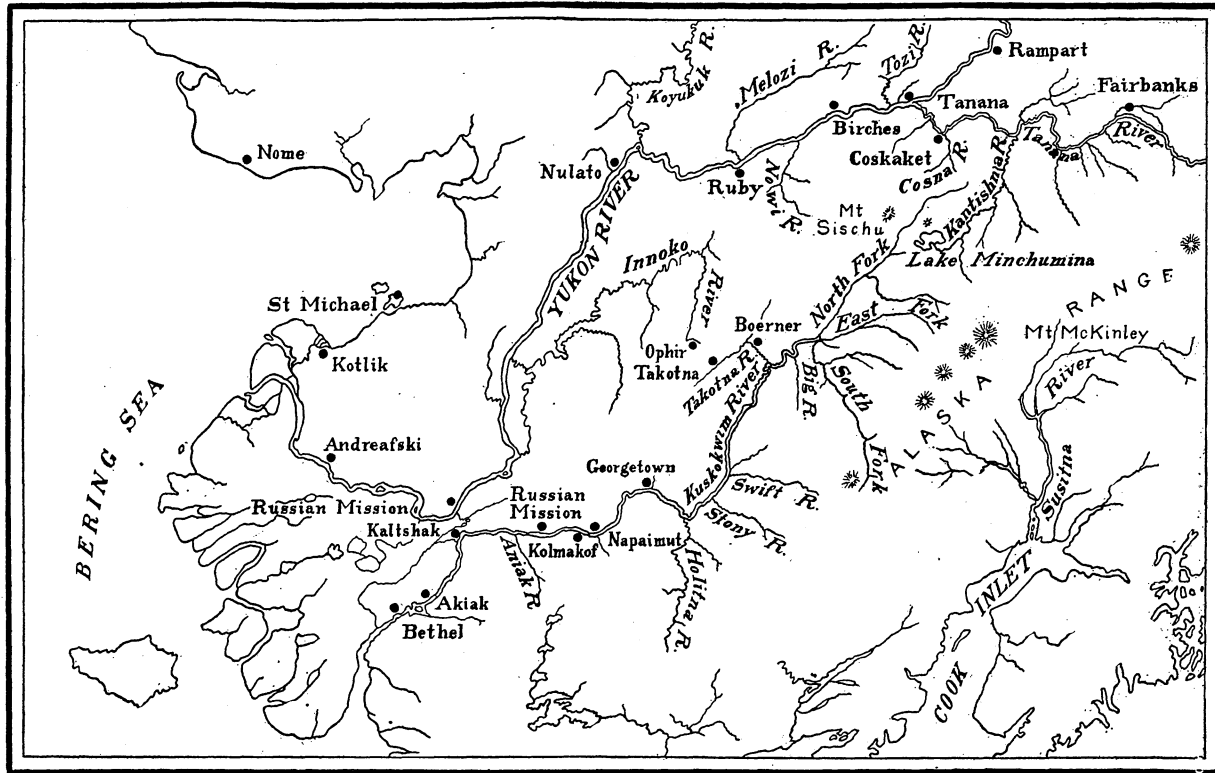


FIG. 1.—Map of west-central Alaska. One inch equals 120 miles

names. However, all the plant specimens collected spoiled during the wet summer of 1912, and the names used are based entirely on field identifications. The whole of the work would have been impossible without the co-operation of Dr. Barton W. Evermann, then chief of the Alaska Fisheries Service.

CLIMATIC CONDITIONS

The climate of interior Alaska is sub-arctic; there is a long winter, with temperatures constantly below freezing and usually below zero, and a short summer, in which the days are often hot, but with nights as a rule cold. Table I gives a summary of meteorologic data for several interior stations from records furnished by

TABLE I
METEOROLOGICAL RECORDS OF INTERIOR ALASKA

	ELEVATION, APPROXIMATE	YEARS	TEMPERATURES		PRECIPITATION, MEAN	AVERAGE SNOWFALL	AVERAGE NUMBER RAINY OR SNOWY DAYS
			Mean	Lowest			
Allakaket . . .	1000 ft.	8	17.2°F	.....	11.68 in.	.....	.....
Eagle.....	834	15	24.0	-75°F.	11.68	48.3 in.	85
Fort Yukon..	700	.....	.....	-68	.....	45.6	75
Fairbanks....	600	9	24.0	-65	11.44	50.8	91
Rampart.....	500	10	22.0	-68	10.25	51.4	92
Tanana.....	500	16	22.0	-76	11.97	48.6	79

the United States Weather Bureau. The records for lowest temperature, average snowfall, and average number of rainy or snowy days are taken from charts which evidently are somewhat old. A noticeable feature is the close similarity in the records from the different stations. Nearly uniform climatic conditions are found over nearly the whole of the interior.

Throughout the region the variations in temperature are extreme. On June 27, 1915, a temperature of 100° F. was officially recorded at Fort Yukon, and temperatures of 90° are common in summer at many places in the interior. The recorded extreme

limits of temperature range are from -76° to 100° F., a range of 176° , and yearly ranges of over 150° are normal. The daily range also is often great, especially in summer, and killing frosts may occur in any month of the year.

To indicate the climatic conditions during the various seasons, the monthly averages of temperature and precipitation are given for Tanana (Table II). A noticeable feature is the scanty amount of precipitation.

TABLE II
TANANA, MONTHLY AVERAGES

	Jan.	Feb.	Mar.	Apr.	May	June	July
Temperature (F.)	-16.0°	-5.0°	8.0°	23.0°	44.0°	58.0°	59.0°
Precipitation in inches.	.77	.62	.61	.20	.95	.73	2.01

	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	
Temperature (F.)	52.0°	39.0°	22.0°	-2.0°	-13.0°	22.0°
Precipitation in inches.	2.42	1.18	1.04	.79	.65	11.97	.....

At Tanana in 1911 the leaves on the birches and poplars began to turn yellow in late August, and by late September nearly all the leaves had fallen. A light snow fell in the Yukon Valley on October 2, and the surface of the ground had frozen solid by October 20. Ice began to run in the Yukon on October 25, and the river froze over on November 8, at a temperature of about -14° F. Numerous light snows fell during October and November, but the snow did not become deep enough to require snowshoes until the middle of December. However, the snow was said to have come late that year.

In the spring of 1912, at the head of the north fork of the Kuskokwim, a thawing temperature was first reached on March 22, though the snow had by that time partly melted off the exposed slopes. The snow melted slowly, but was almost entirely gone by April 26; the ground, however, remained frozen for several weeks

longer. Willows were in bloom on April 29. The ice in the river, which of course was small at this place, broke up on April 26. During the second week in May the willows and birches began to send out vigorous buds, and small leaves had appeared by May 15. A week later they were well leafed out.

VERTEBRATE HABITATS AND ASSOCIATIONS

Aquatic habitat and association:

- Rana cantabrigensis latiremis*. Northern wood frog. Summer.
- Colymbus holboellii*. Holboel grebe. Summer.
- Gavia pacifica*. Pacific loon. Summer (Blackwelder).
- Gavia stellata*. Red-throated loon. Summer.
- Anas platyrhynchos*. Mallard. Summer.
- Mareca americana*. Baldpate. Summer.
- Nettion carolinense*. Green-winged teal. Summer.
- Dafila acuta tzitzihoa*. Pintail. Summer.
- Clangula clangula americana*. Golden-eye. Summer.
- Charitonetta albeola*. Bufflehead. Summer.
- Harelda hyemalis*. Old-squaw. Summer.
- Histrionicus histrionicus pacificus*. Harlequin duck. Summer.
- Oidemia perspicillata*. Surf scoter. Summer.
- Anser albifrons gambeli*. White-fronted goose. Summer.
- Branta canadensis hutchinsi*. Hutchins goose. Summer.
- Lobipes lobatus*. Northern phalarope. Summer.
- Pandion haliaetus carolinensis*. Fish hawk. Summer.
- Streptoceryle alcyon caurina*. Western kingfisher. Summer.
- Mustela vison ingens*. Alaska mink.
- Lutra canadensis canadensis*. Canada otter.
- Fiber zibethicus spatulatus*. Northwestern muskrat.
- Castor canadensis canadensis*. Canada beaver.
- Alces gigas*. Alaska moose.

In interior Alaska there are two principal rivers, the Yukon and the Kuskokwim, each fed by numerous tributaries, some of which are of large size. Small streams and creeks abound, and most of these flow throughout the year, though they are frozen over in winter. Those streams which flow from the region of active glaciers on the north side of the Alaska Range carry much fine mud in suspension during the summer, and for this reason the Yukon and the main Kuskokwim are muddy streams. The

smaller streams draining lakes and swamps carry sediment only during freshets, but they carry much organic matter, enough sometimes to give the water a brownish or blackish color. Sloughs in all stages of filling abound along the larger valleys.

Lakes are common in the valleys, and are especially abundant along the upper parts of the Kuskokwim. Most of the lakes are small and shallow, though a few, Lake Minchumina, for example, are a number of miles across and are deep in parts.

The shallower lakes usually contain an abundance of water lilies and other aquatic plants, but the rivers and sloughs seldom contain much aquatic vegetation.

This habitat is used by a number of birds and by several mammals for shelter from enemies. It is the feeding-place also of a few birds and of the mink and otter. The moose enters the lakes in summer for protection from mosquitoes. During the breeding season nearly every small lake is the home of at least one pair of breeding ducks, while the larger lakes shelter numerous pairs of ducks and also geese and other aquatic birds.

Shore habitat and association:

- Larus hyperboreus barrovianus.* Glaucous gull. Summer.
- Larus brachyrhynchus.* Short-billed gull. Summer.
- Larus philadelphia.* Bonaparte gull. Summer.
- Anas platyrhynchos.* Mallard. Summer.
- Nettion carolinense.* Green-winged teal. Summer.
- Histrionicus histrionicus pacificus.* Harlequin duck. Summer.
- Anser albifrons gambeli.* White-fronted goose. Summer.
- Branta canadensis hutchinsi.* Hutchins goose. Summer.
- Olor columbianus.* Whistling swan. Summer.
- Grus canadensis canadensis.* Little brown crane. Summer.
- Lobipes lobatus.* Northern phalarope. Summer.
- Pisobia minutilla.* Least sandpiper. Summer.
- Totanus melanoleucus.* Greater yellowlegs. Summer.
- Totanus flavipes.* Yellowlegs. Summer.
- Tringa solitaria cinnamomea.* Western solitary sandpiper. Summer.
- Actitis macularia.* Spotted sandpiper. Summer.
- Charadrius semipalmatus.* Semipalmated plover. Summer.
- Bonasa umbellus yukonensis.* Yukon ruffed grouse. Resident.
- Euphagus carolinus.* Rusty blackbird. Summer.

- Seiurus noveboracensis notabilis*. Grinnell water-thrush. Summer.
Hylocichla aliciae aliciae. Gray-cheeked thrush. Summer.
Ixoreus naevius meruloides. Northern varied thrush. Summer.
Saxicola œnanthe œnanthe. Wheatear. Summer.
Sorex tundrensis. Tundra shrew (Osgood).
Ursus americanus americanus. Black bear.
Vulpes alascensis alascensis. Alaska red fox.
Mustela vison ingens. Alaska mink.
Lutra canadensis canadensis. Canada otter.
Microtus xanthognathus. Chestnut-cheeked vole (Osgood).
Fiber zibethicus spatulatus. Northwestern muskrat.
Erethizon epixanthum myops. Alaska porcupine.
Castor canadensis canadensis. Canada beaver.
Lepus americanus macfarlanei. Macfarlane snowshoe hare.
Alces gigas. Alaska moose.

The shore habitat comprises the areas of nearly bare mud, sand, and gravel found along the shores of the streams and lakes. It is often only a narrow strip a few feet in width, but along the larger rivers it may in places expand into bars many rods in width and miles in length. The habitat is washed over at periods of high water, especially in the spring, and as a rule supports little vegetation. A few scattered willows may occur, and sometimes scattered herbaceous plants; rarely a thin growth of horsetails is found. In parts of streams and in sloughs where the current is sluggish and where the shore habitat is composed mostly of wet mud bars, there is a tendency for these to become rapidly covered by horsetails, sedges, willows, and other plants, and so to pass into the swamp-meadow or willow-alder type of habitat.

The shores are the feeding- and resting-places of a number of species of birds; and they are also used by several species of mammals as routes of travel and as hunting places.

Cut-bank habitat and association:

- Streptoceryle alcyon caurina*. Western kingfisher. Summer, breeding.
Tachycineta thalassina lepida. Northern violet-green swallow. Summer (Blackwelder).
Riparia riparia riparia. Bank swallow. Summer, breeding.
Lemmus yukonensis. Yukon lemming (Osgood).
Microtus mordax. Merriam vole (Osgood).
Citellus osgoodi. Yukon ground squirrel.

In many places the streams are undercutting their banks, leaving a nearly vertical exposure of earth and sometimes gravel. The exposure of cut bank is usually from ten to fifteen feet in height, but where the stream is cutting against a hill it may be much higher.

The soft dirt banks are the nesting-places of several species of birds, and the burrows of a few mammals are found here also.

Cliff habitat and association:

Aquila chrysaetos. Golden eagle. Summer, breeding (Osgood, Blackwelder).

Falco peregrinus anatum. Duck hawk. Summer, breeding.

Falco columbarius columbarius. Pigeon hawk. Summer.

Sayornis sayus. Say phoebe. Summer (Osgood).

Corvus corax principalis. Northern raven. Summer, breeding (Osgood).

Petrochelidon lunifrons lunifrons. Cliff swallow. Summer (Blackwelder).

Tachycineta thalassina lepida. Northern violet-green swallow. Summer, breeding (Osgood, Blackwelder).

Rocky cliffs occur frequently along the larger rivers, especially where these wash against the base of a hill or mountain. Cliffs are also found sparingly in the higher parts of the hills and in a few places in the lowlands, notably where an outcrop of harder rock occurs. These cliffs are usually exposures of bare rock, somewhat broken into ledges and sometimes with little gullies coming part way down. A few herbs, shrubs, and small trees may, in the lowlands, grow on the ledges and in the gullies.

The cliffs are the nesting-places of a number of birds, but no trapping was done in the habitat and I have no records for mammals.

Equisetum habitat and association:

Anas platyrhynchos. Mallard. Summer.

Nettion carolinense. Green-winged teal. Summer.

Dafila acuta tzitzihoa. Pintail. Summer.

Anser albifrons gambeli. White-fronted goose. Summer.

Buteo lagopus sancti-johannis. Rough-legged hawk. Summer.

Synaptomys dalli. Dall lemming-vole.

Evotomys dawsoni dawsoni. Dawson red-backed vole.

Microtus pennsylvanicus drummondi. Drummond vole.
Fiber zibethicus spatulatus. Northwestern muskrat.
Alces gigas. Alaska moose.

Equisetum in practically a pure growth is often found growing extensively on wet mud bars along the rivers, and was especially noticeable along the lower Kuskokwim above Bethel. But the habitat is best developed about shallow lakes. Here horsetails may extend out into the lake until the water reaches a depth of about a foot, and they also occupy the adjacent low ground. In favorable places they form almost a pure stand in a belt ten to twenty yards or more in width.

Sedge habitat and association:

Rana cantabrigensis latiremis. Northern wood frog. Summer.
Anas platyrhynchos. Mallard. Summer.
Nettion carolinense. Green-winged teal. Summer.
Marila affinis. Lesser scaup. Summer (Osgood).
Lobipes lobatus. Northern phalarope. Summer.
Gallinago delicata. Wilson snipe. Summer.
Tringa solitaria cinnamomea. Western solitary sandpiper. Summer.
Euphagus carolinus. Rusty blackbird. Summer.
Melospiza lincolni lincolni. Lincoln sparrow. Summer.
Mustela arctica arctica. Arctic weasel.
Mustela vison ingens. Alaska mink.
Synaptomys dalli. Dall lemming-vole (Osgood).
Eutamias dawsoni dawsoni. Dawson red-backed vole.
Microtus pennsylvanicus drummondi. Drummond vole.
Microtus xanthognathus. Yellow-nosed vole (Osgood).
Fiber zibethicus spatulatus. Northwestern muskrat.
Alces gigas. Alaska moose.

Sedges occur to some extent on the river banks, and sometimes grasses are found along the streams at the edge of the forest. Around lakes a belt of sedges is often found surrounding the belt of horsetails, but around lakes containing much decaying vegetation horsetails are not well developed, and the sedges reach the water's edge, and may sometimes be partly submerged. The belt of sedges is often ten to twenty yards in width and may in favorable situations be much wider. In a filled-in swamp sedges may cover an area many acres in extent.

Niggerhead habitat and association:

- Lagopus lagopus albus*. Willow ptarmigan. Resident.
- Sorex personatus arcticus*. Arctic shrew.
- Sorex tundrensis*. Tundra shrew.
- Microsorex eximius*. Alaska microsorex.
- Mustela arctica arctica*. Arctic weasel.
- Mustela vison ingens*. Alaska mink.
- Lemmus yukonensis*. Yukon lemming.
- Eutamias dawsoni dawsoni*. Dawson red-backed vole.
- Microtus pennsylvanicus drummondi*. Drummond vole.
- Microtus operarius endæcus*. Interior vole.
- Alces gigas*. Alaska moose.

Extensive areas of niggerheads occur in parts of the valleys where drainage is poor. These niggerheads are tussocks of tough grass, which elongate each year until the head may be several feet above the ground. The heads usually grow close together, there being usually a free space of six to twelve inches between the pedestals. The ground is bare and moist. Willows, alders, blueberries, and other shrubs when present grow thinly; or in places the willows or the blueberries increase sufficiently to dominate, giving rise to a different type of habitat.

Niggerheads also occur on nearly level slopes up to and above timber-line. In such places a growth of blueberries and dwarf birch, with sphagnum growing between the niggerheads, is commonly dominant and areas of pure niggerheads are infrequent.

On the somewhat better-drained ground around the belt of sedges surrounding a lake, grasses, mostly in tussocks of the niggerhead type, are common and may form a distinct belt. Thickets of willows and alders frequently invade this belt from the edge of the forest, and isolated thickets of these shrubs may appear in the midst of a large area of niggerheads.

In time the niggerheads of poorly drained situations seem to be invaded by sphagnum, which ultimately fills the interstices between the heads, and, if below timber-line, black spruces appear, and finally the area becomes a black spruce forest.

The vertebrates listed from this habitat are recorded from the larger valleys in areas of typical niggerheads nearly free from sphagnum and unmixed with any considerable amount of shrubs.

Valley willow-alder habitat and association:

- Bonasa umbellus yukonensis*. Yukon ruffed grouse. Resident.
Lagopus lagopus albus. Willow ptarmigan. Resident.
Lagopus rupestris rupestris. Rock ptarmigan. Resident.
Buteo lagopus sancti-johannis. Rough-legged hawk. Summer.
Bubo virginianus lagophonus. Northwestern horned owl. Resident.
Empidonax traillii alnorum. Alder flycatcher. Summer (Osgood, Blackwelder).
Perisoreus canadensis fumifrans. Alaska jay. Resident.
Loxia leucoptera. White-winged crossbill. Summer.
Acanthis hornemanni exilipes. Hoary redpoll. Winter.
Acanthis linaria linaria. Redpoll. Resident, breeding.
Passerculus sandwichensis alaudinus. Western savanna sparrow. Summer.
Zonotrichia gambeli. Gambel sparrow. Summer.
Zonotrichia coronata. Golden-crowned sparrow. Summer (Osgood).
Spizella monticola ochracea. Western tree sparrow. Summer.
Junco hyemalis hyemalis. Slate-colored junco. Summer.
Melospiza lincolni lincolni. Lincoln sparrow. Summer (Osgood).
Passerella iliaca iliaca. Fox sparrow. Summer.
Vermivora celata celata. Orange-crowned warbler. Summer.
Dendroica aestiva rubiginosa. Alaska yellow warbler. Summer, breeding (Osgood, Blackwelder).
Dendroica coronata hooveri. Myrtle warbler. Summer.
Seiurus noveboracensis notabilis. Grinnell water-thrush. Summer.
Wilsonia pusilla pusilla. Wilson warbler. Summer.
Penthestes hudsonicus hudsonicus. Hudsonian chickadee. Resident.
Regulus calendula calendula. Ruby-crowned kinglet. Summer.
Planesticus migratorius migratorius. Eastern robin. Summer.
Ixoreus naevius meruloides. Northern varied thrush. Summer.
Sorex personatus arcticus. Arctic shrew.
Sorex obscurus obscurus. Mountain shrew.
Ursus americanus americanus. Black bear.
Vulpes alascensis alascensis. Alaska red fox.
Mustela arctica arctica. Arctic weasel.
Mustela vison ingens. Alaska mink.
Lutra canadensis canadensis. Canada otter.
Lynx canadensis. Canada lynx.
Synaptomys dalli. Dall lemming-vole.
Evotomys dawsoni dawsoni. Dawson red-backed vole.
Microtus pennsylvanicus drummondi. Drummond vole.
Microtus operarius endæcus. Interior vole.

- Erethizon epixanthum myops*. Alaska porcupine.
Citellus osgoodi. Yukon ground squirrel (Osgood).
Castor canadensis canadensis. Canada beaver.
Lepus americanus macfarlani. Macfarlane snowshoe hare.
Alces gigas. Alaska moose.

On the mud bars along the larger rivers and at the outer edge of the grassy areas about lakes a growth of willows, *Salix*, is likely to spring up. Alders, *Alnus*, occur sometimes mixed with the willows and rarely form pure stands, seeming to represent mostly a stage following the willows. Willows and alders rarely form isolated thickets in patches of niggerheads. The ground under the growth of willows and alders is often bare, but may in wet situations on mud bars be covered by horsetails, or in the drier areas about lakes by grasses and other herbs. An older growth of willows may attain a treelike form, and rarely alders also attain considerable size; but old growths of either willow or alder are rare, for these formations are rapidly replaced by poplars and by the more permanent types of forest.

Thickets of willows and of alders, the two sometimes mixed together, occur along the smaller creeks up to timber-line, there connecting with the timber-line willow-alder habitat, which is here considered as distinct. The distinction between the willow and alder habitats of the lowlands and highlands is, however, not sharp, and subsequent observations may show that the two should be combined.

Poplar habitat and association.

- Colaptes auratus borealis*. Boreal flicker. Summer (Osgood).
Vulpes alascensis alascensis. Alaska red fox.
Microtus xanthognathus. Yellow-nosed vole (Osgood).

Forests of poplar, *Populus candicans*, occur in the valley of the Yukon, where they are best developed on islands. Fringes of poplars between the willow-alder thickets and white spruce-paper birch forest may often be seen. Along the Kuskokwim the poplar seems to be much less abundant.

As found on islands at Tanana poplars thickly cover many acres with nearly a pure stand, the trunks often reaching a diameter of eighteen inches or more. Under an old forest of this kind there are many decaying limbs and logs, but there is little herbaceous vegetation. Old trees of willow and scrub alders may often be found in the forest; there are also numerous young paper birches and white spruces, and it seems certain that the poplars will eventually be replaced by the white spruce-paper birch type of forest.

Tracks of mice and shrews and of red fox were seen in a poplar forest near Tanana in winter, but no trapping was carried on in this habitat and no opportunity was found to study a well-developed poplar forest in summer. However, a few records from Osgood are available. The vertebrates of the habitat probably differ little from those of the white spruce-paper birch forest.

A grove of aspens, *Populus tremuloides*, was noted near timberline in a cove on the hills north of Tanana, and several isolated trees were seen on the shores of a small lake near the head of the north fork of the Kuskokwim. The species was also found on the divide toward Lake Minchumina, some of the trees being fair sized, but on the top of a wind-swept hill they occurred in a thick growth of stunted shrubs not over two or three inches in diameter and about ten feet tall. It is probable that aspens occur much more frequently than these notes would indicate. No records of vertebrates were secured from the aspens.

White spruce-paper birch habitat and association:

- Canachites canadensis osgoodi*. Alaska spruce grouse. Resident.
- Bonasa umbellus yukonensis*. Yukon ruffed grouse. Resident, breeding.
- Buteo lagopus sancti-johannis*. Rough-legged hawk. Summer, breeding (Osgood).
- Aquila chrysaetos*. Golden eagle. Summer.
- Pandion haliaetus carolinensis*. Fish hawk. Summer, breeding.
- Bubo virginianus lagophonus*. Northwestern horned owl. Resident.
- Surnia ulula caparoch*. Hawk owl. Resident.
- Streptoceryle alcyon caurina*. Western kingfisher. Summer.

- Dryobates villosus septentrionalis*. Northern hairy woodpecker. Summer.
Picoides americanus fasciatus. Alaska three-toed woodpecker. Resident.
Colaptes auratus borealis. Boreal flicker. Summer.
Nuttallornis borealis. Olive-sided flycatcher. Summer.
Perisoreus canadensis fumifrons. Alaska jay. Resident.
Corvus corax principalis. Northern raven. Resident.
Loxia leucoptera. White-winged crossbill. Resident.
Acanthis hornemanni exilipes. Hoary redpoll. Winter.
Acanthis linaria linaria. Redpoll. Resident, breeding.
Passerculus sandwichensis alaudinus. Western savanna sparrow. Summer.
Zonotrichia gambeli. Gambel sparrow. Summer.
Spizella monticola ochracea. Western tree sparrow. Summer.
Junco hyemalis hyemalis. Slate-colored junco. Summer.
Passerella iliaca iliaca. Fox sparrow. Summer.
Dendroica coronata hooveri. Myrtle warbler. Summer.
Seiurus noveboracensis notabilis. Grinnell water-thrush. Summer.
Wilsonia pusilla pusilla. Wilson warbler. Summer.
Penthestes hudsonicus hudsonicus. Hudsonian chickadee. Resident.
Regulus calendula calendula. Ruby-crowned kinglet. Summer.
Hylocichla ustulata swainsoni. Olive-backed thrush. Summer.
Planesticus migratorius migratorius. Eastern robin. Summer.
Ixoreus naevius meruloides. Northern varied thrush. Summer.
Sorex personatus arcticus. Arctic shrew.
Ursus americanus americanus. Black bear.
Vulpes alascensis alascensis. Alaska red fox.
Martes americana actiosa. Alaska marten.
Mustela arctica arctica. Arctic weasel.
Mustela vison ingens. Alaska mink.
Lutra canadensis canadensis. Canada otter.
Lynx canadensis. Canada lynx.
Evotomys dawsoni dawsoni. Dawson red-backed vole.
Erethizon epixanthum myops. Alaska porcupine.
Sciurus hudsonicus hudsonicus. Northern red squirrel.
Glaucomys sabrinus yukonensis. Yukon flying squirrel.
Lepus americanus macfarlani. Macfarlane snowshoe hare.
Alces gigas. Alaska moose.

On the better-drained parts of the river valleys, especially along the edges of the streams, and on many of the lower slopes having a southern exposure, may be found a mixed forest of which the dominant trees are the white spruce, *Picea canadensis*, and the Alaska paper birch, *Betula alaskana*. Other trees found in this

forest are the willows, *Salix*, poplar, *Populus canadensis*, a red birch, perhaps a color phase of *Betula alaskana*, and black spruce, *Picea mariana*. A considerable amount of underbrush chiefly of alder, *Alnus*, occurs. If the shade is not too heavy there are also grasses and a few shrubs such as the high-bush cranberry, *Viburnum pauciflorum*, trailing juniper, *Juniperus sibirica*, and bearberry, *Arctostaphylos uva-ursi*.

The altitudinal range of this type of forest is usually not high, though on the warm and well-drained southern slopes of Mount Sischu a burned forest of white spruce and birch was found to have formerly extended up to timber-line.

Nearly pure forests of Alaska paper birch occur on some warm slopes. The trees in these forests are quite uniform in height and apparently in age, and vary from six to twelve inches in diameter, with a height of about sixty feet. Such forests are particularly common on the slopes near Lake Minchumina, where they have apparently developed following a fire. The ground under the birches is usually covered by a heavy growth of bearberry. In this type of forest young white spruces often occur, and the whole forest is seemingly a younger stage in the development of a white spruce forest.

A few groves of nearly pure white spruces occur along the stream margins in the broader valleys. These groves are usually small in extent, probably because the streams, undercutting their banks in their meanders across the valleys, do not give time to develop any considerable extent of white spruce forest to full maturity. The trees even in the larger groves seldom have a greater diameter than two feet. The forest floor under the white spruces is either nearly bare of vegetation and covered by spruce needles, or in open forest a growth of grass may be present.

The occurrence of a pure forest of either paper birch or white spruce is rare, the common condition being a mixed forest with these two species represented in varying proportions.

Black spruce habitat and association:

- Canachites canadensis osgoodi*. Alaska spruce grouse. Resident.
Lagopus lagopus albus. Willow ptarmigan. Resident.
Lagopus rupestris rupestris. Rock ptarmigan. Winter.
Pediæcetes phasianellus phasianellus. Sharp-tailed grouse. Winter.
Surnia ulula caparoch. Hawk owl. Resident.
Perisoreus canadensis fumifrons. Alaska jay. Resident.
Corvus corax principalis. Northern raven. Resident.
Pinicola enucleator alascensis. Alaska pine grosbeak. Autumn.
Loxia leucoptera. White-winged crossbill. Winter.
Acanthis linaria linaria. Redpoll. Winter.
Passerculus sandwichensis alaudinus. Western savanna sparrow. Summer.
Junco hyemalis hyemalis. Slate-colored junco. Summer, breeding (Osgood).
Passerella iliaca iliaca. Fox sparrow. Summer, rare.
Bombycilla garrula pallidiceps. Bohemian waxwing. Spring.
Hylocichla alicia alicia. Gray-cheeked thrush. Summer.
Planesticus migratorius migratorius. Eastern robin. Summer.
Ixoreus naevius meruloides. Northern varied thrush. Summer.
Sorex personatus arcticus. Arctic shrew.
Ursus americanus americanus. Black bear. Summer.
Vulpes alascensis alascensis. Alaska red fox.
Martes americana actiosa. Alaska marten.
Mustela arctica arctica. Arctic weasel.
Mustela vison ingens. Alaska mink. Winter, rare.
Eutamias dawsoni dawsoni. Dawson red-backed vole.
Sciurus hudsonicus hudsonicus. Northern red squirrel.
Lepus americanus macfarlani. Macfarlane snowshoe hare.
Alces gigas. Alaska moose.
Rangifer stonei. Stone caribou.

The forests which cover the low hills and the greater part of the valleys in interior Alaska are mainly composed of black spruce, *Picea mariana*. The trees are mostly stunted, growing from six to twenty feet high and having trunks only from one to six inches in diameter, though in exceptionally favorable situations, mostly in white spruce forest, the black spruce may reach a trunk diameter of twelve inches. The tamarack, *Larix laricina*, occurs sparingly with the black spruces in damp situations near Tanana and at the head of the north fork of the Kuskokwim, and the trunks reach a maximum diameter of eight inches.

The black spruce forest is not as a rule very dense, and a person can usually pass easily between the trees. The ground is heavily covered, to a depth of from several inches to several feet, with sphagnum moss, which retains a large amount of moisture. Various shrubs grow in the available space between the trees, the principal species being the dwarf birch, *Betula glandulosa*, blueberries, *Vaccinium*, dwarf willows, *Salix*, dwarf alders, *Alnus*, and Labrador tea, *Ledum*. A few tough grasses of the type found in the niggerheads also occur, nearly covered by the sphagnum.

Lakes which occur in an area of black spruces are commonly invaded at their edges by the sphagnum. About such lakes the vegetation is usually not different from that of the black spruce forest, and no fringe of shrubs or other plants is developed. Neither is there any evidence for the presence of a water-margin vertebrate society about such lakes.

Timber-line willow-alder habitat and association:

- Lagopus lagopus albus*. Willow ptarmigan. Resident.
- Lagopus rupestris rupestris*. Rock ptarmigan. Resident.
- Asio flammeus*. Short-eared owl. Summer (Osgood).
- Zonotrichia gambeli*. Gambel sparrow. Summer.
- Junco hyemalis hyemalis*. Slate-colored junco. Summer.
- Wilsonia pusilla pusilla*. Wilson warbler. Summer.
- Penthestes hudsonicus hudsonicus*. Hudsonian chickadee. Summer.
- Acanthopneuste borealis kennicotti*. Kennicott willow warbler. Summer.
- Regulus calendula calendula*. Ruby-crowned kinglet. Summer.
- Planesticus migratorius migratorius*. Eastern robin. Summer.
- Ixoreus naevius meruloides*. Northern varied thrush. Summer.
- Sorex personatus arcticus*. Arctic shrew.
- Evotomys dawsoni dawsoni*. Dawson red-backed vole.
- Lepus americanus macfarlani*. Macfarlane snowshoe hare.

Thickets of scrub willow or alder frequently occupy the moist ground at the head of a ravine or cove at timber-line or above, and any small stream flowing above timber-line is likely to be fringed by a thicket of these shrubs. Tongues of stunted willows and alders also extend up protected slopes and gullies for a long distance above timber-line. A fringe of alders was found on

Mount Sischu to occur just above a white spruce-paper birch forest where this reached timber-line on a steep slope.

This habitat is somewhat more exposed to the winds than the lowland willow-alder habitat, and the species of animals in the habitats surrounding it differ to some extent from those of the habitats surrounding the lowland habitat. Yet, with a few apparent exceptions, the species found in the willows and alders are the same above timber-line as in the bottoms of the valleys.

Blueberry-dwarf birch habitat and association:

- Canachites canadensis osgoodi*. Alaska spruce grouse. Resident.
Lagopus lagopus albus. Willow ptarmigan. Resident.
Lagopus rupestris rupestris. Rock ptarmigan. Resident.
Pediæcetes phasianellus phasianellus. Sharp-tailed grouse. Winter.
Asio flammeus. Short-eared owl. Summer (Osgood).
Surnia ulula caparoch. Hawk owl. Resident.
Acanthis linaria linaria. Redpoll. Winter.
Passerculus sandwichensis alaudinus. Western savanna sparrow. Summer.
Planesticus migratorius migratorius. Eastern robin. Summer.
Ursus americanus americanus. Black bear. Summer.
Vulpes alascensis alascensis. Alaska red fox.
Martes americana actiosa. Alaska marten.
Mustela arctica arctica. Arctic weasel.
Eutamias dawsoni dawsoni. Dawson red-backed vole.

A thick growth of low shrubs is commonly found in the open parts of the valleys, but especially on the hills just above timber-line. These shrubs are the common ones found in the black spruce forests, here growing more closely together and forming more of a thicket. The dominant species are the blueberries, *Vaccinium*, and dwarf birch, *Betula glandulosa*. Other common species are the dwarf willows, *Salix*, dwarf alders, *Alnus*, and Labrador tea, *Ledum*. Clumps of the niggerhead grass are often abundant, and occasional small, stunted black spruces occur. The ground is usually heavily covered by sphagnum, with which is frequently growing reindeer "moss," *Cladonia rangiferina*.

Bare-ridge habitat and association:

- Lagopus lagopus albus*. Willow ptarmigan. Resident.
Lagopus rupestris rupestris. Rock ptarmigan. Resident.
Surnia ulula caparoch. Hawk owl. Winter.
Otocoris alpestris arctica. Pallid horned lark. Summer.
Leucosticte tephrocotis. Gray-crowned rosy finch. Summer (Blackwelder).
Calcarius lapponicus alascensis. Alaska longspur. Summer (Osgood).
Calcarius pictus. Painted longspur. Summer (Blackwelder).
Passerculus sandwichensis alaudinus. Western savanna sparrow. Summer (Blackwelder).
Anthus spinoletta rubescens. Pipit. Summer.
Saxicola ananthe ananthe. Wheatear. Summer (Blackwelder).
Ursus phæonyx. Tanana grizzly. Summer (Osgood).
Evotomys dawsoni dawsoni. Dawson red-backed vole.
Microtus pennsylvanicus drummondi. Drummond vole.
Microtus operarius endæcus. Interior vole (Osgood).
Rangifer stonei. Stone caribou.
Ovis dalli. Dall sheep (Osgood).

On the ridges and slopes of the higher hills or mountains where the ground is not covered by rocks there is either a sparse growth of grass or of sphagnum moss. The grass is found in the more swampy situations, such as at the head of a cove, while the moss covers the drier slopes. On Mount Sischu at an estimated elevation of 2,500 feet the blueberries and other shrubs almost disappear, and the slopes above are carpeted with a thin covering of moss, through which small loose rocks often project. A few very low shrubs occur at intervals, and sometimes small patches of bare ground appear.

Rocky-slope habitat and association:

- Lagopus rupestris rupestris*. Rock ptarmigan. Resident.
Otocoris alpestris arctica. Pallid horned lark. Summer.
Leucosticte tephrocotis. Gray-crowned rosy finch. Summer (Osgood).
Saxicola ananthe ananthe. Wheatear. Summer (Osgood).
Mustela arctica arctica. Arctic weasel (Osgood).
Marmota caligata caligata. Hoary marmot (Osgood).
Ochotona collaris. Collared pika (Osgood).
Ovis dalli. Dall sheep (Osgood).

A few talus slopes occur on the higher parts of the mountains of interior Alaska. Some of the slopes are of considerable extent,

though most are small. Also many of the higher mountains are flat topped, and these tops are usually covered by large broken rocks. Lichens are abundant on the rocks which remain long in one position. However, the topography of interior Alaska north of the Alaska Range is not rugged, but is mostly of a rolling type in which rock exposures are few.

Aerial habitat and association:

- Sayornis sayus*. Say phoebe. Summer (Osgood).
Nuttallornis borealis. Olive-sided flycatcher. Summer.
Empidonax traillii alborum. Alder flycatcher. Summer (Osgood).
Hirundo rustica erythrogaster. Barn swallow. Summer.
Petrochelidon lunifrons lunifrons. Cliff swallow. Summer.
Tachycineta thalassina lepida. Northern violet-green swallow. Summer (Osgood).
Riparia riparia riparia. Bank swallow. Summer.
Wilsonia pusilla pusilla. Wilson warbler. Summer.
Saxicola ananthe ananthe. Wheatear. Summer.

The aerial association in interior Alaska is made up of the flycatchers, swallows, Wilson warbler, and wheatear, all of which are birds securing food in the air.

Burn habitat and association:

- Canachites canadensis osgoodi*. Alaska spruce grouse. Resident.
Lagopus lagopus albus. Willow ptarmigan. Winter.
Buteo swainsoni. Swainson hawk. Summer.
Surnia ulula caparoch. Hawk owl. Resident.
Dryobates pubescens nelsoni. Northern downy woodpecker. Autumn.
Picoides americanus fasciatus. Alaska three-toed woodpecker. Resident.
Nuttallornis borealis. Olive-sided flycatcher.
Perisoreus canadensis fumifrons. Alaska jay. Resident.
Pinicola enucleator alascensis. Alaska pine grosbeak. Autumn.
Loxia leucoptera. White-winged crossbill. Winter.
Acanthis hornemanni exilipes. Hoary redpoll. Winter.
Acanthis linaria linaria. Redpoll. Resident.
Acanthis linaria holballi. Holboll redpoll. Winter.
Plectrophenax nivalis nivalis. Snow bunting. Winter.
Zonotrichia gambeli. Gambel sparrow. Summer, breeding.
Spizella monticola ochracea. Western tree sparrow. Summer.
Junco hyemalis hyemalis. Slate-colored junco. Summer, breeding.
Melospiza lincolni lincolni. Lincoln sparrow. Summer.
Bohemycilla garrula pallidiceps. Bohemian waxwing. Summer.

- Vermivora celata celata*. Orange-crowned warbler. Summer.
Hylocichla aliciae aliciae. Gray-cheeked thrush. Summer.
Planesticus migratorius migratorius. Eastern robin. Summer.
Sorex tundrensis. Tundra shrew.
Mustela arcticus arcticus. Arctic weasel.
Evolomys dawsoni dawsoni. Dawson red-backed vole.
Microtus operarius endæcus. Interior vole.
Alces gigas. Alaska moose.

Extensive areas of forest in interior Alaska have been burned, for fires are common. Forests of both the black spruce type and of the white spruce-paper birch type are destroyed by these fires, and though the trees themselves are seldom burned they are killed by the fire at their bases. In a burned black spruce forest the dead trees may stand for many years, but the larger white spruces are more easily blown down by the wind, and seemingly are more apt to be partially burned.

Following a fire in a location suitable for the development of a white spruce-paper birch type of forest, the first year herbs seem to take control. Of these herbs the most characteristic is the fireweed, *Chamænerion angustifolium*. It is not known how long the herbaceous stage continues, but grasses invade the area, and then willows and alders; paper birch finally succeeds the alders; and under the birches white spruces develop.

Following a fire in a black spruce forest the sphagnum moss is very slow to return. No burned forest of this type was studied in the first year following a fire, but it is probable that there is a herbaceous or fireweed stage here also. The tussock grasses of the niggerhead type appear after a time, and then willows, alders, blueberries, dwarf birch, and sphagnum. Ultimately, after the lapse of many years, the black spruce forest will be re-established.

The burn habitat as here considered includes all the stages following a fire until the new forest begins to show its own individuality.

Cultivated-field habitat and association:

- Anthus spinoletta rubescens*. Pipit. Summer.

Cultivated fields are rare in interior Alaska, but they are increasing in number and size. The only vertebrate record at hand from this habitat is that of the pipit, of which a small flock was seen in a plowed field in the Yukon Valley at Tanana.

Edificarian habitat and association:

- Sayornis sayus*. Say phoebe. Summer (Osgood).
Perisoreus canadensis fumifrons. Alaska jay. Resident.
Corvus corax principalis. Northern raven. Winter.
Passerculus sandwichensis alaudinus. Western savanna sparrow. Summer (Osgood).
Zonotrichia gambeli. Gambel sparrow. Summer.
Passerella iliaca iliaca. Fox sparrow. Summer.
Petrochelidon lunifrons lunifrons. Cliff swallow. Summer, breeding.
Tachycineta thalassina lepida. Northern violet-green swallow. Summer, breeding (Osgood).
Planesticus migratorius migratorius. Eastern robin. Summer (Osgood).
Sorex personatus arcticus. Arctic shrew.
Sorex obscurus obscurus. Mountain shrew.
Microsorex eximius. Alaska microsorex.
Mustela arctica arctica. Arctic weasel.
Mustela vison ingens. Alaska mink.
Evotomys dawsoni dawsoni. Dawson red-backed vole.
Rattus norvegicus. Norway rat.
Sciurus hudsonicus hudsonicus. Northern red squirrel.

Several species of vertebrates are closely restricted to the vicinity of buildings, and a number of other species sometimes make use of buildings either as places of refuge or as places of food supply. To designate this habitat and association the name *edificarian* is proposed. The habitat includes the buildings of whatever sort erected by man, and the immediately adjacent areas. This would include the streets of cities and the yards of houses with their planted lawns, gardens, and shade trees. However, it does not seem desirable to include in the habitat parks, orchards, or cultivated fields away from the near vicinity of buildings.

Buildings and towns are rare in Alaska, so the habitat is extremely small in area. Nevertheless, at least one species of mammal, the Norway rat, is restricted to it, and a number of species of other mammals and birds either nest or feed in or around buildings.

PLATE I

FIG. 1.—A small lake near the junction of the east fork with the north fork of the Kuskokwim. A belt of horsetails, *Equisetum*, surrounds the edge of the lake; outside this in the foreground is a belt of sedges, while the forest of white spruce and paper birch appears on the right. July 9, 1912.

FIG. 2.—Niggerheads in the Yukon Valley near Tanana. These are tussocks of tough grasses which grow higher from year to year, often reaching a height of two to three feet above the general level of the ground. September 12, 1911.



Figure 1

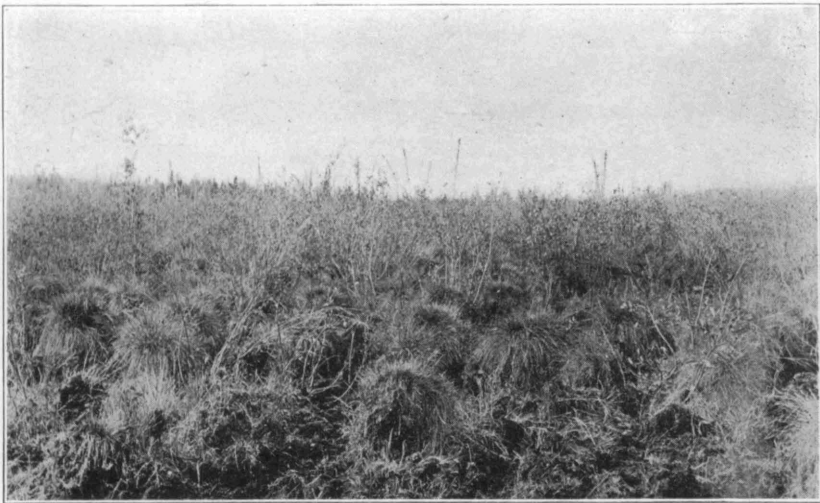


Figure 2

PLATE II

FIG. 1.—The north fork of the Kuskokwim near its head. A gravel bar shows on the left, fringing which is a thicket of willows and alders. On the right in the foreground and in the left in the distance the river has formed a cut bank. The forest is of white spruces and paper birches. April, 1912.

FIG. 2.—The ridges north of Takotna at timber-line. Stunted black spruces are almost the only trees, and these grow best in the slightly protected draws. Along the tiny streams in the ravines are small thickets of willow and alder. Dwarf birches and blueberries grow thickly in the open places among the spruces and for a short distance above timber-line July, 1912.



Figure 1



Figure 2

PLATE III

FIG. 1.—A white spruce-paper birch forest beside the Koyukuk trail on the low hills north of Tanana. The birches have already lost most of their leaves. September 12, 1911.

FIG. 2.—Stunted black spruces at the head of the north fork of the Kuskokwim. None of the trees in the picture are over three inches in diameter. April 28, 1911.

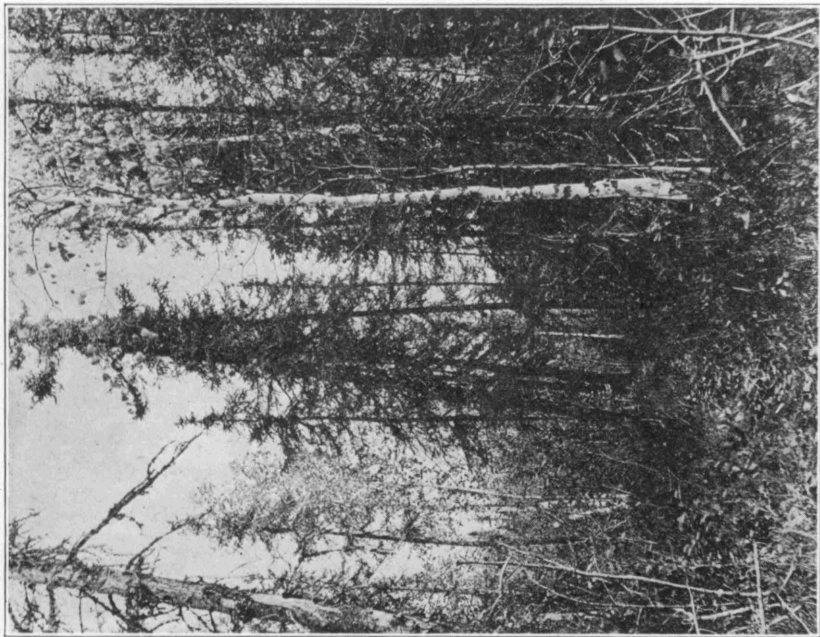


Figure 1

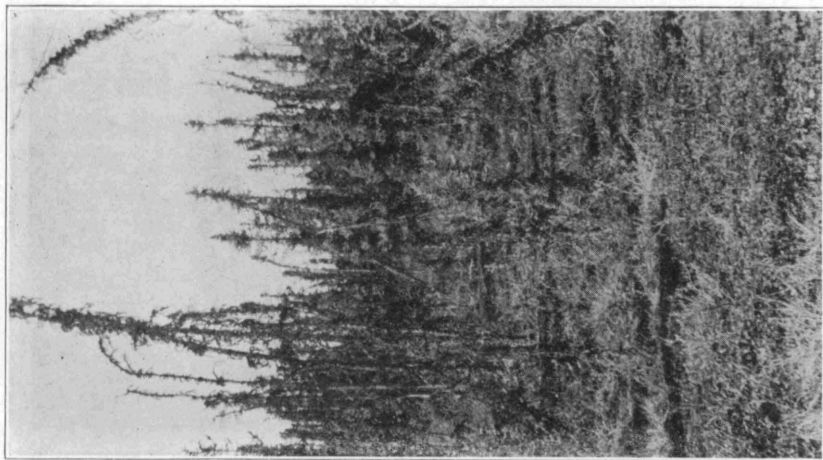


Figure 2

PLATE IV

FIG. 1.—The upper slopes of Mount Sischu, forming the divide between Novi and Kuskokwim rivers. Scanty exposures of lichen-covered rocks appear, and the ground is sparsely covered by sphagnum and grass. The flat top of the summit in the distance shows plainly. June 5, 1912.

FIG. 2.—Burned black spruce forest near the head of the north fork of the Kuskokwim. The shrubs are mostly dwarf birch. April 28, 1912.

